GREEN FINANCE AND SUSTAINABLE COCOA PRODUCTION IN GHANA: THE ROLE OF FARMERS' LIVING INCOME

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Approval of the Thesis

GREEN FINANCE AND SUSTAINABLE COCOA PRODUCTION IN GHANA: THE ROLE OF FARMERS' LIVING INCOME

The committee members below have played a crucial role in approving Ibrahim Menkeh Muafueshiangha's thesis. Their recommendation that it be accepted by the faculty of Unicaf University in Zambia as a partial fulfillment of requirements for the degree of

Doctor of Philosophy (Ph.D.) in Business

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Abstract

GREEN FINANCE AND SUSTAINABLE COCOA PRODUCTION IN GHANA: THE ROLE OF FARMERS' LIVING INCOME

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This study examines the connection between green finance and sustainable cocoa farming in Ghana, emphasising the mediating role of farmers' living income in the relationship. The study aimed to comprehend better how green finance supports sustainable cocoa production and whether it depends on farmers' living income. Through such interaction, the research sheds light on how finance, economic equity, and environmental sustainability work in Ghana's cocoa industry. This sector is crucial to the country's economy and a significant contributor to global cocoa production. This study used a mixed-method approach using qualitative and quantitative research methodologies. The study sampled 412 participants, of whom 388 participated in the quantitative study and 24 participated in focus group discussions. The study found a moderate positive relationship (CFA Estimate = 0.335; CR 7.15) between green finance and sustainable cocoa production. In addition, the study found that farmers' living income had a moderately positive effect on green finance (CFA Estimate = 0.407; CR 7.62) and a strong positive impact on sustainable cocoa production (CFA Estimate = 0.716; CR 10.66). The results underscore the importance of green finance in sustainable cocoa production and the need to enhance farmers' living incomes to ensure green financing initiatives are effective. The results also suggest the need for better green finance policies and specialised incentives, like government-backed low-interest loans and tax incentives for farmers who adopt sustainable farming. The study was limited as it only considered green finance and focused only on smallholder cocoa farmers. Other considerations for future studies regarding sustainable cocoa production would be access to markets, technological innovation, and general environmental policy. The study recommends that the government provide government-backed, sustainable green financing, such as low interest rates for cocoa farmers and tax incentives for farmers who adopt green cocoa farming practices. Policymakers and stakeholders in Ghana should also prioritise inclusive and accessible green finance pathways for sustainable cocoa cultivation. This combination of financial and environmental interests, as well as farmers' economic well-being, suggests a path to long-term sustainability and fairness in the cocoa industry. In conclusion, businesses in Ghana's sustainability finance and cocoa-growing sector with access to eco-loans can use such

resources in ways other companies that do not have eco-loans cannot. The study concludes that although Ghanaian cocoa farmers generally had a fair understanding of what green finance was about and understood the benefits that could be derived from it, the incentives available, and government initiatives, the actual adoption remains low due to numerous key challenges. The study further concludes that green finance and farmers' living income significantly and positively influence sustainable cocoa farming. Finally, the study concludes that there are significant positive relationships among green finance, sustainable cocoa farming, and farmers' living income.

Declaration

I declare that this thesis has been composed solely by myself and has not been submitted to any previous application for a degree, in whole or in part. Unless stated otherwise by reference or acknowledgement, the work presented is entirely my own.

AI Acknowledgment

I acknowledge using Grammarly (https://grammarly.com/) to proofread chapters 1 to 5 of my thesis. This action was completed on 19.01.2025.

The app was connected, and suggestions for grammar were applied to the work.

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Dedication

This work is dedicated to my wife and kids.

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List of Abbreviations

ADB	-	African Development Bank
AIS	-	Agriculture Innovation Systems
ANOVA	-	Analysis of Variance
AVE	-	Average Variance Extracted
BFfSD	-	Blended Finance for Sustainable Development
BMfSF	-	Business Models for Sustainable Financing
CAA	-	Cocoa Abrabopa Association
CAQDAS	-	Computer-Assisted Qualitative Data Analysis Software
CB-SEM	-	Covariance-Based SEM
CDM	-	Clean Development Mechanism
CFA	-	Confirmatory Factor Analysis
CFI	-	Comparative Fit Index
CGIAR	-	Consortium of International Agricultural Research Centres
CMP	-	Conditional Mixed Process
COCOBOD	-	Ghana Cocoa Board
CR	-	Composite Reliability
CRIG	-	Cocoa Research Institute of Ghana
CSR	-	Corporate Social Responsibility
DEA	-	Data Envelopment Analysis
DF	-	Degrees of Freedom
DFID	-	Department for International Development
EKC	-	Environmental Kuznets Curve
ESG	-	Environmental, Social and Governance
EU	-	European Union
FAO	-	Food and Agricultural Organization
FCPF	-	Forest Carbon Partnership Facility
FGDs	-	Focus Group Discussions
GBs	-	Green Bonds

GDP	-	Gross domestic product
GFIP	-	Ghana Forest Investment Program
GSCA	-	Generalized Structured Component Analysis
GSS	-	Ghana Statistical Service
IFI	-	Incremental Fit Index
IPM	-	Integrated Pest Management
IRB	-	Institutional Review Board
ISNAR	-	International Service for National Agricultural Research
KENDBIP	-	Kenya National Domestic Biogas Programme
KMO	-	Kaiser-Meyer-Olkin
LID	-	Living Income Difference
ML	-	Maximum Likelihood
NFI	-	Normed Fit Index
nFMI	-	Farmers' Living Income
nGF	-	Availability of Green Finance
NGOs	-	non-governmental organisations
nSF	-	Access to Sustainable Farming
Pclose	-	P-value
P2P	-	Peer to Peer
PES	-	Payments for Environmental Services
PLS-SEM	-	Partial Least Squares - Structural Equation Modelling
RBT	-	Resource-Based Theory
RMSEA	-	Root Mean Square Error of Approximation
SCT	-	Social Capital Theory
SDGs	-	Sustainable Development Goals
SEM	-	Structural Equation Modelling
SIBs	-	Social Impact Bonds
SLA	-	Sustainable Livelihood Approach
SPSS	-	Statistical Package for Social Science
SRI	-	Socially Responsible Investing

SS	-	Sum of Squares
TDB	-	Theory of the Development of the Company
TLI	-	Tucker-Lewis Index
UREC	-	University Research Ethics Committee
VB-SEM	-	Variance or Component-Based SEM
VRIO	-	Value, Rarity, Imitation, and Organisation

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CHAPTER ONE: INTRODUCTION

Research Background

In many countries, the impact of agriculture on the development and the economic growth of the government cannot be overemphasised; indeed, in Ghana, it is the most reliable source of livelihood for a significant part of the rural populace and a major contributor to the economy through the provision of raw materials, jobs, and exports (Ghana Trade and Government in Africa, 2021). According to Kries and Associates (2021), cocoa contributes about Ghc1.77 billion annually to Ghana from exports to the United States.

The cocoa industry of Ghana has faced significant fluctuations in volumes of production during the 2024 and 2025 cocoa seasons. These fluctuations were a result of several factors, which include diseases, weather and economic policies. This supports the relevance and need for sustainable cocoa production practices and green financing strategies that aim to improve farmers' living income. Prior to the current cocoa season, Ghana had experienced one of the poorest cocoa harvests in a decade, with cocoa production dropping to 429,323 metric tons as of June 2024. This reduction in cocoa production can be attributed to poor weather conditions, prevalence of cocoa diseases, smuggling and lack of finance. This calls for sustainable cocoa practices to mitigate these challenges. In view of this, there is a need to integrate green finance into the cocoa sector to enable access to funding for environmentally friendly farming practices. This implies that when financial incentives are aligned with sustainable production goals, it will help stakeholders to improve farmers' living incomes and, at the same time, ensure environmental stewardship. It implies that the dual focus on sustainability and economic viability is essential for improving the long-term resilience of Ghana's cocoa industry and the livelihoods of its farmers.

The cocoa trade is a vital activity for Ghana and provides a source of income and employment to many rural dwellers. Ghana produced about 450,000 metric tonnes of cocoa in

the year 2000. Production was at a historic 1,045,500 metric tonnes by the 2020/2021 season compared to the 900,000 tonnes projected by the Ghana Cocoa Board. Ghana's cocoa production has grown rapidly over the past two decades but is often linked with deforestation, as landowners raze forests to make land for agriculture, further affecting the environment (World Resources Institute, 2020; Rainforest Alliance, 2021). Green finance is a sustainable solution. It supports climate-smart agriculture and land use by taking forest clearing out of the production equation (FAO, 2021; OECD, 2020). This helps farmers become more sustainable and increases yields on existing land. By so doing, green finance links economic development and ecological sustainability in Ghana's cocoa industry (UNEP, 2021; World Bank, 2021).

Soil erosion, water pollution, and deforestation are some of the environmental realities of the growth of the cocoa industry (Yamoah et al., 2021). Current production declines in cocoa exacerbate these environmental issues. As of mid-year 2024, Ghana's cocoa production sank to just under 429,323 metric tons, less than 55% of the average seasonal output (CDSAfrica, 2024). This drastic fall was due to prolonged droughts, crop diseases, and inefficient farm management, and it led the Ghana Cocoa Board (COCOBOD) to cut its production target for the 2024/25 season by 19.8% (The Ghana Report, 2024). The cocoa business is further challenged by the global price rise in precious metals, specifically gold, for which land is fought over by cocoa farmers (Osei et al., 2020). An upsurge in gold mining is a competition that cocoa farms can no longer resist (Gupta, 2020; Nyamekye et al., 2021). An increase of $0.66 daily in the price of cocoa is needed to give Ghana's cocoa producers a decent income (Kaba et al., 2022). This pertains to cocoa issues or problems with jobs, money, trees, and cocoa products. Climate change is one of the myriads of existential threats to the cocoa industry. Debrah et al. (2022) and Gupta (2020) have researched green funding to tackle these problems and mitigate some of the environmental damages brought about by climate change as it affects regional, national and international interests. However, the glaring lack of information and

literature on sustainable cocoa production and green financing, which are essential for Ghana's economy, is a key obstacle to realising the importance of the growth in funding green in Ghana's banking industry. The expression 'green finance', which will be referred to interchangeably as 'Green finance' for this essay, has become a valuable instrument in the struggle against environmental and social issues, particularly in low-income countries. Green finance, as it is understood in today's global environment, has the potential to redirect funding to sustainable projects that can improve environmental and social sustainability, particularly in the African continent (Akomea-Frimpong et al., 2022; Bhatnagar & Sharma, 2022; Desalegn & Tangl, 2022).

Green finance plays a vital role since many Ghanaian farmers depend on the cocoa industry for their livelihood but are confronted with several problems regarding deforestation, unsafe working conditions, and prices that are not high enough (Desalegn & Tangl, 2022). In particular, Attipoe et al. (2021) point to the unsustainability of the Ghanaian cocoa industry as well as the farmers' livelihoods due to child labour and the lack of welfare for farmers and their families, while others have highlighted the negative impact of mono-crop development and deforestation. Many farmers continue to operate in a financially unsustainable manner. Given the concerns about deforestation, child labour, and the livelihood of farmers, green funding could fund or incentivise solutions that might improve these problems, such as reforestation, better farming practices, and the certification of cocoa production using sustainable methods. Given that cocoa production is expected to become increasingly important for Ghana in the future, Osei et al. (2020) suggest how green finance might be used to promote agroforestry techniques to make the industry more resilient. Their findings show that agroforestry might be a promising investment for farmers and investors alike since agroforestry systems guarantee yield increase, afforestation and improvement of soil quality. Green finance is seen as a crucial element for the transition and involves financial decision-making that considers environmental

sustainability. Green finance can raise the efficiency of and promote sustainable agriculture, potentially contributing to lowering environmental degradation and climate change and mitigating socioeconomic vulnerabilities (Attipoe et al., 2021). At present, green finance has a limited but steadily growing role in the cocoa production landscape in Ghana, which is a cornerstone of the national economy. The literature on green finance focuses mainly on highlighting the potential, but there is little research exploring the actual effectiveness of green finance on cocoa production sustainability (Guo et al., 2022). Only a handful of studies explicitly explore the mediating role of farmers' living income.

There are many barriers to smallholder cocoa farmers in Ghana accessing green finance, whether it is lack of awareness of such products, the eligibility criteria, or transaction costs that collectively make it harder for the majority of these smallholders to be able to increase the use of sustainable agricultural practices (Gilchrist et al., 2021; Kaba et al., 2022; Ozili, 2022; Tuninetti et al., 2022). For example, farmers may lack the collateral needed to access loans, and financial institutions may be reluctant to invest in agriculture, given the perceived riskiness. For smallholders, a lack of financial literacy may also prevent farmers from understanding the products that support these sustainable cocoa production practices.

Green finance can make cocoa production more sustainable in Ghana. For example, Ghanaian farmers who practice sustainable agricultural methods, such as agroforestry and reforestation, can get carbon credits by funding the World Bank's Forest Carbon Partnership Facility (FCPF) (Forest Carbon Partnership Facility, nd). A carbon credit is a currency used internationally to provide farmers with an additional and steady stream of profits. Thus, the carbon footprint of the Ghanaian cocoa industry can be reduced by allocating financing to farmers who use sustainable agriculture methods and save resources (Cocoa Barometer, 2018).

Moreover, by increasing farmers' access to loans and investment, green finance might expand the country's capacity to increase its sustainable cocoa output, giving Ghanaian cocoa

farmers a big leg up. Furthermore, green finance may overcome a key constraint on sustainable agriculture: the limited availability of capital and investment for farmers. The World Bank lists a programme that funds sustainable farming of cocoa production in Ghana (World Bank, 2006). The Ghana Forest Investment Program (GFIP) provides financial and technical support to smallholder cocoa farmers to help them adopt more sustainable agricultural practices and increase their incomes (Akomea-Frimpong et al., 2022). For example, GFIP uses community grants and subsidies for seedlings and veterinary supplies to help farmers invest in dairy, beef cattle, and/or sheep to boost their income. The programme also promotes innovative technology, such as solar drying for smallholders.

Green financing can help Ghana increase its longer-term, environmentally friendly cocoa output. Some producers in Ghana struggle with sound environmental practices because they lack the skills and understanding to adopt good ecological use of a cocoa farm (Cocoa Barometer, 2018). The extension of sound environmental practices is another area where green financing can help Ghana scale up its longer-term, environmentally friendly cocoa output. For example, under the auspices of the Forest Carbon Partnership Facility (FCPF), extension workers are sent on short courses to earn certification in planting high-yield trees (Forest Carbon Partnership Facility, n.d..). This situation leads to greater use of more environmentally friendly agricultural practices, higher carbon storage in the land where the new trees are planted, and more financial return for the farmers (World Bank, n.d.).

Tsitati (2023) suggests that green financing can greatly help African countries like Ghana. Climate change affects agricultural productivity all over Africa, but the governments of the countries on the continent could use green financing to address the emission and adaptation gaps. Through initiatives that focus on embracing renewable energy, efficiency in energy usage, and sustainable agriculture, green funding can help fight against rising greenhouse gas emissions and aid in adapting to climate change. Green financing supports

sustainable agriculture methods such as agroforestry, crop rotation and soil conservation for Ghanaian cocoa producers, thereby enhancing the quality of living conditions for cocoa farmers and reducing the environmental impacts of cocoa production. Green financing can help provide access to renewable energy for rural people in Ghana, which would result in fewer emissions by reducing the usage of inefficient, traditional fuels such as wood or charcoal. In addition, green municipal bonds could support adaptation activities expected to minimise climate change impacts on Africa and improve water security for the continent, such as drought-resistant crops, better irrigation and water management.

Adom (2020) pointed out that sustainable cocoa certification schemes, which could be considered a green finance endeavour, are necessary to promote sustainable production in Ghana. This research was carried out in three zones of Ghana's cocoa farmers, and in general, farmers who had joined sustainability programs had a better chance to use sustainable strategies, such as planting shade trees to keep cocoa plants healthy and using chemicals for pest management. It could be the case that green finance aimed at these farmers is more successful because they make more money, acquire better knowledge about the industry during these sustainable programmes, or have better connections with people who can help them with further education. Green finance can make Ghana's cocoa industry more viable, but it will probably depend on the income of the country's farmers. Adom (2020) wrote that farmers who make a better income are more likely to use sustainable practices. As referred to earlier, this situation is because having a better income makes farmers more likely to adopt sustainable practices: they can afford to and are more willing to try new machinery and methods.

A move to green finance might be more successful for some farmers than others, depending on many factors beyond income, including levels of education, physical proximity to extension services, and access to loans. The more educated the farmers are, the more likely they are to use more sustainable farming practices, as was illustrated in research by Debrah et

al. (2022). Conclusively, farmers with access to extension services were more likely to practice farming sustainably (Kaba et al., 2022).

Green financing might help safeguard Ghana's and Africa's cocoa industries in the long term if it is well designed. Farmer income, educational level, and access to extension services are mediators in play in determining the success of green financing (Asare et al., 2018). Designing green finance engines that would yield long-term sustainability for farmers within the sector in sub–Saharan Africa and, by extension, Ghana will require looking into the said mediators (Akomea-Frimpong et al., 2022). This research seeks insight into how smallholder income mediates the relationship between green financing and the long-term viability of the Ghana cocoa industry. It aims to understand the level of awareness amongst people of the existing green finance regulations and incentives, the challenges that go with them and the progress that has been made so far in implementing Ghana's green finance laws. Overall, a strong need exists to heighten public awareness of two important economic segments, banking and agriculture, which form the cornerstone of the economy.

There is a pressing need for empirically testing whether green finance advances cocoa to be produced more sustainably. The relationship between green finance incentives and actual environmental outcomes is complex in the cocoa sector. While some studies show the positive impacts of green finance on sustainability, others indicate that green finance instruments have had limited positive effects. They underline the need for more robust, targeted and improved financial mechanisms. (Bhatnagar & Sharma, 2022)These mechanisms should be linked to the relevant area of the value chain for impact. For instance, investments in sustainable cocoa farming practices, including organic farming and agroforestry, must be integrated into the financial products that support these practices.

An important but less-studied pathway is how farmers' living income can help mediate the relationship between green finance and cocoa sustainability. If farmers earn more, they can

invest more in green practices, suggesting a second pathway through which green finance can hopefully achieve its intended outcomes (Gilchrist et al., 2021). Income security can give farmers more capacity to adopt new practices, rely less on environmentally degrading farming practices, and become more adapted to the impacts of climate change. This situation suggests that green finance can indirectly promote cocoa sustainability.

Problem Statement

The 2018 Cocoa Barometer reports that to increase sustainable cocoa output in Ghana, farmers must use sustainable farming practices that reduce their environmental impact, keep their land healthy, and provide steady revenue. According to reports from the World Bank, about 6% of the gross domestic product (GDP) and 40% of foreign currency revenues come from the cocoa business in Ghana, making it a significant sector of the economy (World Bank, n.d..). Unfortunately, farmers' earnings have been impacted negatively by deforestation, soil degradation, and poor yields from traditional techniques (Cocoa Barometer, 2018). Challenges such as poor productivity, aged cocoa fields, and low economic returns for farmers plague the Ghanaian cocoa sector (Cocoa Barometer, 2018).

Despite these obstacles, Ghana is under increasing pressure from the international community to lessen its impact on climate change (World Bank, n.d..). Sustainable cocoa production might be helped by green finance, which gives farmers the resources and motivation to use more eco-friendly practices. Sustainable cocoa production in Ghana has been aided by the Forest Carbon Partnership Facility (FCPF), funded by the World Bank through the distribution of seedlings and the provision of education on ecologically friendly methods (World Bank, n.d.). To help generate more funds for eco-friendly farming methods, the FCPF has also established a carbon credit trading platform (Forest Carbon Partnership Facility, n.d.).

Lack of investment in renewable energy, restricted access to clean energy, and poor infrastructure are some of the causes of the African emission gap, as stated by Tsitati (2023). African cocoa production suffers from a lack of infrastructure as well. While countries in Africa require about $50 billion per year to enforce climate change action, only around $5 billion per year is being allocated for this purpose, according to the African Development Bank. Tsitati (2023) expressed a severe shortage of green funding to combat climate change, ensure the sector's continued viability, and boost farmers' living incomes. According to Tsitati (2023), the adaptation gap is exacerbated by a lack of international cooperation, geopolitical differences due to insufficient funding, expertise, government regulations promoting green financial strategies, and a lack of information about the topic. One of the major risks has to do with elite capture, which occurs when political actors who are disproportionately stronger end up becoming the beneficiaries of green finance initiatives at the disadvantage of less privileged groups (Hickel & Dorninger, 2023). Large businesses and dominant financial institutions might secure considerable green investments, whereas businesses whose sizes are small and local communities are faced with challenges in accessing funding (Naidoo & Gasparatos, 2022). This results in the unequal distribution of resources, emphasising prevailing economic differences rather than ensuring that there is inclusive growth. In the case of some developing economies, multinational corporations obtain green financing for renewable energy projects; however, local communities are continuously excluded from decision-making processes and, as a result, do not have access to tangible benefits (Khan et al., 2023). Subsequently, green finance can unintentionally deepen socio-economic disparities rather than shared prosperity. Greenwashing is another critical challenge encountered: this is where businesses and financial institutions misleadingly depict themselves as environmentally responsible to attract investors and improve their public image (de Freitas Netto et al., 2023). These risks are further worsened by regulatory and implementation irregularities, which include weak governance frameworks

and unreliable sustainability standards (Sharma et al., 2023). In line with this, it is observed that the absence of a universally accepted taxonomy for green finance creates ambiguity, allowing firms to self-label projects as sustainable without meeting rigorous environmental benchmarks (European Central Bank, 2023).

Sustainable cocoa production in Ghana may benefit from green financing in several ways. Studies have found that farmers use renewable energy sources for agricultural operations, such as solar-powered irrigation systems, sprayers, pruners, and land techniques that promote sustainability (Wilson, 2010). For Africa to produce cocoa sustainably, it must minimise its dependence on non-renewable energy sources to manage the growing population and the emission of C02 gases contributing to climate change (Tsitati, 2023). Clean energy and sustainable infrastructure can be developed with the help of green financing, but it might be difficult for Ghana to get the required cash. Although studies on the relationship between green finance and sustainable development exist, none have been undertaken using Ghana as the case study (Asante-Poku & Angelucci, 2013; Peprah, 2019).

According to their study, there is a lack of data to adequately assess the contribution of green financing to economic growth (Aneani & Ofori-Frimpong, 2013). Consequently, Asante-Poku and Angelucci (2013) advocated for more transparency in the green finance sector and its potential effect on GDP growth. To fill this knowledge gap, researchers in Ghana need to look at the relationship between green financing and sustainable cocoa production. In addition, the social and environmental implications of sustainable cocoa production have not been adequately examined in the present study, highlighting that more research must be done in this area.

Peprah (2019) studied the effects of green financing on sustainable development in Ghana, zeroing in on the role of cocoa growing in this endeavour. Informational interviews and questionnaires were used to collect primary data from people in Ghana who had experience

with green financing and sustainable cocoa production. Findings from this study indicate the need for more research into the influences of green funding on long-term growth and prosperity and the impact of decent wages on cocoa farmers.

Research by Peprah (2019) shows that sustainable financing and cocoa production are essential to Ghana's economy and ecology. Still, more research is needed to understand the interaction between these aspects properly. If we want to keep the cocoa sector going strong in the future, we need to find creative ways to finance it, and there is no easy answer. Farmers, especially those with lower incomes or restricted access to financial institutions, may not have equal access to green finance, and it may not be as helpful for some farmers as it is for others. Other variables, like government policy and market demand, play key roles. This condition demonstrates the need to adapt green funding models to Ghana's unique setting and people.

This study aims to fill in some knowledge gaps on how green finance might help boost sustainable cocoa output in Ghana and how that can affect farmers' earnings. The research will examine green finance, sustainable cocoa production, and farmers' livelihoods. The study will assess the connection between green finance and the economic viability of farms and the nation's long-term sustainability, as well as the best strategies for sustainable cocoa production and green financial policies. Green funding for sustainable cocoa production is emphasised, as is the significance of considering the individual situation and target demographics. The findings also show how important it is to help smallholder farmers overcome the hurdles of using more environmentally friendly cocoa farming methods.

Purpose of the Study

This study aims to understand how green finance, sustainable cocoa production, and farmers' living income in Ghana are interconnected. Hence, the research uses a mixed approach, combining qualitative and quantitative methods. Creswell and Clark (2018) were of

the view that the use of a mixed method is an appropriate research design because it is established by the fact that it allows for the data to be triangulated, thereby boosting the study's reliability and validity. Researchers may improve their flexibility, integration, and coverage using a mixed-methods research plan (Robert et al., 2011).

The results are also more credible when qualitative and quantitative methodologies are used instead of just one (Harrison et al., 2011). Integrating qualitative and quantitative data helps the reader understand the findings and the bigger picture (Onwuegbuzie et al., 2010). According to Onwuegbuzie et al. (2010), the credibility of integrated data is increased when there is consistency between the quantitative findings and the qualitative outcomes from an exploratory sequential design. The epistemological assumption of this work is grounded in the pragmatic research philosophy, which holds that given the variety of actualities, there must be more than one method to make sense of them (Collis & Hussey, 2009). The study employed a mixed-methods approach to assess the effectiveness of Ghana's green finance policies (2011–2020) in ensuring sustainable cocoa farming. The study made use of a quantitative analysis to examine the policy impact indicators and further assesses farmer green financing and its relationship with sustainable farming practices using surveys. Furthermore, in the use of qualitative methods, interviews were used to explore the challenges faced by farmers in the acquisition of green finance. Additionally, the study investigated how farmers' living income influenced the effectiveness of green finance in driving sustainability (Onwuegbuzie et al., 2010). This was done because by integrating statistical analysis with in-depth insights, this approach provides an in-depth understanding of the relationship between green finance and sustainable cocoa production, leading to practical policy recommendations.

Methods such as focus group discussions (FGDs) were used to acquire qualitative data for the study (Creswell, 2014). The researcher ran a pilot test of the survey to see how well it would perform and to find any flaws in the study's design, and any required adjustments were

made before launching the entire research (Yin, 2014). Furthermore, the pilot survey yielded valuable preliminary data that might be utilised to lobby for further financing of future investigations (Saunders et al., 2012). To gain additional insight into the relationship between farmers' living income situation, green financing, and sustainable practices in the cocoa industry, the survey by Zhang (2020) examined the mediating effect of farmers' living income. The researcher reached out to key informants to clarify the study's context, limitations, and demographics and to ensure that the study's objectives were communicated clearly to participants. This approach allowed the researcher to select individuals with significant experience in cocoa-producing regions and specialised knowledge in cocoa finance.

This research surveyed financial institutions, cocoa farmers, and policymakers in Ghana's Ministry of Finance and Ministry of Food and Agriculture using a stratified random sample technique (Kombo, 2005). The study gathered information on environmental activities such as farming, land restoration, alternative energy sources, cocoa production, and smallholder farmers' living income. Given the unfavourable growing conditions, lack of farmer inputs, inadequate cultivation techniques, environmental degradation, and long-term viability of cocoa production, the research sought to address the potential impact of financial stability on how well green funding works to spread eco-friendly cocoa production methods. Ghana and other nations are concerned that by 2034, the rainforests of Côte d'Ivoire will have been removed for cocoa plantations (Daoui, 2018; Dontenville, 2018).

Climate change, the prospect of job and income losses, the deterioration of vegetation, and the endangered availability of chocolate goods all contribute to the bad status of cocoa production sustainability. Finding solutions that assure the sustainability of cocoa production is becoming more urgent due to the complexity and multidimensional nature of these difficulties.

Research Aims

The study aims to examine the interactions between green finance and sustainable cocoa production in Ghana and investigate the extent to which cocoa farmers' living incomes strengthen or reduce the relationship between them.

Research Objectives

Specifically, this study seeks:

1. To examine how effective the green finance policies and incentives the government of Ghana enacted between 2011 and 2020 have been.
2. To identify the challenges cocoa farmers in Ghana encounter when trying to get green finance and how it affects sustainable cocoa farming in Ghana.
3. To determine the link between green finance and sustainable cocoa farming in Ghana.
4. To evaluate how farmers' living income mediates the relationship between green finance and sustainable cocoa farming in Ghana.

Research Questions

The research is designed to investigate the relationship between green finance, sustainable cocoa production, and the income of smallholder cocoa farmers in Ghana. The following research questions were formulated to achieve this purpose:

RQ1: How effective are the green finance policies and incentives that the government of Ghana enacted between 2011 and 2020?

RQ2: What challenges do cocoa farmers in Ghana encounter when trying to get environmentally friendly financing?

RQ3: What is the relationship between green finance and sustainable cocoa farming?

RQ4: What role does farmers' living income play in the relationship between green finance and sustainable cocoa farming in Ghana?

Nature and Significance of Study

The purpose and cause were to see how green finance, sustainable cocoa production, and the income of smallholder farmers in Ghana are interconnected. The objectives were met thoroughly by the previous studies from 2003 - 2018, where the database was used to explain smallholder farmer revenue, average annual cocoa yield, rapid climate change, and green financing. The researcher could not have completed the study without using the mentioned data to guide my actions, research formulation, and investigation.

Following the empirical studies done by previous researchers, this study used structural equation modelling to determine the complex relationships between the given variables. This study focused on establishing the link between sustainable financing, cocoa production and the living income of smallholder farmers using structural equation modelling (SEM). The overall objective was to test the impact of green finance on the financial health of cocoa plantations and, above all, the producers. How green finance affects the financial health of cocoa plantation producers is the topic tackled in this study, and green finance will enhance the production of chocolate sustainably. The availability of green funding can amplify sustainable chocolate production practices. Higher yield and quality of chocolate and low environmental footprint production can be enhanced with green finance. Green funding has the potential of helping farmers improve their farming activities and increase their yield from their farms. However, when farmers' living incomes are not enough to support their activities, this might affect their operations and the relationship between green finance and sustainable farming by the farmers by cancelling it out. The level of income farmers earn negatively affects the extent to which green funding encourages environmentally friendly production of chocolate.

The study also employs structural equation models in SPSS and AMOS to test the underlying substantive basis for the proposed hypothesised causality among these variables. It considers the conceptual anchor points and their hypothesised relationships to provide the mathematical measurement framework for the impact of sustainable financing on the production volume of cocoa, the earnings of the smallholder farmers, and how the earnings of smallholder farmers mediate the relationship between green finance and the longevity of the viability of cocoa production.

It means that we can now understand whether and to what extent applications of green funding to this development context can contribute to developing and sustaining the long-term viability of cocoa farms and the bottom lines of cocoa farmers through the lens of the structural equation. These sophisticated statistical and mathematical computations will help policymakers, practitioners, and scholars understand the impact of green funding on the viability of cocoa farms and their farmers' bottom-line earnings. Qualitative data was achieved through in-depth interviews and focus groups combined with quantitative analysis. Farmers' views on green finance, sustainable cocoa production, and personal financial security will be presented in detail in a later chapter. In-depth interviews and focus groups were used in data collection about farmers' thoughts and views on these issues. Data was analysed qualitatively by identifying emergent patterns, themes, categories, and relationships (Bryman & Ball, 2015). These types of data collection are conversational; therefore, farmers are more likely to answer questions honestly (Clark et al., 2018; Creswell & Clark, 2018).

This implies that if they answer questions well, it will, in turn, include many gates and locks in the data collecting and analysing phases to ensure honest and accurate results. Fourth, a preliminary validation test of the honesty and validity of focus group talks and interviewees was conducted (Creswell & Weitz, 2011). To reinforce the validity of the results, the researcher conducted a pre-test with the help of structural equation modelling tools (Long, 2013; Byrne,

2016), as well as additional pilot research to validate the accuracy of the results (Easterly & Levine, 1997). The mixed methods approach to structural equation modelling, focus group talks, pilot research, and a pre-test employed in this study assured the data's validity and reliability (Easterly & Levine, 1997).

Purposeful sampling was applied to the participants of focus group discussions and the interviewees, whereby they were selected due to their power of knowledge on the sustainability of financing, cultivation of sustainable cocoa and cocoa earning by smallholder cocoa farmers. The term ‘green finance’ denotes how financial markets attempt to address global heating and other environmental threats by channelling money for action on conservation and sustainable development of the natural world, and sustainable cocoa production is best understood as the way to grow and sell cocoa that is also both ecologically benign and centres the survival of cocoa-farming peoples’ financial and social wellbeing (Creswell & Clark, 2018).

As one of the leading producers of cocoa, accounting for 20% of the world’s output (World Cocoa Foundation) and constituting about 4% of the country’s economy (Ghana Statistical Service, 2021), the cocoa industry is of significant importance to the government and should be protected. However, Ghana’s dependence on the cocoa industry has its claws on the trees, soil and water quality (Food and Agriculture Organization of the United Nations, 2019). To make harvesting and processing less aggressive, Ghanaians can use sources of the banking system to buy green machinery, apply the new advanced farming methods, and go through certification programmes (International Cocoa Organization, 2020). To a certain point, these procedures might roughly arrange the cocoa industry's negative impact on nature. However, as Osei et al. (2020) argue, sustainable financing can affect (both positively and negatively) the sustainability of Ghana’s cocoa industry. The point is that the farmers’ living incomes play a significant role in the access of Ghanaian farmers to green funding, and their motivation to adopt sustainable farming methods depends on the farmers’ living income.

In Ghana, the causal relationship between green finance and sustainable cocoa will be moderated by the income of farmers (Easterly & Levine, 1997). Therefore, a deeper understanding of this relationship will help promote the viability of the cocoa business in the country for the long term. This study aims to assist in deepening the existing knowledge and explain the role of green financing in enhancing the sustainability of the cocoa business. Using the study results, policymakers and other stakeholders can develop a better long-term plan for the cocoa market (Bryman & Bell, 2015). Moreover, there are new understandings it can shed on green finance and sustainable development research fields. This study can act as a launching point for scholars, policymakers and the broader public to continue their research and analysis (Creswell & Clark, 2018). The findings from the study are significant as they highlight some key implications relevant to policy decisions for ensuring sustainable cocoa farming through green financing. In order to provide support for eco-friendly practices, the Ghanaian Government should consider the introduction of loans with low interest, which include green cocoa financing schemes that will enable farmers to invest in agroforestry, purchase and use organic fertilisers and implement methods aimed at conserving water bodies. Furthermore, there is a consideration of the implementation of a minimum price guarantee policy or a living wage for cocoa farmers to stabilise incomes, with the aim of protecting farmers from global price fluctuations and ensuring long-term sustainability. The next significance of this study relates to expanding financial inclusion through the provision of a simplified loan process, digitising the banking process, and engaging in more financial literacy programmes, which will further enhance access to green finance. Furthermore, the provision of complementary policies, such as the Sustainable Cocoa Export Policy, can provide trade incentives. At the same time, investment in research and development through a Cocoa Sustainability Innovation Fund can drive climate-resilient cocoa farming and eco-friendly processing techniques. This implies that there is a need for a more holistic approach that seeks to integrate finance, economic support,

and environmental strategies that will ensure that Ghana's cocoa industry is robust and remains sustainable, competitive, and resilient in the face of climate challenges.

Research Hypotheses

Several writers have explored the relationship between sustainable financing and sustainable cocoa production (Takyi & Amponsah, 2020; Daoui, 2018; O'Donnell, 2019; Nieburg, 2015; Teguh & Misnawi, 2019). Although the association between green finance and cocoa cultivation has not been thoroughly explored, there is expected to be a positive association between the two, with the strength of the relationship being influenced by the income levels of Ghanaian farmers. In international studies, sustainable cocoa production has been shown to have a connection to green financing. According to research conducted in Vietnam by Tran et al. (2020), using green funding in agriculture raised the profitability of smallholder farmers. It ensured the long-term viability of the country's cocoa supply. Investment in green financing in Indonesia boosted cocoa output, productivity, and smallholder farmers' living income, as Syafri et al. (2019) revealed.

According to research conducted in Japan, Kato and Sakurai (2018) discovered that environmentally friendly loans and other green financing helped improve agricultural sustainability by promoting organic farming practices and decreasing non-organic farming practices, such as the use of chemical fertilisers. Owusu-Ansah and Buah (2020) found that smallholder farmers in Ghana with access to sustainable financing had higher earnings and were more susceptible to sustainable cocoa production methods, positively impacting the maintenance of cocoa-growing areas' biodiversity and resources. Acheampong et al. (2019) also expressed that cocoa farmer in Ghana benefited from assistance with sustainable cocoa production techniques, such as training and access to sustainable financing.

According to the resource dependence idea, businesses (and farmers specifically) need access to external resources like money to stay afloat and further their missions (Pfeffer & Salancik, 1978). Green financing may provide farmers access to tools and resources that help them produce food in a way that does not harm the environment. By providing funding for agroforestry, green finance may help curb deforestation and boost efforts to preserve biodiversity. Fairtrade and Rainforest Alliance are only examples of sustainable certification programmes that may get backing from green financing, helping cocoa producers earn more money via higher product pricing.

Although green financing is crucial, it may not be enough to ensure the long-term viability of cocoa farming. According to social capital theory, a person's or group's capacity to access resources and bring about good change is increased by having a strong support structure and network, such as a secure income (Putnam, 2000). Income from farming may help farmers make better use of green financing, reducing the negative impact on sustainable cocoa production. Farmers with higher incomes, for instance, have a better chance of gaining access to green funding, either by being accepted as collateral or having a better credit history.

The income of farmers is shown to modulate the beneficial association between green financing and sustainable cocoa output. Scientists in Ghana discovered that green funding in the form of Fairtrade certification increased farmer income and ensured the long-term viability of cocoa cultivation (Amankwah et al., 2016). Higher-income farmers were shown to have the potential for increased use of environmentally friendly practices and accreditation in this research, indicating that farmer income positively moderated the association between Fairtrade certification and sustainable cocoa output. These findings suggest that boosting farmers' living income using green financing, such as fair trade incentives, may promote the long-term viability of the cocoa industry.

Studies have shown a significant correlation between green financing and the sustainable production of cocoa. Côte d'Ivoire farmers were more likely to follow sustainable practices after receiving loans from a microfinance organisation that prioritised environmental responsibility (Gockowski et al., 2018). Better economic conditions for cocoa growers in Indonesia were achieved via the availability of green financing in the form of grants and subsidies (Santoso et al., 2019). Hence, the study will test the following hypothesis.

H1: There is no significant correlation between green finance and sustainable cocoa production

H2: Farmers' living income does not significantly affect the relationship between green finance and sustainable cocoa production

CHAPTER TWO: LITERATURE

Introduction

The main objective of this chapter is to give a complete review of the literature, particularly the theoretical and conceptual framework relating to the constructs associated with this research. This research project aims to illustrate the role of smallholder income on the nexus between green finance and sustainable cocoa production in Ghana. A thorough and systematic literature review was carried out to achieve the above-stated aim using various key terms and databases. The databases include JSTOR, ScienceDirect and Google Scholar. The date of search is from 1990 till date. The information mining procedure on literature involves a literature review, a critical review of the seminal writings of the modern and well-reviewed literature, and other materials such as publications, reports, and policy papers. The literature review is prepared in an ordered and organised way; furthermore, the framework for which the constructs for the study was to be carried out revolved around five unique subjects. The constructs are sustainable development; the concept of green finance; the determining factors, either an enhancer or a deterrent to the growth of green finance; the impact of green finance on sustainable development; and the prospects of green finance. The main objective of the literature review is to provide a complete understanding of the concepts of green finance and sustainable development and their dynamic relationship.

Theoretical and Conceptual Framework

This section elaborates on the theoretical frameworks utilised in the present investigation. The study uses the Sustainable Livelihood Approach, Agriculture Innovation Systems (AIS) framework, Social Capital Theory (SCT), and Resource-Based Theory. The ensuing discussion will furnish a synopsis of the genesis and academic dialogue encompassing

these frameworks. The section starts by explaining the theories. In this context, the first theory is explained.

The Social Capital Theory (SCT)

The idea of social capital was proposed to extend our understanding of how social relationships can be used to procure relevant benefits that can be drawn upon to further our pursuits. It emphasises that social interaction is not just an end but also a route to acquiring valuable resources, including knowledge, trust and social support (Putnam, 1995). Social Capital theory promotes social connections, forming capital that people and groups can use to produce social and economic benefits. The social capital theory distinguishes between two types of social capital: bonding and bridging. A bonding type of social capital refers to the clustering of social relationships among similar people, including those with the same race, ethnicity and religion. As Putnam (2000) described, the bridging type of social capital refers to social affiliations among those of differing socioeconomic backgrounds.

The identifying feature of Social Capital theory is that social networks and connections generate collective impacts that are more than the sum of individual actor interests. Social capital can thus be deployed to create public goods, such as trust in institutions or to allow for joint action, such as social movements and community organisations that have the potential to materialise in local, national or even global positive change. Social Capital theory enjoyed wide popularity through the 1990s and beyond.

Social capital theory is a theoretical construct that partly draws on findings from sociology, political science, and economics. Scholars in sociology, in particular, have examined the ability of networks and relationships ‘to facilitate cohesion and a sense of community’, according to a report by Sallie Buckley of the World Bank Group. Political scientists study the role social capital plays in civic participation, that is, enhancing ‘democratic

action and developing democracy', while in economics, the relationship between market exchange and economic production can improve the 'transmission of information' and bring about 'economic development'. Fukuyama (1995) expressed that when individuals within a society have higher levels of trust in one another, transaction costs are reduced, dissemination of information is improved, and market efficacy increases.

Although Social Capital theory has opened our eyes to various new ways of thinking, scholars have also pointed out the challenges of the framework. For example, measuring social capital has been criticised as complex; thus, comparisons of social capital between contexts may be complicated. A prominent critique is that social capital can be used to promote exclusion by favouring one group over another. It has also been claimed that social capital might not be a different form of capital but could result from education and economic capital (Portes, 1998). The Social Capital Theory sheds light on the power of social networks in promoting economic and social benefits (Putnam, 1995). The theory is mostly pertinent to green finance and sustainable cocoa production, in which the social relationship existing between farmers, financial institutions, and governments and their agencies tend to improve access to funding, information sharing, and sustainable farming practices. In the context of green finance, it aims at promoting environmentally sustainable investments, and it plays a key role in ensuring that cocoa production is in line with ecological and social objectives (Chen et al., 2023). This is done by ensuring that farmers are able to leverage on social capital to form cooperatives that aim at improving their bargaining power, secure fair trade certifications, and access financial products that provide some form of incentives to sustain their farming activities. Considering examples from Ghana and Ivory Coast, initiatives like the Ghana Cocoa Board (COCOBOD) as well as the Cocoa & Forests Initiative (CFI) enable social networks amongst cocoa farmers, policymakers, as well as financial institutions to ensure the adherence to reforestation and agroforestry-based cocoa farming (Aidoo et al., 2022).

From the above, there is evidence of bonding social capital in farmer cooperatives. This can be evidently clear where shared values and trust improve access to sustainability programmes, which include programmes such as the Rainforest Alliance certification. It must be further noted that, in the meanwhile, bridging social capital allows partnerships between cocoa-producing communities and global buyers, which assures that farmers receive better prices. In Peru, examples of green finance mechanisms include blended finance models in which both public and private funds are invested in sustainable agriculture, which has helped empower cocoa farmers to transition to deforestation-free production and, at the same time, improve their incomes (González & Porras, 2023).

Regardless of the benefits discussed earlier, some challenges persist. Although it is observed that social capital fosters inclusivity, it tends to result in the exclusion of independent farmers who are not part of any form of cooperative, which has the effect of limiting their access to green finance opportunities (Portes, 1998). Furthermore, differences in social capital between regions make it more challenging to assess its impact on farmers' living income consistently (Wang et al., 2024). This implies that to address these challenges, there is a need for policy frameworks aimed at strengthening social networks and, at the same time, making sure that green finance mechanisms get to the most vulnerable cocoa farmers.

The Resource-Based Theory (RBT)

By spotlighting a company's resources and competencies, RBT is a theoretical framework to explain how businesses obtain and maintain marketplace advantage. The traditional view of the concept is that a firm's resources are its primary source of strategic advantage and that firms with a distinctive and valuable resource base can earn benefits in the marketplace that are difficult for their rivals to imitate. RBT dates back to the early 1980s: its

forerunner is the Theory of the Development of the Company (TDB) that gave special emphasis to the role of the resources for the company's development and therefore laid down the foundation for the resource-based view of strategic management that attaches special importance to resources. Olavarrieta and Ellinger (1997) likewise stated that the resource-based theory focused on the importance of resources for creating and sustaining the company's development, thus initiating the resource-based view of strategic management, which puts resources in the centre.

In the 1990s, Resource-Based Theory (RBT) in its current form made outstanding contributions to business and management and 'remains the dominant paradigm in strategic management and planning' (Barney, 1991). A US study cited by Barney and Mackey (2005) proposed a system for assessing the worth of a product based on the extent to which it could satisfy four value criteria: value, rarity, imitation, and organisation (VRIO), this being a pragmatic approach to assessing a firm's resources and/or capabilities and the respective ability to create sustainable competitive advantage. RBT focuses on the distinctive resources and capabilities of the firm and its sustainable competitive advantages. The centrality of RBT is defined as 'the potential of business resources to deliver a sustained competitive advantage based on their variability' (Acedo et al., 2006).

In RBT, resources can be categorised as tangible and intangible. The category of intangible resources would include brand reputation, intellectual property and human capital, while tangible resources would consist of equipment and land. The theory of RBT has been used extensively in management, such as marketing, operational management, economics, supply chain management, and innovation, and scholars have written about it in academic journals. Authors, including Barney (2014), David et al. (2014), Hitt et al. (2016), and McWilliams and Siegel (2011), assert that big-data analytics, dynamic capabilities,

procurement and supply management approaches, marketing capabilities, and innovation have all made use of RBT.

Barney (2014) examined the association between RBT and organisational performance and recommended that its implementation could enhance business performance. Despite its widespread use, the Resource-Based Theory (RBT) has faced criticism for neglecting the external environment and chance creation of competitive advantages (Priem & Butler, 2001), arguing that RBT overemphasised internal factors. This study evaluates the role of environment and chance in forming competitive advantages. Various industries have widely applied the crucial tenet of resource-based theory (RBT), a management framework. The text demonstrates how organisations can obtain and sustain a competitive advantage through their different resources and capabilities. Despite considerable criticism, the theory has strongly influenced strategic management and planning. It continues to be a critical area of investigation in the discipline of management.

Sustainable cocoa production in Ghana depends on green money, and RBT helps us think it through. Likewise, according to the theory, building an advantage for a firm depends on possessing idiosyncratic resources and capabilities. For sustainable cocoa production in Ghana, green cash as a resource is differentiating or idiosyncratic because it can be available to some firms and not others. By exploring how firms deploy green money to sustain their business, we can see if these resources can offer a competitive advantage in the marketplace. According to Kozlenkova et al.. (2014), the RBT pays attention to the impact of resource heterogeneity on organisational performance. Green financing allows companies in the Ghanaian cocoa-producing industry to access resources that other companies lack while positioning them to compete. The study of how green finance has affected the long-term viability of cocoa production could shed light on how resource availability (or lack thereof) influences a company's capacity to operate.

Furthermore, RBT emphasises the potential for resource immobility to enhance competitiveness. What does this mean for green finance and cocoa cultivation in Ghana? Companies that receive access to green finance might be able to utilise that green resource in complex ways that other firms cannot replicate. The cocoa sector needs a sustainable competitive advantage. Examining the relationship between resource immobility and corporate performance could help us understand how firms might leverage green finance to build such an advantage. The Resource-Based Theory (RBT) provides a basis for examining ways through which firms in Ghana's cocoa industry can be competitive as well as gain sustainable competitive advantage through the use of green finance. The theory posits that firms with exceptional and unique resources can sustain superior market positions (Barney, 1991). In the framework of ensuring sustainable cocoa production, the consideration for green finance funding, which is aimed at supporting environmentally friendly agricultural practices, can be used as a distinctive resource. This is because not all firms can have equal access to it as a resource. In advancing sustainable cocoa production, green finance is seen to play a crucial role by providing financial support for agroforestry, climate-resilient cocoa production, and carbon credit initiatives. In the Ghanaian context, there have been some initiatives, such as the Cocoa & Forests Initiative (CFI) and the Ghana Cocoa Board's (COCOBOD) climate-smart cocoa programs, to determine how firms take advantage of green finance to build competitive advantages (Aidoo et al., 2022).

When cocoa companies access green financing, they can invest in sustainable production technologies and adhere to global environmental standards, positioning themselves positively in international markets. The theory also highlights the importance of resource immobility, which implies that resources are not easily moved or imitated across firms. For example, institutions that establish long-term partnerships using leaders who are focused on sustainable lenders and investors might obtain exclusive access to preferential financing terms.

This is also evident in the Ivory Coast, where some selected cooperatives have attained green finance aimed at implementing organic cocoa farming as well as providing them with a competitive advantage over firms dependent on traditional farming methods (Kouadio & Mensah, 2023). Furthermore, RBT highlights that institutions attaining resource heterogeneity and having unique competencies can sustain their market advantage. In the context of Latin America, firms like Ecookim in Ecuador have effectively used green finance to fund agroforestry-based cocoa farming, which has improved soil fertility at the same time as increasing harvestable produce and incomes for farmers (Rodríguez & Salazar, 2023). This is in line with the assertion by Kozlenkova et al. (2014) that resource diversity impacts firm performance. Notwithstanding all of these benefits, challenges exist. Although green finance presents a likely advantage, differences in access may exclude smaller, independent farmers, restricting industry-wide sustainability improvements (Priem & Butler, 2001). This implies that policymakers must, as a matter of urgency, design frameworks that guarantee the equitable distribution of green finance resources, fostering industry-wide competitiveness rather than benefiting only a few firms.

a) Sustainable Livelihood Approach

The Sustainable Livelihood Approach (SLA), a way of understanding how the micro-socioeconomic and dynamic interconnections between poverty and livelihoods work, was developed in the late 1990s by the United Kingdom's Department for International Development (DFID). The importance of understanding the relationships among various livelihood assets and how the framework from these assets generates livelihood strategies is noted by Tao and Wall (2009). Similarly, the contextual sensitivity of interventions and the local people's participation in the design and implementation of poverty reduction programs is acknowledged in the framework (Su et al., 2009).

The SLA framework has been used to inform research and development efforts in rural and urban settings and health, education and agriculture (Morse et al., 2013; Shen et al., 2008; Su et al., 2021; Tao Wall, 2009). For instance, the SLA has been used in the agricultural sector to analyse how smallholder-based livelihoods can generate an income by considering the changes brought about by different sorts of openings such as markets, inputs and extension services. The fisheries industry has used the SLA to describe the aspects, for instance, access to fishing grounds, forces of the market, and the regulatory framework, that facilitate fishing-based livelihoods in the long run (Massoud et al., 2016)

The participatory nature of the framework also seeks the involvement of local communities in both the development and implementation of poverty reduction strategies, both of which are important in helping with successful rollout and long-term sustainability. Through primary and secondary research, administrators and researchers can determine the underlying economic, social, political, and environmental factors contributing to poverty and vulnerability. Researchers can identify the root causes of poverty, which could inform the development of detailed and coherent poverty reduction strategies that address the fundamental causes of poverty, according to Morse and McNamara (2013).

Furthermore, the SLA has been applied to assess the consequences of various interventions to improve subsistence livelihoods. For instance, it has been used to analyse natural resource management policies, agricultural and rural development programmes, and microfinance schemes. Employing the SLA, scholars have explored how the changing climate might affect livelihood security, particularly in rural areas where villagers are more vulnerable to ecological hazards.

Many academic studies have challenged the conceptual boundaries of the SLA framework, including the fact that it places a disproportionate emphasis on agency at the expense of broader structural constraints on the conditions of existence, such as patterns of

power inequalities, land tenure regimes and market structures. Aazami and Shanazi (2020), Elasha et al. (2005) and Morse and McNamara (2013), among others, all make the case that the SLA approach gives too little attention to the temporal dynamics of livelihoods and that it tends to underestimate the role of the cultural and identitarian factors on the development of livelihood repertoires.

The application of the Sustainable Livelihood Approach can be a helpful normative guide to understanding the impact of financial interventions on the livelihoods of cocoa farmers and their communities when assessing whether sustainability financing is making a difference in the cocoa market in Ghana. Indeed, an analysis of the impact of funding green on the variety of the assets and resources that cocoa farmers own and can use when producing cocoa (such as credit appropriation, knowledge on improved agronomic practices, social networks, etc.) is likely to offer relevant learnings to how Ghanaian cocoa producers' livelihoods might change as a result of such measures.

b) The Agriculture Innovation Systems (AIS) Framework

Recent imperatives to make agricultural investments economically viable have also lent prominence to the Agricultural Innovation Systems (AIS) analytical framework in the farming community. The AIS paradigm notes not only the links and knowledge flows across actors but also the innovation process itself as the creation and utilisation of knowledge, the role of institutions in deciding the nature of the innovations, and the role of learning in creating innovation systems that are particular and site-specific (Kingiri, 2013).

Agriculture Innovation Systems (AIS) is a framework that emerged at the end of the 1990s and in the early 2000s. The premise of this initiative has a story behind it. In brief, the old ways of conducting agricultural research and extension were not compelling enough to deal with the many complex challenges facing the sector, including climate change, food security

and poverty reduction (Spielman & Birner, 2008). Systems thinking, which underpins AIS, underscores the importance of knowing how parts of the system are connected. The paradigm's primary influence comes from the innovation systems approach that sees innovation as a driving force for progress and prosperity. The Netherlands-based International Service first introduced the framework for National Agricultural Research (ISNAR). Different organisations and experts worldwide have developed and refined it, including the Food and Agricultural Organization (FAO) and the Consortium of International Agricultural Research Centres (CGIAR).

As summarised by Spielman (2005), the key aspect of the AIS approach is bringing together different stakeholders, organisations and regulations to develop a holistic approach to agricultural development, one that recognises the complexity and heterogeneity of agrarian development and acknowledges that various stakeholders and interventions are needed to provide solutions and foster innovation. The AIS framework heavily emphasises innovation as contributing to agricultural development (Toillier et al., 2021). Thus, fostering sustainable agriculture requires creating an environment that supports innovation and has the appropriate legal and institutional framework and infrastructural setup to facilitate the development and diffusion of technologies and knowledge. Creating such an environment is essential in the virtuous circle theory of how green financing can help cocoa farmers in Ghana.

The AIS framework has also been used worldwide in agricultural research and development (R&D) projects. This AIS framework provides an overview of the primary literature that has applied the AIS framework in more detail. The AIS is a system often used when implementing innovation platforms to help stakeholders collaborate and coordinate knowledge and membership exchange activities. Van Schalkwyk et al. (2019) reported that research in Tanzania showed that innovation platforms led to the scale-up of new agricultural technologies and practices by facilitating cross-stakeholder learning and the development of

stakeholder relationships. Birachi et al. (2017) also argued that strengthening farmers' and other relevant stakeholders' capabilities can enhance the adoption of new agricultural technologies and practices because they can scale up innovation.

The AIS has been used to guide the analysis and implementation of policies to create an innovation-incentive environment. For example, Babatunde et al. (2018) applied an AIS in their study in Ghana to describe the policy environment supporting agri-food innovation in the hope of informing policy decisions to improve the innovation system. Bhattarai and colleagues (2019) used the AIS framework as a roadmap for enhancing agricultural value chains in Nepal. The authors explained that when the AIS framework was applied to guide the development of a dairy value chain, it was done by identifying key industry stakeholders in the value chain, which helped improve farmers' standard of living. It identified the key measures to make the value chain more resilient and sustainable.

The current study will use the AIS framework to assess the stakeholders in developing sustainable cocoa production and farmers' livelihoods. The study's authors, Lamprinopoulou et al. (2014), wrote: "The relevant variables will include efforts from sustainable financial mechanisms and governmental funding to advance the adoption of sustainable methods for the cocoa farming sector. The activities associated with the project would include research and development activities to formulate sustainable farming methods, the establishment of farmer groups, and settlement of the farmer's involvement in the financial sector by advocating the use of Green finance".

In addition, the findings will apply the AIS framework to examine the existing policy environment for promoting sustainable cocoa production in Ghana and provide policy recommendations for enhancing the innovation system. The proposed model could be used to identify the actors (farmers, input suppliers, agro-processors, exporters, financiers and

government) in the cocoa value chain and provide a platform for them to collaborate on and share knowledge.

Conceptual Framework

A conceptual model, shown below, is designed based on the literature review and the theories discussed above.

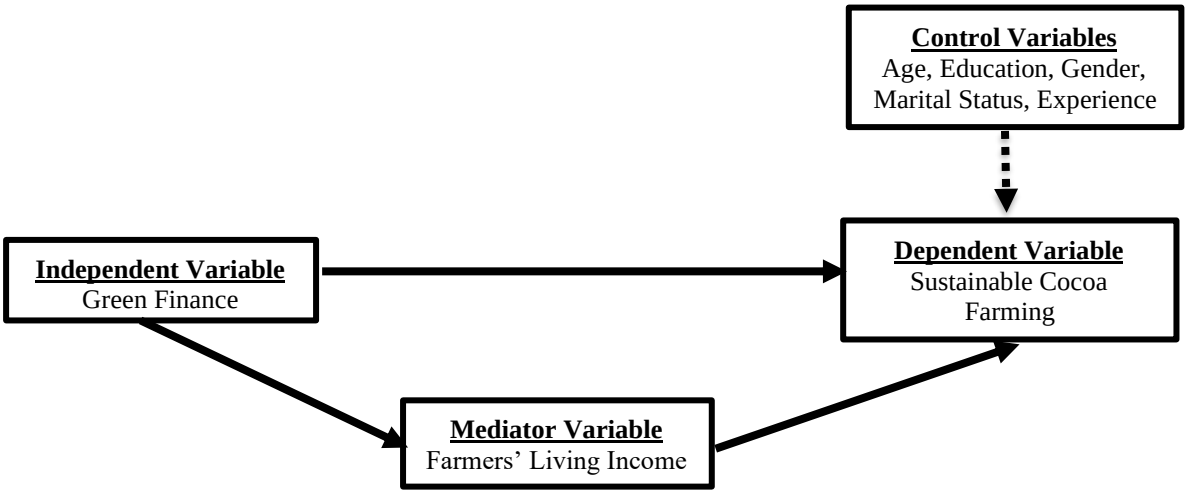


Figure 2.1 – Researchers Conceptual Model

Figure 2.1 presents the conceptual framework for our study. In this framework, green finance is the independent variable; sustainable cocoa production is the dependent variable of farmers' living income; farmers' living income is the mediator variable; and age, education, gender, marital status and experience are control variables. There is a direct relationship between green finance and sustainable cocoa production utilising farmers' living income. As suggested by Deschryver and de Mariz (2020), as mentioned above, the framework designates green finance as an independent variable, a financial instrument creating a value that facilitates access to sustainable agricultural techniques, particularly those more relevant to cocoa cultivation. The literature reviewed has documented the importance of green finance in promoting sustainable agriculture.

A study by Adenle et al. (2019) points out the importance of the incentive systems in the financial models and their potential as a critical element in the viability and sustainability of the cocoa sector. They note that using such models favours the continuity of cocoa cultivation and that the effects on small-scale farmers are significant. It depicted the farmers' living income as a mediation variable. Meanwhile, the capacity of financial instruments and institutional mechanisms to promote ecologically sustainable production practices in the agricultural sector, such as cocoa production, was discussed by Wang et al. (2018). In the authors' opinion above, the role of the farmers' living income is critical in moderating the relationship between green finance and sustainable cocoa production.

Furthermore, the conceptual framework includes certain control variables such as age, education, gender, marital status and experience. Adom et al. (2023) studied how cocoa financing can lead to sustainable cocoa farming in West Africa. The study shows that farmers are encouraged to adopt sustainable practices when specific funding and incentives are provided. However, by using control variables, the researcher was able to understand whether some other variables can help or hinder cocoa production from being sustainable.

By including the control variables above, we can gain a more wholesome understanding of the variables that can help or hinder sustainable cocoa production (Adom et al., 2023).

'Green finance' sometimes refers to offering financial services and products to foster this transition to a more environmentally sustainable economy, focusing on carbon emission mitigation and climate change adaptation. Enabling cocoa farmers to access finance, technology, and knowledge can facilitate their transition to more sustainable farming practices, potentially reducing their environmental footprint. Green finance can enable cocoa producers to adopt climate-smart agricultural approaches, including agroforestry, shade-grown cocoa,

organic fertiliser and insect management, irrigation systems, and renewable energies (World Resources Institute, 2019).

These techniques can improve the efficiency and quality of cacao production while at the same time addressing the issues and threats related to climate change, such as water scarcity, floods, pests, and diseases. So, according to the resource-based view, green finance can provide cocoa producers with valuable, rare, inimitable, and non-substitutable resources that can help them be better performers and gain a competitive advantage in the market. (Barney, 1991). Furthermore, per the Social Capital Theory, it could change people's attitudes and modify social norms in essential ways, as well as the perceived behavioural control of cocoa producers related to sustainable cocoa production, which might affect their intentions and behaviour (Barney, 1991). According to the Agriculture Innovation System framework, green finance can help cocoa producers achieve certifications from Fairtrade, Rainforest Alliance, UTZ, etc., which can offer premium prices and market access to producers according to social and environmental standards.

Sustainable cocoa production means producing cocoa that contributes to the current generation's needs without compromising future generations' ability to meet their needs economically, socially, and environmentally. This refers to reducing greenhouse gas emissions, protecting biodiversity, and improving ecosystem services. The goal of sustainable cocoa production is to produce better yields qualitatively and quantitatively, increase income, enhance the resilience of farmers, and preserve and restore forests, according to the European Commission (2020) and the World Cocoa Foundation (2020). Sustainable cocoa production can improve the lives of many subsistence farmers who rely on cocoa for their livelihoods and food security. Cocoa production in some regions has the potential to contribute to reducing poverty, increasing gender equality and social inclusion, and respecting human rights.

Implementing sustainable cocoa production may preserve biodiversity and the various ecosystem services of the tropical forests in which cocoa plantations are located, including carbon sequestration, water regulation, soil fertility, and pollination. It may also prevent deforestation and the destruction of forests that represent the habitat of fauna, flora, and people living in forest areas. Sustainable cocoa production can potentially align with the sustainable livelihood approach (Chambers & Conway, 1992) that sees sustainable chocolate production as possible because it balances sustainability's economic, environmental and social pillars to provide value for people, the planet and profit. Sustainable cocoa production also has the potential to respond to the expectations and needs of the stakeholders involved in the cocoa value chain, including farmers, traders, processors, manufacturers, consumers, farmers, governments, NGOs, and civil society, according to the stakeholder theory (Freeman et al., 2010).

The European Commission (2020) argues that the financial income of cocoa producers and their households is a vital determinant likely to impact their livelihood and welfare significantly. Cocoa farmers' consumption and savings will be determined by the net income that results from their production activities after deducting all production and marketing costs. This circumstance can also affect access to essential health, education, and social security services. Higher incomes can improve conditions for cocoa growers and their families and reduce poverty in the cocoa-growing regions. Moreover, a farmer's revenue can affect their decisions regarding sustainable cocoa production practices (European Commission, 2020). A more significant income can increase the propensity and capacity of individuals to adopt new technologies, practices and standards that impose upfront costs or involve risks.

One strategy for stimulating sustainable cocoa production could be using resources to implement nature-positive practices, such as agroforestry and shade-grown cocoa cultivation, organic fertilising and pest control, irrigation facilities, renewable energy technologies, etc.

Sustainable practices can increase biomass production, cocoa yield, and quality and be a climate adaptation strategy. Furthermore, it can lead to a more extraordinary biodiversity of plants and animals and support the maintenance and enhancement of ecosystem services. Another avenue through which remuneration can influence farmer conduct relates to farmers' bargaining power and agency. The European Commission (2020) suggests that higher-income farmers may be able to negotiate better prices for cocoa, enter new markets, and obtain green credit from banks and value-added opportunities. Suppose individuals are allowed to participate more fully in governance and policy-making processes affecting their livelihoods and the sustainability of cocoa production. In that case, this can be a positive development.

The moderating influence of farmers' living income is attributable, in part, at least, to their differences in preferences, incentives, constraints, and opportunities. They might also succumb to the temptations of short-term profit over long-term sustainability, or they might find themselves constrained by market and institutional barriers that limit their ability to invest in and implement sustainable cocoa production practices, even if they have increased income. It means that the contextual factors and constraints that cocoa farmers face need to be considered, as well as the proper design of tailored solutions and policies that incentivise and enable them to produce more sustainably while fairly sharing benefits along the value chain. According to the European Commission (2020), an increase in income can pave the way for improved farmers' demand for green finance, thus facilitating their access to resources such as capital, technology, and knowledge crucial for adopting more sustainable and environmentally friendly practices.

The Concept of Sustainability in Agriculture

Sustainable agriculture refers to the ability of agriculture to remain the same or improve over time while preserving natural resource capacity to support agriculture. It includes utilising agricultural management methods to optimise agriculture's food-, environmental-, and social-related impacts, such as soil health, water quality, biodiversity, and ecosystem services. Sustainable agriculture improves food security, rural livelihoods, and equal access to resources while reducing the negative impacts on environmental quality and dependence on non-renewable resources. Like everything else, agriculture is not a stand-alone system and depends on the surrounding system to flourish (Kremen & Merenlender, 2018).

The issue of agricultural sustainability has become a significant topic in recent decades due to the growing demand for food security and, therefore, the goal of developing natural resources for future generations. According to Kremen and Merenlender (2018), agricultural sustainability is defined as a method of organising and managing food, fibre, and other agricultural systems in a way that meets society's current needs for food, fibre, and different outputs while enhancing the natural resource base and environment for future generations. Achieving agricultural sustainability is challenging, requiring numerous steps to balance the economic, social, and environmental aspects. This paper aims to review the history of agricultural sustainability and indicate the main concepts of sustainability, its challenges, and different methods to achieve it.

In the late 1960s and '70s, concerns about the harmful effects of industrial farming systems on ecosystems and human health reached a new level of interest, leading to agricultural sustainability. Rachel Carson’s book Silent Spring (1962) contributed to the rise of environmentalism and the concern about using chemical pesticides in modern agriculture. This effort resulted in the development of sustainable agricultural practices that would help enhance natural resource conservation. The main principle of sustainable agriculture is to use EC

resources like soil, water, biodiversity, and others sustainably. Soil degradation is one of the most pressing problems facing agricultural systems worldwide. The FAO (2015) estimates that soil quality has declined globally. Conservation agriculture is a method to prevent soil erosion and improve soil health, using cover crops, reduced or no tillage, and crop rotation. Water conservation is one of the most essential principles in sustainable agriculture, especially in countries with limited water resources. The main techniques here include drip irrigation and collection of rainwater.

Conservation and increased biodiversity are other tenets of sustainable agriculture. Generally, agroecosystems with higher diversity are more resistant to pests, diseases, and climate change. Some sustainable agricultural practices that can potentially increase biodiversity in the field include intercropping, agroforestry, and crop rotation. Sustainable farming practices can also promote other essential ecosystem services, such as pollination, pest control, and carbon sequestration. Although sustainable agriculture practices have advantages, achieving agricultural sustainability is complex. The most challenging task among them is to balance the three dimensions of sustainability: economic, social, and environmental. Sustainable agriculture may also require more labour and technical skills, resulting in a higher production cost than conventional farming. Meanwhile, in developing countries, there is often inadequate infrastructure and support regarding technical advice and financial assistance for farmers who want to adopt sustainable agriculture. Access to markets and capital for farmers who wish to adopt sustainable agriculture is a significant obstacle.

The emergence of green finance as a seemingly feasible solution to the problems of sustainable agriculture is no coincidence. ‘Green finance’ refers to financial instruments employed to finance environmentally sustainable projects, such as green bonds. Sustainable bonds are bonds (debt instruments) used to generate funds to finance ecologically sustainable

projects. The proceeds from green bonds can finance sustainable agriculture projects such as conservation agriculture and using renewable energy for agricultural purposes.

In the past few years, many approaches to agricultural sustainability have emerged, such as organic farming, agroecology, and precision farming. Organic farming is a technique that relies on natural processes rather than synthetic inputs like fertilisers and pesticides. Organic farming's goals include improving soil quality, reducing water consumption, and increasing biological diversity. Agroecology is a scientific approach that considers ecological principles in conjunction with social and economic issues in the agricultural sector. Agroecology deals with matters related to the maintenance of natural resources, the improvement of biological diversity, and the enhancement of smallholder farmers' living conditions.

Sustainable Cocoa Farming

In most parts of Ghana, cocoa farming has enormous economic significance. As one of the most important cash crops in the country and a major contributor to GDP, cocoa farming has become a significant livelihood for many farmers (Cocoa Barometer, 2021). Ghana's cocoa farming has been plagued with several emerging threats and challenges linked to the agricultural sector, including deforestation, soil degradation, child labour use, and farmers' low remuneration. Various steps are being taken to promote the adoption of some sustainable cocoa-growing practices among farmers in Ghana and Africa.

Cocoa sustainability refers to a production system that satisfies the needs of the present without compromising the ability of future generations to meet their needs. As defined by Gockowski and Afari-Sefa (2016), sustainable cocoa farming involves ‘the use of techniques that maintain or enhance soil fertility, preserve biodiversity, reduce greenhouse gas emissions, and ensure adequate compensation and decent living standards for farmers.

Africa, particularly Ghana, established a few methodologies for cocoa cultivation to promote a sustainable business model: agroforestry, integrated pest management, and farmer capacity building. Agroforestry involves the simultaneous cultivation of cocoa alongside other crops such as timber trees, fruit, and vegetables. These cultivation procedures always aim to enhance land fertility, reduce erosion, and promote biodiversity. Integrated Pest Management (IPM), a globally approved method, can control pests and diseases, preventing pesticides from endangering human health and ensuring a bumper harvest for farmers. The term "farmer capacity building" refers to any procedure that aims to enhance or develop the existing skill sets of farmers. The procedures must improve farmers' agricultural skills, financial management expertise, and marketing knowledge through information, equipment, or resource supply.

Initiatives in Ghana and Africa have been geared towards sustainable cocoa cultivation, such as the Ghana Cocoa Forest REDD+ Program, the World Cocoa Foundation, and the Cocoa Forest Initiative. The Ghana Cocoa Forest REDD+ Program aims to promote the sustainable cultivation of cocoa and the reduction of forest loss; the World Cocoa Foundation promotes sustainable cocoa cultivation by helping farmers adopt sustainable cocoa cultivation methods through research, education and stakeholder collaboration, while the Cocoa Forest initiative by the governments of Ghana and Cote d'Ivoire with chocolate companies are aimed at promoting the sustainable cultivation of Cocoa.

However, these attempts can only be considered small first steps towards sustainable cocoa farming. Even in Ghana, the largest cocoa producer in the world, and the whole African continent, farmers are paid too little for their crops to implement any SFP, and child labour feasibly remains a significant issue in the cocoa sector. Low funding for SFP and low access to technology and infrastructure are limiting factors.

Another major challenge limiting the adoption of sustainable cocoa farming in Ghana and Africa is financial inaccessibility. Sustainable cocoa farming is capital intensive, and financiers are needed for the construction of infrastructures, equipment procurement, and farm workers' training. The lack of collateral challenges farmers in accessing financial support for investments, hindering their ability to adopt sustainable cocoa farming methods. The low knowledge and skills of farmers and other stakeholders in sustainable cocoa farming methods bar their complete application.

The concept of green finance, financing activities that develop sustainably, can accelerate the development of sustainable cocoa farming in Ghana and across Africa. Green bonds, in particular, can finance practices such as agroforestry, which improve soil fertility and maintain biodiversity. Green finance mechanisms can also enable access to financial resources to increase farmer capacity-building or improve financial incentives to shift to environmentally sustainable agricultural practices.

Indeed, the long-term sustainability of the sector in Ghana and Africa will depend on the ability to conduct cocoa production in more sustainable ways from today. The future of sustainable cocoa production will depend on farming practices that use or increase soil productivity, prevent deforestation, mitigate greenhouse gas emissions, and improve farmers' livelihoods with fair compensation and agreeable living conditions for workers. The shift towards sustainable cocoa farming requires substantial investment in infrastructure, machinery, and training, which farmers might find hard to access. Communication and information sharing have changed a lot due to technological development.

The Concept of Green Financing in Agriculture

ESG

Green finance, which aims to divert investments towards socially and ecologically responsible avenues, greatly emphasises environmental, social and governance (ESG). Kumar et al. (2018) define ESG factors as ‘non-financial concerns relating to sustainability and ethical impact of investments, ’ which include environmental concerns relating to pollution and climate change, social considerations relating to labour practices and human rights, and governance considerations relating to openness and accountability. Many stakeholders acknowledge the importance of ESG concerns when considering an investment's success (or otherwise) in the long run.

However, without a formal definition of the ESG terms, its implications might be disastrous for Green Finance. For instance, given the non-financial nature of factors that might influence the success of an ESG investment (such as environmental impact and social impact), investors might find it more challenging to analyse and assess these kinds of investments. The various ways in which lack of standardisation can creep in might take several forms, such as the use of inconsistent definitions of ESG terms, a variable grading system, a lack of reporting standards and sector-based challenges, as noted by the European Union High-Level Expert Group on Green Finance (2018). As investment and financial sectors move towards adopting green and sustainable practices, there might be an emerging need for a transparent and standardised vocabulary to facilitate informed decision-making in the sustainable and green financial markets.

From Migliorelli's (2021) perspective, green and sustainable economies cannot be built without green finance. Green investments, sustainable development, and socially responsible behaviour are seen as ways finance may transform its purpose, aspiring to move from maximising short-term profit. Green finance can help make environmental sustainability

possible by supporting the transition to a low-carbon economy, financing renewable energy projects, and inspiring the development of new technologies and ways of thinking. The way forward requires much closer cooperation between financial institutions, policymakers and civil society to bring about environmental sustainability, and it cannot be disconnected from the social, economic and ecological dimensions of sustainability. The main point is that green finance can help to achieve a sustainable future.

However, as Migliorelli (2021) points out, the term ‘finance for sustainability’ (as opposed to ‘Green finance’ or ‘green finance’) is more consistent with the intricacies of the market and its role in achieving sustainable development goals. These studies highlight the need for an integrated, holistic, and coordinated approach to green finance, considering environmental, social, and governance (ESG) issues in forming, managing, and promoting financial products and services. Migliorelli (2021) describes the current legal and regulatory frameworks and discusses future policy challenges related to green financing. They emphasise the importance of the role that green finance can play in creating a just and sustainable society. More importantly, the studies make the case for an ESG-integrated green finance policy that must cover a broader ground range.

Green finance could benefit a broad spectrum of eco-friendly policies that could be considered more in formulating and structuring financial products and services. These include policies that direct resources towards renewable energy, energy conservation, and sustainable infrastructure. One of the most severe global environmental issues, climate change, could be remedied via green financing that redirects revenues from harmful businesses such as fossil fuel extraction or deforestation. Given the severity of climate change and the inability of previous generations to prevent its disastrous effects on future generations, it is crucial to mitigate climate change’s adverse effects through a rapid transition to a sustainable and low-carbon economy. Green financing can play a vital role in this transition.

Drawing on a conceptual literature review of environmental sustainability, Urban and Wójcik (2019) analysed the gap between possible and actual outcomes of green finance. Recognising the growing awareness of the need for and commitment to green finance, despite an appalling amount of money still flowing into activities that harm the environment, they conclude that finance is increasingly likely to play its part in the sustainability transition. They also point to the vital role of primary markets in green finance and accelerating the finance sector's sustainability transition. The authors rightly point out the difficulties of conceptualising the sustainability transition in finance. Still, regardless of the method of analysis, they also underscore the necessity of having a more complete account of green finance that embeds ecological considerations in monetary evaluation and judgment. As the above discussion shows, the gap in green finance is crucial to environmental sustainability. In contrast, adopting a more complete approach incorporating green finance principles and ecological considerations might quicken the pace of moving towards a more sustainable and resilient future. The assessment that we need a more fine-grained and practical approach to environmentally responsible finance is well-taken.

Jeucken (2001) argues that promoting a sustainability agenda requires including social and governance factors in financial decision-making. We should consider society, not just the environment, when making economic decisions. Green finance can be achieved if and when a holistic approach to sustainability is used and all the factors relevant to achieving sustainability are considered. The problems that society faces today are complex and interconnected. Applying a single, holistic approach that meticulously considers all the factors at play would save society from the perils of ad hoc treatment of problems. The literature suggests that two factors should be considered when developing sustainable financial instruments or facilities: the social, environmental, and governance factors and the financial sector's potential to promote sustainability. Moreover, the literature stresses the need for a single and practical approach to

Green Finance policy. The financial industry could move towards a more equitable society and secure future if the approach to all the issues could be taken as a single, integrated one dealing with social, economic, and environmental issues.

Environmental, social, and governance (ESG) issues are part of green finance and are increasingly the subject of texts like "Green Finance: Paradigm Shift" (2018). The essay emphasises the integration of sustainable development goals into financial decision-making. The author highlights the need for ESG in Green Finance. Environmental, social, and governance (ESG) in Green Finance need a comprehensive strategy. Socially responsible investments, ecological sustainability, or increased equality and justice could benefit from integrating environmental, social, and governance (ESG) issues into financial decision-making. The article states the necessity of a united and effective strategy for a Green Finance policy that introduces ESG factors and hastens the transition to a more sustainable and robust future.

In green finance, Popescu et al. (2021) critically analysed the numerous methodologies and frameworks used to assess the long-term performance of investment funds through ESG (environmental, social, and governance) aspects. Here, it can be found that there is a parallel comparison between various approaches, namely the Sustainable Financing Action Plan of the European Commission and the proposals of leading representatives in the green financing industry. The paper suggests a standardised way to assess the environmental, social, and governance (ESG) performance of investment funds, and it supports a holistic strategy for green policymaking in this respect. The study underscores the potential of green finance as a catalyst for sustainable development and emphasises the significance of this ESG variable in the long-term evaluation of investment funds. The authors argue for the need for more studies to build a standardised, holistic approach to measuring the long-term viability of investment funds and integrating their ESG factors. The paper stresses the need for a unified, standard

green finance plan that considers environmental, social, and governance (ESG) factors, highlighting the green financing potential in achieving sustainable development in agriculture.

In their study of the feasibility of social banking, commonly known as green finance, to foster sustainable economic growth, Weber and Remer (2011) illustrate the present financial system and the need for a more holistic and integrated approach to sustainable or green finance policy, whereby environmental and social dimensions are taken into account while lending. The literature has criticised social banking partly because it requires legislative and regulatory support to thrive. The authors conclude that the financial industry and governments should embrace social banking to foster sustainable development. Hopefully, this review will be a small step toward deepening the understanding of environmental Green Finance and correcting the existing deficiencies in the scholarship by providing perspectives on the key principles and motifs that underscore social banking. Future researchers may be interested in studying the potential of social banking in advancing sustainable agriculture in different contexts and the efficiency of various governmental and regulatory approaches in the way of social banking's proliferation.

In a critical assessment of the EU's Green Finance strategy, Chiu (2022) also articulates the need for adding governance structures for double materiality in emerging sustainability indicators. The author comments on the importance of having sustainability measurements and the difficult task of drafting a coherent and engaging approach to sustainable financing. The author highlights the crucial role of Green Finance in easing the shift towards a green economy and society and emphasises the need for further research to create effective governance structures that incorporate double materiality in sustainability indicators.

Weber (2018) analyses how sustainability rules and voluntary codes of conduct can promote sustainability in the financial sector. Future studies can offer implications for improving relevant policy and more closely consider and assess how legislative requirements

and voluntary codes can enhance the development of a more sustainable financial sector. This essay analyses why it is essential to consider sustainability when making economic decisions. The researcher decided to investigate sustainability legislation and voluntary codes of behaviour as potential ways to foster the development of a more sustainable financial sector. Our research suggests the importance of having a more coordinated and complete approach to sustainability rules and voluntary behaviour codes.

Alhadhrami and Nobanee (2019) contend that sustainability practices are directly associated with financial growth. These authors discuss how financial institutions can foster long-term success by embedding sustainability principles in financial decision-making procedures. In the paper, they discuss in detail what would foster long-term fiscal health. They also emphasise the importance of green practices, environmentally friendly technology, and the inclusion of social and governance factors in budgetary planning. They suggested further research on the long-term relationship between green business practices and economic growth. The authors highlight how integrating sustainability considerations into financial decision-making procedures requires the development of detailed frameworks. They argue that further research is necessary to clarify the precise mechanisms by which sustainability policies generate long-term economic and financial benefits. They hint at the need to find effective ways of motivating sustainable practices within the financial sector. This work relates to specific recurring themes in Green Finance research and practice, guiding where research needs to go next to boost sustainable economic growth, at least within the agricultural sector.

Teichmann et al. (2023) use the peer-to-peer (P2P) enablement of Green Finance as a starting point to illuminate the compliance problem in Green Finance developments. We present an overview of the potential association between P2P lending platforms and sustainability, emphasising the importance of Green Finance as a developing research area with a need to highlight further the compliance issues surrounding it. The study sheds light on how

P2P lending platforms could foster Green Finance by directly connecting borrowers and lenders and reviewing relevant literature. This literature demonstrates the importance of considering ESG (environmental, social, and governance) indicators in financial decisions, adopting standardised reporting frameworks, and the potential for P2P lending platforms to promote Green Finance effectively.

We have proposed further research directions on the association between responsible financial practices and regulatory conformity, focusing on standardised reporting frameworks and practical initiatives for spreading and encouraging responsible financial practices among P2P lenders. The study provides valuable insights into core ideas and possible topics in Green Finance. Still, it also suggests directions of research that might promote further regulatory compliance and sustainability in the realm of finance. La Torre et al. (2019), in their exploration of business models for sustainable financing (BMfSF), used social impact bonds as a case study. The purpose of the study is to analyse the possibility of social impact bonds (SIBs) as a business model for social financing using the case study as the object of the study. The definition of social Impact Bonds, according to the Brookings Institution, has several meanings; some authors refer to it as social impact bonds (SIBs), and it is also sometimes referred to as pay-for-success (PFS) finance or social benefit bonds, which provides one approach to social impact investment. SIBs are a contractual arrangement between the government, social service providers, and investors that couples financial returns with social outcomes. PFS finance is still in its early stages around the world. Still, it has the potential to bridge the gap between finance and social returns, making that investment either feasible or more attractive by allowing private investors to profit from high-quality social outcomes. Several challenges have been identified in the implementation of different types of Social Impact Bonds (SIBs), and the authors propose a more holistic approach to Blended Finance for Sustainable Development (BMfSF) considering environmental, social and governance (ESG)

factors. This study highlights the potential of BMfSF to foster sustainable development while identifying the gaps in our current body of knowledge on the topic and the need better to understand the possible impact of BMfSF on sustainable development.

Green Bonds

A green bond is a fixed-income instrument issued to raise or refinance capital for projects with clear environmental advantages. Among others, renewable energy, energy saving, environment-friendly farming, low-carbon transportation, and water resource management are some of the beneficiaries of the profits from green bonds. Governments, international organisations, and industries use green bonds to signal their commitment to sustainability and attract the capital of socially conscious investors. The issuance of green bonds has expanded substantially in recent years due to the growing interest in Green Finance and the funding needs for the low-carbon transition (Maltais & Nykvist, 2020).

Migliorelli (2021) examined the value of green bonds in fulfilling norms in green financing. The research shed light on global standards and barriers in an emerging market in China to fulfil sustainable development. The writers mention the importance of green bonds to facilitate sustainable development. However, they propose issues like standardisation, worldwide consistency and potential challenges of greenwashing.

In the study by Migliorelli (2021), the authors elaborate on how green bonds can assist in the transition to a low-carbon economy. In addition, they promote transparency and disclosure. They also advocate for standardised rules and processes for issuing green bonds. The article explains the problems in the Chinese market, where green bond marketing is incorrect and requires stricter regulations. The research demonstrates the value of a standardised process in issuing green bonds to facilitate funding for the green economy. Also,

the article promotes the idea of doing more research to fill the gaps in the literature and provide efficient mechanisms for fulfilling sustainable development.

Maltais and Nykvist (2020) studied the contribution of green bonds to sustainability, focusing on Sweden. The study explores the development of the green bond market and the role that this has played in shaping the sustainability-mindedness of the market participants. This area of research has revealed several emerging themes in the green bond literature. The factors mentioned above include the potential role that green bonds could play in expediting the move towards a reduced-carbon economy, the role of transparency and standardisation, and the role of green bonds in incentivising ecological and societal accountability. The study's main conclusion is that green bonds can contribute to sustainability. Green bonds provide investors with an opportunity to participate in sustainable activities, as well as a medium for capital allocation to environmentally and socially relevant activities. Green bonds increase market credibility due to increased disclosure and standardisation. Green bonds play a crucial role in promoting a reduced-carbon economy, which is critical to preventing the adverse effects of climate change. This study highlights the importance of conducting more research to understand the long-term impact of green bonds on sustainability and the need for agreed-upon metrics to measure green bonds' social and environmental benefits.

Teti et al. (2022) investigated the ability of green bond issuers to reduce the cost of their debt by issuing GBs. According to the study, GBs have the potential to contribute to sustainable development, and the creation of consistent frameworks to track GB sustainability is critical. Despite the need for further research on the role of green bonds in promoting environmental preservation, the authors acknowledge the need to organise green finance policy with a transversal and integrated approach in ecological, sociological, and administrative matters. The paper points out the potential of GBs to promote sustainable development.

Agliardi and Agliardi (2019) studied the use of green bonds to fund green initiatives. They investigated the determinants in pricing green bonds to assess policy parameters that would promote their widespread use. The authors proposed a theoretical framework to show how issuer sustainability performance and investor sustainability preferences interact to determine the supply and demand of the green bonds market. They found, consistent with the theory, that corporations with strong sustainability track records are more likely to attract broad investor bases and enjoy lower issuance costs. Furthermore, the authors have suggested that tax incentives and sustainability certificates be employed to increase the supply of green bonds and investor base. As well as emphasising the importance of sustainability measures in the issuing and pricing of green bonds, the study improved our understanding of the role of green bonds in promoting sustainable activities. Policymakers and investors should reflect on the implications of the results for Green Finance and sustainability problems. Future research can consider judging the environmental and social consequences of the financed projects by green bonds and carry out empirical research to discover the determinants of the pricing of green bonds.

This paper by Agliardi and Agliardi (2019) concentrates on an in-depth analysis of green bonds as a form of capital for green activities. The paper offers theoretical implications on the valuation of green bonds and tips for increasing the market of green bonds as a capital resource for green projects. Factors affecting the pricing of green bonds are the issuer's credibility, the funded project's characteristics, and the degree of information asymmetry between the issuer and investors. The paper stresses the need for more credible legislation that improves the reliability and openness of green bond markets. They also show that green bonds hold great potential for funding sustainable development. Overall, the paper sheds light on the potential of green bonds to provide capital for sustainable development. It stresses the need for more educational study to establish policies that could aid their effectiveness.

Gianfrate and Peri (2019) studied whether green bonds effectively promote the shift toward a sustainable economy. Green bonds as financial instruments for sustainability: “There are indeed grounds to believe that green bonds have a significant potential to contribute to the advancement of sustainability goals.” The benefits of GB issuance have been highlighted, such as the ability to enlarge funding sources, enhance visibility and reputation, and provide access to a group of investors interested in Green Finance. The present study is empirical evidence that using GB can have a favourable effect on corporate financial performance. The study establishes the determinants of GB issuance, such as market conditions, regulatory environment, and organisational characteristics. The authors inferred that GB issuance depends on a series of factors, and further study is needed to understand the green bond market dynamics and GB's impact on Green Finance.

Tolliver et al. (2019) studied whether green bonds can help achieve the Paris Agreement and SDG goals. The researchers reported an apparent discrepancy in the allocation of funding across green bond sectors and, based on the findings that the overall allocation of green bond proceeds was favouring activities that contribute to environmentally and socially sustainable development, concluded that green bonds are effective at mobilising private funds for sustainable development. They also suggested that because the prevailing specification of details on the use of green bond proceeds is weak, efforts are needed to improve the quality of this information across issuances. They argued that more research is required to enhance understanding of the role of green bonds in advancing sustainable development and to overcome shortcomings in the current academic literature on the role of green bonds in social and environmental outcomes.

Tolliver et al. (2020) tried to identify the drivers of the growth of the green bond market through an empirical study. This study mainly focuses on one of the main drivers of developing a green global economy, which is Nationally Determined Contributions and the

implementation of those toward the success of the Paris Agreement. The research explores the distribution of green bonds in 49 countries from 2007 to 2017. This study asserts that Nationally Determined Contributions to the growth of the green bond market are a significant factor. Other scholars identified several other factors, such as government policies and regulations, investor interest and the availability of qualified green initiatives. This study brings out the possible consequences of these drivers on sustainability. This statement claims that the quality and effectiveness of green initiatives supported by green bonds may differ based on underlying factors. This study highlights the importance of knowing growth drivers in the green bond market and their explications on sustainability. In addition, it brings out possible future research directions in this arena.

Schumacher (2020) performed a detailed examination of the different classifications of green bonds to expose the inconsistencies in criteria and terminology within the green bond market. The article argues that a uniform methodology is needed to issue and evaluate green bonds. Investors and issuers have been confused by the lack of clear guidelines. The author describes different classifications of green bonds: first, ‘labelled green bonds’, which may be certified by external parties by meeting a set of criteria (based on the Green Bond Principles, 2018); second, ‘use of proceeds bonds’ where the proceeds from the bonds are explicitly earmarked for green projects; third, ‘green project bonds’ in which the bond may fund a pre-defined list of projects; and fourth, ‘sustainability bonds’ that are used to fund a wide range of projects, including green and non-green ones. The article then provides examples of each classification and argues for the need to enhance the transparency and uniformity of the green bond market because of the potential of green bonds to further sustainability goals. Possible academic rewrite: Future papers could try to set common standards for the issuance and evaluation of green bonds and/or examine the ability of green bonds to forward sustainability goals across sectors and countries.

In their paper, Zhan and Santos-Paulino (2021) specifically analyse ‘how investments into the SDGs can be mobilised, channelled and impacted’. The work follows a second trend analysing the ‘role of diverse’ financial instruments ‘in moving private capital for sustainable development’. More specifically, the paper studies the role of sustainability bonds or ‘green bonds’, offering a current analysis of ‘patterns in the issuance and utilisation of sustainability bonds, focusing on the African continent’ using data from different sources. The authors emphasise the role of sustainability bonds as a vehicle for private capital to direct resources towards goals and regulations that relate to the SDGs. At the same time, the authors identify the challenges and limitations of using such projects, such as the necessity of a clear and consistent definition for ‘green’ initiatives and the possibility of ‘greenwashing’ initiatives. The paper ends by highlighting the need for further research assessing the effectiveness of sustainability bonds for achieving SDGs. Secondly, the paper emphasises the role of other financial instruments, such as ‘impact investing funds and blended finance’, in pushing the private sector to invest in Sustainable Development Goals (SDGs). This paper contributes to the body of scholarly work on Green Finance, especially by offering two important insights into the role of different financial tools in helping achieve SDGs.

Carbon Finance

In her study, Atela (2012) investigated the policy process of the Kenya Agricultural Carbon Finance Project because of the nation’s local and national history, as well as the political dynamics related to agricultural carbon finance. This study adopted a qualitative approach with semi-structured interviews, document analysis and observation as its primary data collection tools. Atela’s research was conducted under the Clean Development Mechanism (CDM) framework, which is designed to reduce greenhouse gas emissions in developing countries primarily by supporting sustainable development projects. The study

revealed how power dynamics, stakeholder interests and the politics of inequality at local and national levels significantly shaped the formation and implementation of the programme. The text pointed out the shortcomings of relying on a ‘market-based’ mechanism and suggested that agricultural carbon finance programs be modified to adapt to small-scale farmers' particular needs and constraints. However, as the study focused on just one project and faced limitations in gathering reliable data regarding carbon finance transactions, future research can address the consequences of agricultural carbon finance on small-scale farmers via green finance. It could also explore alternative financial models that are suited to them.

Porras et al.. (2015) examined carbon finance as an incentive for agroecological agriculture through the Kenya National Domestic Biogas Programme (KENDBIP). The CDM and voluntary carbon markets derive from the intellectual premise of PES provided in the form of carbon offsets and from theoretical and empirical approaches to environmental governance. The references to ‘statistical data’ and ‘contextual information’ in the following excerpt refer to an analysis of this programme. The KENDBIP initiative, the main focus of the study, intends to enable domestic biogas access to rural homes with the dual aim of mitigating greenhouse gas emissions and encouraging agroecological agriculture. The methodology for this study was based on a qualitative approach involving examining project records and conducting interviews with relevant project stakeholders. Main results: Due to the observed performance of carbon financing, it seems likely to be an incentive for small-scale agriculturalists to adopt environmentally friendly land-use techniques because they provide financial advantages. Although carbon financing can enable environmentally friendly agricultural spaces, price drops in the CDM and voluntary markets, high transaction costs, complicated protocols and low figures in carbon valuations persist. Study findings conclude that future questions should prioritise the simplification of carbon project protocols, improving their clarity and ease of implementation. Small-scale farmers must be readily facilitated into markets and optimise the

co-benefits linked to carbon projects. There is a likelihood that new revenue streams can be established through payments for ecosystem services.

This study titled ‘Contested Arrangements of Carbon Finance in Agriculture in Western Kenya’ by Cavanagh et al. (2021) focuses on Kenya and the Agricultural Carbon Project (KACP) built on the principle of additionality, focusing on the carbon sequestration or emission reduction that would not have occurred in the absence of a financial incentive through carbon markets. This study rests on the case study of KACP, an initiative of ‘the sustainable agricultural practices that reduce the impacts of climate change by distributing improved cook stoves and agroforestry technologies’ for data and context. The analytical method used for this study includes a qualitative analysis of project records and interviews with project participants. The key findings of this study include carbon-finance initiatives for agriculture as a complex and contentious endeavour with power relations, inequality and interests. The findings of this study suggest that future research should prioritise understanding the social and political context of carbon-finance initiatives among Indigenous communities, assessment of carbon project durability and increasing space for small-farmer participation and representation in project decision-making processes.

The article evaluates the work of the BioCarbon Fund to promote sustainable land management through carbon-finance-related projects. The approach is based on sustainable land management and carbon finance principles. The study uses a case analysis of the BioCarbon Fund. This carbon offset programme supports carbon projects that promote sustainable land-use practices and create carbon offsets for the voluntary carbon trading market. Analytical methods are qualitative reviews of project records and stakeholder interviews. Key findings suggest that carbon finance can incentivise smallholder farmers to adopt sustainable land-management practices, earn more and live better. The paper recommends future research priorities to improve the design and implementation of carbon

finance projects, increase the co-benefits of carbon projects, and solve the challenges and limitations of measuring carbon sequestration and emission reductions.

The study by Amrein and colleagues (2015) examines whether carbon financing can be used to promote sustainable agriculture. The study focuses on a project on coffee and afforestation in Sierra Piura, Peru. It is based on the theoretical framework of carbon offsets and payments for ecosystem services (PES) in the context of CDM and the voluntary carbon market. The research is based on a case study of the Norandino-Progreso project, which aims to promote afforestation, produce environmentally friendly coffee, and improve climate change by selling carbon credits. The methods used are quantitative analysis of project documents and interviews with stakeholders interested in the project. The results show that carbon financing can support small-scale farmers financially in adopting sustainable land-management techniques and provide additional income. There are various disadvantages, such as higher transaction costs, complexity and market instability. The study results show that future research projects should pay more attention to improving the management and responsibility of carbon finance projects, improving the co-benefits of carbon projects and improving the participation and representation of small-scale farmers in the decision-making of the projects.

In particular, Veelen (2021) examines low-carbon agriculture as an outcome of green finance, focusing on the spatial geographies and communal dimensions of carbon finance operations. To help understand the analytical concepts of socio-spatial assemblages and the political use of green finance, this study relies on a project-focused case study of a green finance initiative in the Netherlands that aims to foster low-carbon agriculture through enabling practices. Data and context for the study are explicitly drawn from this project. Data collection in the context of a project is often an analysis of project papers and interviews with the project's stakeholders that employ analytical tools. The main findings show that, ecologically, Green Finance is embedded within particular socio-spatial settings created and realised by the

project's stakeholders, as well as their objectives and associated power relations. Given the findings of the research appraisal, it is recommended that future research should place more emphasis on understanding the complex spatial and social settings of green finance initiatives, evaluate the ecological and social impacts of these initiatives, and promote more meaningful participation and representation of small-scale farmers in their decision-making processes.

Porras et al.. (2015) evaluated the potential of carbon financing to promote adopting sustainable smallholder practices related to reforestation and carbon sequestration in Nicaragua. The main ideas behind this analysis come from a report about the Taking Root initiative in Nicaragua. These ideas include the Clean Development Mechanism (CDM), the voluntary carbon market, and the ideas of carbon offsets and payments for ecosystem services (PES). This project aims to promote the application of sustainable agricultural practices and afforestation, with the additional objective of producing carbon offsets for free exchange. Adopting carbon finance as a mechanism for promoting sustainable agriculture practices can lead to economic incentives for small-scale farmers. Nevertheless, several limitations exist, such as high transaction costs, complex frameworks, and market uncertainty. The report proposes future queries that prioritise improving the transparency and accountability of carbon finance projects, incrementing the co-benefits of carbon projects, and solving small-scale farmers' social and environmental concerns.

The viability of payments for environmental services (PES) and carbon finance as mechanisms for incentivising smallholder cocoa farmers in Indonesia to engage in agroforestry practices is explored in this study. The theoretical foundations for the above research lie in the concepts of PES, while carbon finance is applied as a central framework in the context of the above study. The data and context for the above case study are from a cocoa agroforestry system located in Central Sulawesi, Indonesia. Using carbon finance for a cocoa agroforestry system to provide economic incentives for smallholder farmers is then analysed quantitatively

through a simulation model to understand the various carbon financing scenarios regarding cost-efficiency. The main results of the above study include the following: Using carbon finance to incentivise smallholder cocoa farmers in Indonesia to engage in agroforestry practices can provide economic returns for farmers, as well as the potential additional income due to carbon finance in agroforestry systems. The effectiveness and efficiency of the carbon finance approaches can be influenced and varied through specific parameters such as the price for carbon, transaction costs and the formulation of the projects. The above study results recommend that based on the results in the study, future studies should involve the improvement of the structure and implementation of the carbon finance initiatives, the increase of the co-benefits associated with carbon projects, and the improvement in the participation and representation of smallholder farmers in the decision process of the above carbon finance projects.

This study, conducted by Agbotui et al. (2023), examines the potential of carbon payments to make conventional and organic cocoa agroforests more economically sustainable in the Eastern Region of Ghana. The theoretical framework is based on carbon offsets and economic feasibility. At the same time, empirical data and factual background information were obtained from investigating cocoa agroforestry systems in Ghana. This research uses analytical tools to provide quantitative assessments of the economic feasibility of conventional and organic cocoa agroforests and the impact of various carbon payment scenarios. The results suggest that carbon payments can potentially make the financial viability of traditional and organic cocoa agroforestry systems more sustainable. This conclusion is particularly valid when insect infestations and weather conditions limit manufacturing. The suggested line of future research is to focus on increasing the structure and efficiency of carbon offset programmes, optimising the residual benefits of carbon projects, and addressing subsistence farmers' sociocultural and ecological fears.

Zeller's (2009) study evaluates the likely impact of carbon payments on the uptake of agroforestry practices among small-holder farmers, focusing on cocoa agroforestry systems in Indonesia, with theoretical foundations in payments for ecosystem services (PES) and carbon finance and analysis of cocoa agroforestry systems in Central Sulawesi, Indonesia. It carefully analyses the data and context, and the analytical methods are based on a numerical evaluation of the potential monetary benefits of carbon payments at different carbon price points. The main findings suggest that smallholder farmers can be encouraged to adopt ecologically sound land-use practices by providing economic incentives through payments for carbon sequestration. The effectiveness and efficiency of carbon finance schemes depend on many factors, ranging from project design to transactional costs and carbon valuations. Study results showed that further research is needed to improve the development and implementation of carbon finance schemes, increase the co-benefits of carbon schemes, and enhance small-holder farmer participation in project governance.

The central question of this study concerns the level of collaboration between the various stakeholders involved in climate-smart agricultural production innovation in the Ghanaian cocoa sector. This study examines the inception, evolution and function of the Cocoa Abrabopa Association (CAA), a multi-stakeholder forum established to address issues related to sustainability and the viability of carbon finance in the cocoa sector. To achieve this, the present study employs a qualitative approach in which interviews and document analysis were conducted, followed by the content analysis of the data. The study found that multi-stakeholder collaboration can facilitate climate-smart agricultural production innovation in Ghana's cocoa sector. The CAA has played a key role in promoting cooperation between different stakeholders and building awareness about climate change and the potential for carbon finance. However, challenges include a lack of financial resources and the need for stronger regulatory frameworks.

The article ‘Carbon Certification for Sustainable Cocoa Cultivation in Developing Countries’ by Seeberg-Elverfeldt et al. (no date) is written at a scholarly level and concerns the process of carbon certification and the possibilities that it may offer for rewarding small-scale farmers for pursuing sustainable cocoa cultivation. The authors argue that carbon certification has the potential to be an effective tool for encouraging farmers to adopt sustainable and environmentally sound agricultural practices (e.g., shading cocoa); they give a complete description of the certification procedure and the complexity of carbon credit verification, as well as the supporting infrastructure and institutions required to enable the procedure to be successfully implemented. The authors acknowledge the potential benefits that may arise for farmers, such as an increase in income and the potential to access new markets. Still, they also recognise the complexity of the certification process and the need for appropriate support to enable it to work effectively.

Sarpong et al. (2022) investigated the feasibility of West African cocoa farmers leveraging the financing mechanism to develop the irrigation system. The research used a literature review methodology to analyse scholarly articles, reports, and policy papers. The main findings are that sustainable financing ecosystems can go a long way in enhancing the uptake of sustainable irrigation methods for cocoa. The research also pinpointed other hurdles in ecosystem financing, such as limited access to money and inadequate institutional support. The study recommended that future studies focus on developing new funding mechanisms to overcome these hurdles and enhance sustainable irrigation for cocoa.

Shames et al. (2012) examined the institutional innovations used in carbon projects aimed at smallholder farmers in Africa by examining three carbon projects in Uganda and Tanzania. The research question is whether these institutional arrangements allow smallholder farmers to take advantage of carbon finance opportunities, and the theoretical framework applied to the current study is based on the concept of institutional innovation as a driving force

in the improvement of smallholder agriculture through new institutional arrangements toward sustainable development. This study uses a qualitative methodology, relying on interviews and records and examining the information within the framework of a case study structure. The results show that new institutional arrangements have the potential to allow smallholding farmers to participate in carbon projects, thereby improving the farmers' economic situation and promoting sustainable agriculture. However, the study identifies specific problems related to institutional innovation, such as the ability to govern well and the possibility of elite capture.

In their research, Hernandez et al. (2022) sought to determine whether a carbon offset market model could support integrating agroforestry afforestation strategies in central Uganda. The present study uses the Carbon InVEST model to evaluate agroforestry techniques' potential economic benefits and carbon sequestration. The present study utilises a theoretical framework grounded in carbon offset markets, which are valuable tools to support sustainable development efforts in low-income countries. The present quantitative study uses data gathered through the Carbon InVEST model and then subjected to scenario analysis. It is determined that various agroforestry practices can significantly enhance carbon sequestration while also providing financial incentives for farmers to participate in carbon offset markets. Moreover, the research supports the idea that Swiss chocolate firms can develop sustainable practices within their supply chains.

Sustainable Banking

In the banking industry, sustainability means the exchange of financial services that 'help to make the world environmentally and socially sustainable, ' as Delai (2022) writes, citing a standard definition of sustainable practices in the banking industry. Key ESG metrics, including environmental indicators, social indicators, and governance metrics, are used to track sustainability in the banking sector.

This study by Havemann et al. (2022) investigated the feasibility of blended finance as a tool for transitioning agriculture to sustainability. This study focuses on using different financial instruments for investments in sustainable agriculture and the barriers that limit their effectiveness. For this current study, the theoretical framework is based on blended finance. The proposed method combines different financial instruments to reach sustainable development goals. The method used is qualitative, using data from interviews and documents. Thematic analysis was used to analyse this data. The main conclusion is that blended finance can facilitate transitions to sustainable agriculture. Still, essential barriers such as limited financial resources and lack of institutional support must be resolved. The study emphasises the significant role of creating new financial instruments and institutional infrastructure to overcome these challenges and improve investments in sustainable agriculture.

The study by Havemann et al. (2022) examines the scope of sustainable microfinance as an approach for microfinance institutions towards sustainable development. The research examines the importance of sustainability amongst corporations as a responsible practice towards the environment and conservation of resources. The present study uses a theoretical framework of sustainable development and the potential of Microfinance Institutions (MFIs) to promote sustainable development by offering financial services. The methodology used in this study is a conceptual analysis involving a wide range of sources, such as academic publications, reports, and policy documents, that can contribute to enterprises adopting sustainable practices. The study emphasises the need for MFIs to adopt sustainable practices and establish a robust governance and accountability structure to ensure the benefits of sustainable microfinance reach the intended beneficiaries.

This research by Nyebar et al. (2023) looked at whether the credit risk management strategies of commercial banks are effective in Ghana in terms of their agricultural financing. It is relevant as it looks at the sustainability of the funding as it relates to agriculture and, in

particular, critiques the role of commercial banks in lending to the agricultural sector. Sustainability informs the theoretical framework in this study of agrarian financing due to the application of practical methods in credit risk management. The study is mainly quantitative and guided by a survey instrument that collects data from commercial banks in Ghana. The collected data will then be subjected to statistical analysis. The conclusion is that sustainable agricultural financing can be achieved using effective credit risk management strategies. Some policies developed by commercial banks in Ghana have been adopted to manage credit risk associated with agrarian financing efficiently. Distinct challenges relating to funding in agriculture include situations where there is a large population of non-payment and lack of security; hence, there is a need to resolve these issues through practical risk mitigation approaches.

Bani et al. (n.d) examined 'Potential of Banking Policies in Promoting Rural Banking for Sustainable Development in Emerging Economy: The REDD Initiative, a Case of India'. This study by Bani and associates investigates the importance of rural banking in promoting financial inclusion and improving the health of the rural economy of India, especially by enhancing the condition of farmers and agricultural workers, which employed a theoretical perspective and argued for the power of sensible banking policies to improve the chances of sustainable development. The qualitative methodology uses data from academic literature, official government reports, and policy documents. The results suggest that rural banking in India has already moved in the direction of promoting financial inclusion and strengthening the rural economy. At the same time, fierce barriers must be overcome, including limited access to credit and lack of financial literacy, before sustainable development can occur in the rural sector. The authoritative study, therefore, emphasises the need to develop and formulate relevant policies and institutional frameworks that can promote sustainable rural development and help to overcome these challenges.

Joseph and Vetrivel (2023) conducted a study on the level of awareness, attitude and perception of sustainable banking among customers. The limitation of this study was the use of a small sample size. Only 500 banking customers in India were surveyed (Joseph & Vetrivel, 2023). Therefore, further investigation with a larger sample size and coverage from different countries can provide a more in-depth understanding of the situation. The study by Havemann et al. (2022) indicates an essential positive relationship between sustainable banking and environmental preservation. In addition to the different challenges financial institutions face in implementing sustainable banking, this study also reveals the impact of environmentally friendly financial practices on consumer behaviour. It shows that customers' awareness, attitude and belief in their ability to effect change will determine their inclination towards sustainable banking.

Siddique et al. (2023) sought the answer to the role of Corporate Social Responsibility (CSR) in sustainable banking through a systematic literature review. A greater emphasis on sustainability has encouraged the current approach to sustainable banking. The study scrutinises and evaluates the components of corporate social responsibility (CSR) used within a sustainable banking framework. The study finds that CSR is essential in sustainable banking practices. Sustainable banking involves using components of CSR, such as environmental, social, and governance factors. Corporate Social Responsibility (CSR) in sustainable banking is reported to improve the bank's financial performance, increase customer loyalty and reduce risk. The limitations of the study are that studies conducted focused on a narrow aspect of social responsibility and a bit on environmental responsibility without directly looking at the green finance. Financial reporting standards, including CSR, can be used in sustainable banking. Studies in the future can be done on the effectiveness of CSR in supporting sustainable banking practices in different countries and cultural settings.

The study focused on green banking, also known as sustainable banking or ethical banking. It examines the concept of green banking from its historical background to explain its core components. Green banks aim to make banking operations more sustainable and have fewer adverse effects on the environment. They do this by adopting several eco-friendly practices. For example, green banks can reduce their use of paper in their banking operations, enhance their use of renewable energy sources, and invest in environmentally friendly projects. The literature review shows that adopting green banks' practices helps improve their financial performance and builds their image, customer loyalty, and risk-handling ability. The report discusses some potential challenges, such as the requirement for a significant initial investment and the ineffectiveness of measuring the impact of environmentally sustainable banking practices.

One limitation of the study was that some related literature was not considered because it used specific search parameters. Future research can investigate the long-term sustainability of environmentally friendly banking practices' financial feasibility and the resulting ecological impact in various states and societies.

Miah, Hasan, Parisha and Rahman (2023) have formulated an approach to policy towards better management of environmental resources called green banking operations. The present study presents the concept of green banking, its aims and potential, and the prospect of green banking towards augmenting sustainable development. Moreover, it presents a sustainable banking policy and technological platform that intelligently transmits strategic commitments towards sustainable long-term growth. The platform comprises various measures for ecological sustainability, reducing carbon footprint, and adopting green, eco-friendly approaches in banking operations. The report states that adopting beneficial practices of green banking can help achieve sustainable development by ensuring the long-term viability of environmentalism investment. The study's main limitation is the lack of empirical evidence to

verify the proposed paradigm. Research avenues for future studies can include the assessment of the effectiveness of the proposed conceptual model in promoting sustainable development in various countries and communities.

In their research, Bhaskaran, Sujit and Mongia (2023) examined the association between performance and sustainability initiatives in the banking sector. The research in the current paper attempts to highlight the impact of sustainability initiatives in the banking sector on financial outcomes and competitive advantage. The authors' study showed that implementing sustainable banking practices could help the financial industry improve the economic performance of the institution and help achieve development goals with the help of a long-term signalling system. The authors' study pointed out that the implementation of sustainable banking practices can help the financial sector in achieving a level of customer loyalty. Moreover, according to the authors' claim, implementing sustainable banking practices can help the financial industry create a positive image in the eyes of its customers and increase its brand value.

In addition, according to the authors' statement, implementing sustainable banking practices can help the financial sector achieve long-term profitability and competitiveness. However, this study has limitations. The authors concentrate only on a specific nation and negate the possibility of generalising the results to another setting. Future research could explore the efficiency of sustainable banking strategies in different countries and cultures.

In their study, Ngwang and Bime (2023) examine the determinants of financial inclusion among cocoa farmers in the Southwest Region of Cameroon. This study, conducted in Cameroon, examines the effect of financial inclusion on rising cocoa production and the reduction of poverty traps. The study's finding reveals that the accessibility of financial services such as savings, loans, and insurance significantly affects cocoa production and the livelihood of cocoa farmers. The study outlines many variables influencing financial inclusion among

cocoa producers, including financial literacy, trust in financial institutions and proximity to banking services. The authors propose promoting financial inclusion in the cocoa sector by first emphasising increasing cocoa producers' financial literacy and establishing trust among farmers by governments and financial institutions. The study further highlights that integrating financial services has the potential to bolster the long-term sustainability and success of the cocoa industry in Cameroon. At the same time, it also acts as a protective shield against the trap of poverty. One of the potential limitations of this study is the particular focus on a specific geographical area in other countries such as Nigeria, Burkina Faso and other industries in Cameroon.

In 2023, Schaafsma, Dreoni, Ayompe and Coker conducted a study to map the social implication of agricultural commodity trade onto the Sustainable Development Goals. This study explores the social implications of the commodification of soy, coffee, cocoa and palm oil. It examines the plausible linkages and associations between the societal implications, outputs of commodity trade, and the Sustainable Development Goals (SDGs). An extensive literature review has been conducted to assess the social implications of commodity trade. The implications of this theory have been explored and distinguished in the literature, including labour, income inequality, land tenure rights, and gender parity. The authors used a dichotomous method of literary exploration to divide the research method into quantitative and qualitative research and identified the link between societal implications and SDGs. The study reveals that the exchange of commodities can have positive or negative implications on society. Through the alignment of the results with the SDGs, there is a possibility of promoting sustainable development. The authors recommend that policymakers and stakeholders focus on reducing the negative implications of commodity trade in society and promoting the positive impact of commodity trade. The limitation of this study lies in the inclusion of only four commodities and the possibility of missing relevant literature due to the search parameters

applied. Future research could focus on the social implications of commodity trading in other regions and commodities and find appropriate ways to align these implications with the SDGs.

Sustainable Investment

In their scholarly exploration of the literature on Socially Responsible Investing (SRI) and sustainability indices, Koenigsmarck and Geissdoerfer (2023) further emphasise the importance of sustainability indicators in creating a framework for measuring sustainability performance. Their study examines what sustainable investing means, demonstrating the value of sustainability indicators in informing investors' choices and empowering them to make decisions based on accurate data. Several sustainability metrics were outlined, including ESG criteria, carbon emissions and measurements of social impact. The authors further suggest that a joint effort of investors, regulators and the government is required to develop standardised and transparent sustainability metrics to foster sustainable investment and lead investors to increased confidence. The report suggests that using sustainability indicators holds great potential to encourage adopting sustainable investment practices. Its limitations relate to overlooking some vital literature due to the search parameters used. Future research on the subject could take the form of a study exploring the effectiveness of sustainability indicators in supporting the adoption of sustainable investment practices across different sectors and geographical areas.

The case study by Popa et al. (2023) explores the potential sustainability of growing intensive and super-intensive organic walnuts in Gorj County, Romania. In this context, the authors have investigated whether the production of organic walnuts represents a viable option for revitalising rural economies and creating, for small-scale farmers, a sustainable source of income. The study makes the argument that the production of organic walnuts can notably contribute to building a virtuous circle in which the economy, society and environment all

benefit from several positive externalities, such as a further increase in profits, the creation of new jobs, the conservation of natural and environmental resources, the diversification of the economic structure and the valorisation and enhancement of the ecological image of the territory. The authors highlight how walnut orchards greatly benefit from organic farming measures, innovative water management, and integrated pest management (IPM) techniques.

The use of the aforementioned categories of farm measures and rural development approaches is advocated within the context of stimulating a sustainable and positive change in the model of walnut cultivation across the country. The authors argue that the efficient utilisation of these sustainable-oriented practices could drive growth in rural areas and the national economy and propel the country's agriculture sector further into the future. The discussion paper points out that the agri-food sector is paramount in Romania's export policies. Some caveats in the study concern, for example, the fact that results are not generalisable because the authors tested the viability of using sustainable methods of walnut growing in a single locality. Future studies might focus on examining how sustainable methods of walnut growing may be viable in different geographical contexts and national economies.

The implications of sustainable investment for environmental and social sustainability development and changes in corporate governance practices were suggested in a global and a Polish study (Dmuchowski et al., 2023). The authors suggested that sustainable investment is becoming increasingly popular worldwide, providing that investors start to take more interest in environmental, social and governance (ESG) factors. The paper also disproved popular myths about ESG investments, such as the idea that a sustainable strategy provides worse returns than conventional investing. The authors suggest a joint effort of governments and investors to facilitate sustainable investing practices and improve uniformity and clarity of norms. A global and Polish study by Dmuchowski et al. (2023) suggests that sustainable investing could significantly impact sustainable development and make the basis for a secure

financial system. This research is limited in generalizability because the studies were only conducted in one country (Poland). Future research may focus on how well the sustainable investing technique works in different countries and regions.

Osei, Alagidede, and Agbodjah (2023) studied various impact cases in Ghana. The study of impact investment seeks to understand its potential for the sustainable development of the national economy, especially in its agricultural and renewable energy sectors. The authors argue that impact investing has wide-ranging benefits for the sustainable development of the economy, such as an increase in financial inclusion, new job creation, and improved environmental viability. Some key criteria identified for impact investment success in Ghana included stakeholder engagement, measurement of the social impact level, and the impact on investors' compliance with the regulatory frameworks. The researchers believed that governments and stakeholders should join hands to improve the state of impact investing and create an environment that will enable the industry to prosper. The study indicated that impact investment could have a significant role in attaining sustainable growth and producing the desired strong economy in Ghana by establishing viable investment projects. One of the study's limitations is that it was executed in only one country as it could have country-specific factors that could limit the generalizability. Future research on the viability of impact investment approaches across sectors and regions for various countries may be carried out.

Thompson (2023) investigated concerns regarding the use of bonds to invest in biodiversity protection; this study is considered because of the need to explore the potential financial and ecological risks attached to impact investing and the significance of impact investment to biodiversity conservation. From the study’s findings, impact investing as one of the tools to protect biodiversity is potentially imperative as it impacts the financial and environmental sectors; it influences financial results and social and ecological outcomes. It was discovered that impact investing would protect biodiversity in three ways: funding

conservation projects, improving social and environmental results, and promoting stakeholder engagement. The study also identified several financial and ecological issues relating to impact investments in biodiversity conservation, such as lack of liquidity, higher transaction costs and potential unintended consequences to biodiversity; it suggests that investors such as financiers and legislators weigh the pros and cons of impact investment in biodiversity conservation, and fashion ways to mitigate risks associated with it. The study's findings present impact investment as a motivational tool to trigger humanity to move from the negative pace with which biodiversity erodes and preserve the diminishing biodiversity. This study, however, has some limitations, as evidenced by the researchers' preoccupation with impact investing via bonds, which may have influenced other parts of their work. The motivation of the researchers to venture into this area, which is one of the keys to determining a study's strength, is marginalised or perhaps inadequate in this research. Future research could explore the efficacy of impact investment in other investment instruments and different geographical locations for biodiversity conservation.

Based on the SDGs, Siew (2023) suggests the outlines of a new impact-investing paradigm. Research on impact investing as a critical tool for achieving the Sustainable Development Goals (SDGs), a benchmark for development set by the United Nations, states that impact investing needs a standardised methodology. This analysis claims that impact investing is a potentially useful tool to direct private capital to specific sustainable development projects in achieving the SDGs, and their research has identified essential components that make up the SDG impact investment framework. These include measuring, reporting results, stakeholder engagement, and impact investments' possible social, environmental and financial consequences. The author suggests that impact investors should use a standardised method to measure and demonstrate impact, as well as consider the possible social, environmental and financial consequences the impact investment may have on the communities and environment.

According to this research, impact investing has the potential to be a valuable tool to further the sustainable development agenda and achieve the SDGs. We need a controlled framework for impact investing to be open and responsible. Search settings may have missed out on potentially important material, which is a limitation of the study. What is the potential of the impact-investing framework to further the sustainable development agenda across many different industries and locales? It might be an interesting area of future research.

Green Insurance

China's carbon emissions under the impact of crop insurance are studied by Mu et al. (2023). The theoretical mechanism holds that insurance may enable farmers to adopt environment-friendly practices, which, in turn, reduce carbon emissions. The authors applied a quasi-experimental method with the help of panel data from 11 provinces of China from 2010-2018. They found that information was analysed with the help of a difference-in-differences regression model. The key finding was that crop insurance significantly negatively affected China's greenhouse gas production. The effect was even more prominent under the condition of more significant economic growth rates. Limiting data and possible confounders that could not be accounted for were the main caveats of this study. The role of different insurance policies in achieving sustainable agriculture and the mechanisms through which agricultural insurance causes environmental outcomes may be worth exploring in the future.

In their article 'Impact Evaluation of Weather Index-Based Insurance on Cocoa Production in Ghana and Côte d'Ivoire,' Agbenyo et al. (2023) analyse whether the introduction of weather index-based insurance has had significant impacts on cocoa production over time in Ghana and Côte d'Ivoire. Using the panel data set for both countries from 2005 to 2019, the authors then use an endogenous switch regression model to estimate the impact of the intervention. Their results show that cocoa production increased significantly in Ghana with

the introduction of weather index-based insurance. Moreover, the authors identify more substantial effects in dryer and hotter regions. Through this study, we can observe how weather index-based insurance might strengthen agricultural resilience under climate change.

Van Roosebeke and Defina (2023) empirically explore how far deposit insurers have added ESG considerations to their coverage. They focus on the theoretical implications of ESG for deposit insurance. The authors also described their theory. The empirical basis for the paper is international survey data of deposit insurers. The authors also used some analytical techniques, such as descriptive statistics and regression analysis, to explore the answer to their research question. They identified that deposit insurers with a larger size and within a more developed economy are more likely to have a meaningful inclusion of ESG in their coverage (Van Roosebeke & Defina, 2023, p. 11). The paper has several limitations. Due to the self-reporting of data, there could be a bias in the responses from the deposit insurers. An interesting avenue for future research may include studying ESG inclusion's impact on deposit insurers' bottom line.

Apicella et al.'s (2023) study, "Policyholders' Subjective Beliefs: Towards New Drivers of Insurance ESG Reputational Risk", investigates potential new sources of reputational risk in the context of insurance. They use information from the ESG index of European insurers to construct a theory on possible drivers of the insurance market. For instance, the researchers look at individual insurers' assessments and ratings. The writers establish that policyholders hold a higher opinion of European insurers with higher social ESG scores. They also found demographic differences in policyholders' views on insurers (age, gender, income, etc.).

The research is purely quantitative, which makes it possible to use some statistical approaches, such as regression analysis, to conclude. The study shows that insurers should focus on the social ESG rating of insurers if they want to mitigate reputational risk. The

research has several shortcomings. The most obvious is that the researchers do not investigate the links between ESG ranking and insurers' financial performance. They only utilise the subjective opinions of the policyholders. Another shortcoming is that the research focuses on only one aspect of potential insurance ESG reputational risk sources. Other possible sources of such risk should be investigated in future research.

A descriptive study by Van Roosebeke and Defina (2023) on Deposit Insurance in Global Trends and Key Problems also focuses on global trends and key issues. One key issue addressed is whether environmental, social and governance (ESG) considerations are growing in importance for deposit insurance. It is stated that only a subset of deposit insurers now has a formalised ESG strategy and that "the majority of deposit insurers plan to formalise an ESG strategy in the next two years". In other words, ESG is becoming more critical for deposit insurance. The study is descriptive and includes data from multiple sources. It also reviews the growing importance of crisis management and the issues posed by fintech for deposit insurance. The study is relevant for deposit insurance policymakers and deposit insurance business experts.

Environmental Risk Management

Environmental risk management is a systematic approach to recognising, assessing and addressing a company's exposure to environmental liabilities. Faced with tightening environmental regulations and increasing pressure from consumers, companies are under growing pressure to reduce the environmental impact of their operations to avoid fines and reputational damages. Green finance is a suite of financial products and services developed to motivate and enable environmentally responsible business practices. As businesses increasingly integrate sustainability into their operational objectives while reducing financial risk, the relationship between environmental risk management and green finance has become

more significant. This section offers a critical review of the existing literature on the relationship between environmental risk management and green finance and one possible pathway for environmental risk management and green finance to converge towards promoting sustainable corporate behaviour.

Cao et al. (2021) analysed whether China's Green Credit Policy can decrease an enterprise's risk from maturity mismatches in financing and investment. They sought to see how implementing this regulation would have impacted the danger above. This study was based on the theoretical framework of the PSM-DID model. The researchers conclude that in 2012, the primary means of decreasing the risk from maturity mismatches in financing and investment for ecologically harmful firms was for them to adopt green credit strategies. The administration preferred to reduce short-term bank loans as the primary means of achieving this goal. Then, the research shows the significance of the maturity mismatches between investment and finance for ecologically harmful enterprises engaged in environmental protection after the established green credit policy. The primary results indicated that China's green credit policy is a catalyst for increasing corporate environmental protection measures and decreasing capital chain risk from an age disparity between investments and financing. No information about the shortcomings of the study was given. Future research can look into green credit policies to study their relationship with multiple dimensions of business and environmental protection in different contexts.

The aim of the study conducted by Wang (2021) was to understand further what would be the potential impact of green financing systems to curb greenhouse gas emissions production. Given the study's results, green financing systems proved to have a significant unfavourable effect on carbon dioxide emissions and other environmental risks. Devices used in the project could also easily be adjusted to match different ecological policies, enabling significantly reduced carbon emissions. The study's findings show that green finance could

become an effective tool for controlling the environment, managing risks, and reducing carbon emissions. The details of the description of its setting are lacking, as well as the description of the data used and the identification of its limits and suggestions for further development. The findings of the study were published in Sustainability, an academic journal.

Zhou's (2020) study aimed to determine whether there is a relationship between green financing and safety. The author used a theoretical framework based on a built model to identify how green finance can influence environmental progress. A wide variety of data from different sources and contexts were analysed through this research, and analytical methods such as statistical analysis and mathematical models were employed. A finding from the study is that green financing might have a beneficial effect on environmental development. First, there is a possibility that the implementation of green funding can serve as a motivation for ecological conservation and sustainability. However, the investigation did not find any boundary. The results might be more accurate with more research to find the relationship between green financing and other environmental variables using different analytical methods.

The purpose of this study by Blazovich (2013) was to know if companies would be vulnerable to their bottom line if they found eco-friendly practices. So, I chose this study to see the relationship between eco-friendly actions and organised risk. The research data is from 2006 to 2011, and this study is related to all American business companies. A multivariate regression model tests the hypothesis. The main results are that most firms will obtain a green performance boost, and, at the very least, these initiatives will not increase the risk level of a corporation. The results observed that in the most substantial firms, the greatest redirection of the resources travelled towards environmental policies and procedures, which caused the companies to have a lower risk rate than the smaller firms. Based on this idea, firms are expected to encounter few problems and are not expected to influence the environment and promote the economy through eco-friendly practices. This study is critical because the result

revealed that organisation might increase their bottom line and assist in ambient sustainability by implementing eco-friendly practices. In the future, researchers can explore how different eco-friendly business practices affect the firm's bottom line and ambient impacts, as well as the necessity to investigate the processes underpinning policies that may provide economic benefits.

Da-Wei (2011), in his paper, explored why green credit rules and environmental risk management are so important for commercial banks, concluding that there should be more quantitative management for green credit schemes and that an index should be developed to standardise how environmental risks can be addressed. The paper concludes that the most important approaches are using green credit rules in lending and setting an overall strategy for ecological risk management. The author recognises that implementing environmental risk rules can be a practical approach to reduce environmental risks and help the efficient use of green credit rules. Overall, the above topics indicate that green credit policy and ecological risk management can help with sustainable development. In the years to come, more research might be conducted into how different environmental risk governance frameworks could affect the efficiency of green credit rules and how to use new approaches to quantify and tackle ecological risks in the corporate banking industry.

The aim of Negulescu's (2012) qualitative research was to find out whether or not the use of risk management tactics is linked to environmentally responsible business management. The author used a quantitative research strategy and statistical methods to analyse the data. The analysis demonstrates that ecologically accountable businesses' top management uses risk management tactics to prove their commitment to ecological norms. The study's results proved a vital theme or topic on the relation between environmentally responsible corporate governance and risk management tactics. Risk-reduction methods are responsible for current research highlighting the importance of ecological elements.

The critical implications of the study's results for environmentally responsible businesses' top brass are that they should include environmental elements in risk reduction methods. It is precisely responsible top brass that can use risk management tactics to prove their commitment to ecological norms. The study's findings demonstrate that efficient risk management practices might be achieved by a firm's strong commitment to environmental standards. The data was collected through a survey, and a simple statistical method was used to analyse it further. In conclusion, more research should be done on the methods of risk management that environmentally responsible businesses use to stay in business and comply with the rules and regulations. Future studies could analyse how environmentally responsible management techniques influence productivity and profitability. Chen et al.'s (2021) study looks at the impact of environmentally oriented investments on long-term company performance. The data comes from examining the performance of Chinese listed companies from 2013 to 2018 using a panel data theoretical framework for analysis. The findings conclude that environmental performance improves once green investment strategies are integrated into operations. The results appear to show that green investment has a positive effect on long-term company success. The conclusion that can be drawn from the research is that green investment can boost long-term company profitability, as well as contribute to ecological sustainability through improving environmental performance. However, the research is not without its caveats. It is limited to only looking at Chinese public corporations and relies on companies to self-report their environmental performance. Future research might look at different circumstances and settings and how they impact the effects of environmentally aware investments on various aspects of business function and ecological sustainability.

Green Finance in the Cocoa Farming Sector

Green Finance in Ghana

The Sustainable Financing Framework of the Ghanaian government, the very existence of which is the result of the structuring by the inter-ministerial working group established by the Ministry of Finance (2021), has been designed to help people identify green, social and sustainable initiatives or projects, and to issue or refinance green, social or sustainable bonds to finance them. Having provided valuable insights about the framework, Sustain Analytics has expressed its confidence in Ghana's capacity to issue bonds for green, social or sustainable aims with the aim of financing activities in this area. Shortcomings in skills in renewable energy and green finance, coupled with the necessity for an enabling business environment that can attract private sector investment, have been found to pose a barrier to the growing financialization of the green economy in the country in the present day (Sharma et al., 2023).

To enhance sustainable development in African countries such as Ghana, the African Development Bank (ADB) produced a paper reiterating the significance of green banks' creation at the grassroots level (ADB, nd). This paper reveals that using alternative financial options, such as green bonds and green funds, is essential to make sustainable activities accessible in the area. Moreover, technical expertise and capacity development are crucial to groom the green financing sector (ADB, nd).

In addition, the paper mentioned that creating a national green bank in Africa could foster green finance and sustainable development in the area. Hence, the Asian Development Bank (ADB) suggests that providing technical expertise and finances to investors with green solutions is integral to making these industries more affordable. However, environmental challenges stymie Ghana's sustainable development goals, so they cannot support scalable sustainable agriculture. Research conducted for the Green Growth Knowledge Platform shows that banks and other lenders view the agricultural sector as unsafe, which cuts off farmers from

credit and prevents the spread of environmentally friendly practices (GGKP, n.d.). The paper argues that to make lenders less risky and more likely to support farmers, new finance mechanisms such as credit guarantee programs, microfinance institutions and mobile phone-based banking services must be developed (GGKP, n.d.). For farmers to embrace climate-smart practices, capacity development and technical support must be supplied.

To conclude, the way forward for green finance in Ghana would involve innovation in funding methods, bolstering institutional capacities with expertise, and guidance on adopting an approach to finance that aligns with ecological sustainability and sustainable developmental goals (Sharma et al., 2023). With the SDG, the country is determined to bring more finance into the green economy, transforming environmental and social risks into opportunities for private enterprise investment. Similar to challenges elsewhere, the lack of financial resources for sustainable agricultural initiatives in the market and the absence of a facilitative environment for private enterprise investment remain key barriers to the growth of the green finance sector in Ghana.

Access to Green Finance

Green financing is the term for arranging money flows to projects that are good for the planet. Green finance is being adopted across the globe and can change the agricultural economy for better or worse. Particular challenges for green finance in agriculture must be addressed before its full potential can be realised. One of the main barriers to a greater uptake of green finance in agriculture is the lack of a global standard for what ‘green’ means (Röder et al., 2020). Röder et al. (2020) claim that it is challenging to develop precise and universal criteria for specifying a farming investment as ‘green. ’

It becomes difficult for investors looking for viable projects and farmers who want environmentally friendly financing if green finance in agriculture lacks guidelines or

regulations. The issue mentioned above may be a significant obstacle to the spread of ecologically sustainable farming practices since, as argued by Sathya and Suresh (2019), access to eco-friendly funding options by smallholder farmers is hindered by their lack of financial resources as well as knowledge about eco-friendly farming approaches. As green financing is proven to provide low returns with high risks in agricultural activities, it is unsurprising that a large amount of green funding is channelled to central and eastern Europe and Asia. In particular, as Thiam and Ayadi (2020) point out, the agrifood sector is particularly prone to multiple risks, such as natural disasters, the diffusion of diseases, market shocks, and others. Private investors might prefer to eschew putting money into green projects in the agricultural sector as it is likely that they will be left just on the side of the 'green wave. '

Moreover, agriculture's reputation as a risky, low-return industry could turn some potential investors away. As Sathya and Suresh (2019) note, there are several reasons why agricultural produce is unprofitable; one of them is the high cost. Low awareness of the meaning of green finance is among the most serious barriers to its application in agricultural settings. Farmers resist green financing due to a lack of knowledge, resources or incentives (Wollenberg et al., 2019). Farmers might not know that green funding is available and, in some circumstances, might provide benefits. To tackle these challenges, it is essential to have transparent and standardised benchmarks and measures that are directly linked to green finance in agriculture. In this way, investors can find investment opportunities, and farmers can be guided and encouraged towards ecological agricultural methods. Governments and financial institutions can contribute to the growth of green finance in agriculture by giving subsidies and tax benefits to farmers, helping them technically and otherwise (Naidoo & Gasparatos, 2022).

The government can interfere and establish laws and regulations that incentivise farmers who use green methods for agriculture. Sustainable farming can be promoted in various ways, such as by enforcing government regulations that limit the usage of fertilizers and

pesticides. It can also regulate the usage of organic and natural farming techniques like crop rotation, water conservation, and other traditional methods. These regulations could promote Green Financing, as these practices would be friendly to green financing and promote eco-friendly farming methods (Baker et al., 2023).

The term ‘green’ financing means investing money in projects that are good for the earth. Green financial practices could have an unprecedented influence on the agricultural economy. Despite the interest, green finance in the agriculture sector has unique problems that stand in the way of reaching its full potential (de Freitas et al., 2023). However, one major obstacle to the mainstream development of green finance in the agricultural industry is the lack of clear standards by which ‘green’ can be defined: It is challenging to create robust and universally applicable criteria for classifying an investment in agri-food systems as ‘green’, not least due to the long-term, indirect, diffuse and often challenging to quantify environmental impacts of agricultural production approaches (Röder et al., 2020).

This lack of a common denominator or regulation for green finance impedes investment in viable projects and farmers' access to environmentally sustainable financing. In contrast, the earlier problem can be a significant roadblock to expanding greener agricultural practices. Sathya and Suresh (2019) have noted that smallholder farmers' poor financial capacity and low knowledge about ecologically sustainable practices prevent them from accessing green finance choices.

In addition to generating poor returns, investment in agriculture is considered a high-risk venture due to the number of factors that influence the sector, ranging from natural disasters to the spread of disease and even to the vagaries of the market. Thiam and Ayadi (2020) write that the farming industry is fraught with risks. As a result, investors might fear they would miss out on profits if they supported ecologically friendly agriculture projects. Moreover, the reputation of earnings in the agricultural sphere can also deter some potential

investors, the high purchase costs of inputs such as fertilisers, seeds, feeds, etc., being cited as one of the causes of low profitability of agriculture (Sathya & Suresh, 2019).

A general lack of awareness about the concept and perhaps willingness to change, given the lack of knowledge, resources or incentives, are key barriers to green finance in agriculture, as listed by Wollenberg et al. (2019). Farmers may not know about green financing and, in some cases, could benefit from increased knowledge. Specifying clear and consistent rules and standards for environmentally sustainable agriculture finance would help address these problems. The legislation aims to help investors identify good prospects and help guide and incentivise farmers to adopt green methods. Governments and financial institutions can promote green finance in agriculture through tax benefits and subsidies provided to farmers, as well as through technical support and other assistance.

To facilitate green financing in farming, the government might introduce rules and regulations that incentivise farmers to use green farming methods. Green or sustainable farming practices could be encouraged in several ways. Government rules could require farmers to use green methods like crop rotation, water conservation and organic farming. Such a move would result in a more positive environment for green financing and greener farming methods.

Green Finance Opportunities

Following this rationale, green finance can bring about a set of benefits to agriculture: advancing sustainability, increasing production and income, and accelerating the achievement of societal and ecological objectives. It can help to align the interests of farmers, investors and the environment. Green financing can also help farmers grow their businesses by investing in environmentally sustainable practices that reduce environmental impacts. Sustainable agricultural practices such as crop rotation, integrated pest control and agroforestry, for example, might be implemented with the help of green funding. If managed effectively, these

techniques can increase production and economic benefits by improving soil quality, reducing water use and increasing crop yields (Gómez-Limón, 2021).

Green financing will help farmers to increase their market share and get a higher price for their sustainably produced products. Green farmers could attract the increasing demand for sustainably produced food, a rapidly growing market. For farmers, a better income and quality of life is possible, say van Vliet et al. (2019). In addition to offering a way for investors to support environmentally and socially sustainable projects in the agriculture sector, green finance could also help develop rural incomes over the long term. Green finance could diversify investment portfolios and offer new returns. In 2019, the Food and Agriculture Organization (FAO) said that green bonds could help to finance agriculture-related activities that would benefit environmentally and socially responsible projects, offering a reliable return to investors and advancing social and environmental objectives.

Another possible area where green finance could exert a corrective is the growing market for long-term investments. A trend we see today is that investors and consumers are becoming more aware of their decisions' social and environmental implications. It means a growing demand for investments that align with their values. With the emergence of green finance in the agricultural sector, such investments might become available to investors interested in promoting ‘green’ social and environmental goals.

Using green finance to develop agriculture is a promising way to achieve environmental sustainability and sustainable development. Environmentally sustainable agriculture, such as organic farming, agroforestry and conservation tillage, can mitigate greenhouse gas emissions, maintain biodiversity and protect soil and water resources, as Gómez-Limón (2021) suggested. Green finance could provide financial support for implementing environmentally sustainable practices to achieve the goal of ecological

sustainability and assist in implementing international environmental targets, such as the Paris Agreement and the Sustainable Development Goals (SDGs).

Green funding can improve the environmental impact of sustainable agriculture, boost production and profits for farmers, and promote the pursuit of societal and ecological goals by making available finance for farmers to adopt green practices. Green finance could simultaneously be a boon for socially and ecologically responsible activities by providing funds for these initiatives while at the same time furthering the environmental goals of society at large. Green finance can help achieve these lofty objectives by expanding the market for sustainable investment opportunities and offering new avenues for diversification in investors' portfolios. Agricultural green finance could satisfy this strong demand for sustainable investments and further global environmental goals at the same time.

Living Income of Farmers in Ghana

'Living income' is the name given to the amount of money needed for a family of farmers to live comfortably. In that context, it refers to the money given for food, shelter, healthcare, education, and all the other essentials. The majority of smallholder farmers around the world cannot live from their agricultural products. Hence, it is unsurprising that discussions on sustainable agriculture and fair trade often involve the idea of a living income. Attempts are being made to pay farmers a price for their harvests that will give them an honest reward. There is a chance that they might be able to sustain themselves or increase their standard of living.

Boysen et al. (2023), in their paper 'Cocoa to the limit, ' focus on the cocoa living income difference (LID) strategy in Côte d'Ivoire and Ghana. The paper found that a premium would be paid to cocoa farmers who produce cocoa in agreement with the defined criteria. The premium is expected to incentivise the spread of sustainable cocoa production in the region due to the low incomes of cocoa farmers. This paper by Boysen et al. (2023) highlights that

important challenges to implementing the LID policy and the sustainability of the cocoa sector remain. In the study, these challenges include high price volatility, weak institutions and limited resources. The research suggests that the sustainability of cocoa production needs to be approached from multiple angles and should not be limited to just the LID premium. It argues that various factors are important when promoting sustainable cocoa production. Some of these factors include transparent and efficient governance frameworks, reliable cocoa certification programs, access to financial and technical services, and a thorough assessment of the ecological and social impacts of the policy (Sharma et al., 2023). The paper shows that there is new knowledge available on the cocoa sector in Côte d'Ivoire and Ghana that needs to be thoroughly considered and lead to a holistic approach to supporting sustainable cocoa production and the farmers' livelihoods.

Ghanaian cocoa producers' socioeconomic position may also be improved by introducing sustainability programs due to their potential to address other problems identified by Grohs et al. (2023). The authors describe other difficulties suffered by cocoa growers, including low production yields, low incomes and the widespread employment of child labour. According to the article, sustainability initiatives can effectively address these issues, including those 'that foster sustainable agricultural practices, provide access to financial services and agricultural inputs, or provide training and education'. Grohs et al. (2023) argue that the conditions under which cocoa is produced will be improved by sustainability programs that educate and provide alternatives to child work. This study exemplifies the various sustainability initiatives in the cocoa industry, emphasising the importance of commitments and efforts from multiple actors in the cocoa business, from farmers to governments to NGOs to businesses, before we can claim to be sustainable.

Amfo et al. (2023) studied the working and living conditions of cocoa plantation farmworkers in Ghana and how they affect their well-being. This qualitative study collected

data from multiple in-depth face-to-face interviews and focus groups. The farmers and their working conditions in the cocoa plantations are addressed, highlighting the conditions and hazards of agricultural workers in Ghana as well as their low pay, lack of health care and education and other disadvantages (Naidoo & Gasparatos, 2022). The analysis of the text identified through the interviews revealed that all cocoa plantation workers, both migrant and non-migrant, are affected by the working circumstances of the plantations. This study is weak because of its small sample size, and it is not generalisable. The authors suggest that the next studies should target how programmes that improve agricultural workers' working circumstances will enhance their well-being. Workers' living and working conditions are inextricably linked with this study, shedding light on the Ghanaian cocoa farm workers' circumstances.

Kehinde (2021) analysed the nexus between farmers' access to productive resources and their use of the resource-based theory paradigm. He further explores the relationship between farmers' access to productive resources and the use of financial leverage on cocoa production, utilising a survey of 250 cocoa-farming families from 10 local government areas in Nigeria to explore the linkage between access and financial leverage productivity. He used descriptive statistics and regression analysis for data analytics. The results reveal that the access to production resources of cocoa farmers could increase the financial leverage and enhance the productivity of their farm unit.

The results from Kehinde (2021) indicate that financing and extension services can significantly influence the mediation effect of access to productive resources on the direct impact of financial leverage on farm unit productivity. The researcher noted weaknesses such as the small sample size and non-generalization outside the Nigerian cocoa business. Future studies can include the role of market proximity and pro-agric policy in giving impetus to increase agricultural output.

In her paper 'Greening Finance': Barriers and Opportunities for the Agriculture Sector, Migliorelli (2019) set out to investigate the limited use of green finance in the agriculture sector and outline pathways to overcome the barriers to its expansion across the European Union. The research identified some of the special features of the agriculture sector, such as the predominance of small businesses and the current financing model based largely on state subsidies and loans. These issues are major barriers to the creation of eco-friendly financial products. The research proposed several solutions that could be implemented to overcome these barriers, such as the creation of financial instruments for the agriculture sector or the engagement of the cooperative sector (Naidoo & Gasparatos, 2022). The research emphasised the importance of taking into account the specific features of the business for its financing strategies and engaging stakeholders in developing measures for sustainable development. Nonetheless, the report has several limitations, for example, its focus on the European Union or the lack of data to support the proposed solutions.

However, despite these caveats, the study highlights the potential of eco-friendly finance in the agriculture sector and its capacity for the development of sustainable solutions since, according to the outcomes, eco-friendly farming practices such as sustainable land management, renewable energy might benefit from the development of new green finance products, which can help reduce emissions and promote more eco-friendly farming practices (ECB, 2023). The study also expands on the need to overcome the barriers to accessing green funding for the agriculture sector and the importance of stakeholders' engagement to develop more sustainable development measures.

To foster long-term cocoa development in Ghana, Danso-Abbeam and Baiyegunhi (2020) examined and modelled the technical efficiency and welfare, particularly the income, of smallholder cocoa farmers. The researchers used the Conditional Mixed-process (CMP) and Data Envelopment Analysis (DEA) models. The study concluded that farmers can increase

output by 56% without further investment. In addition, the study shows that farmers' financial security and happiness correlate with adopting sustainable techniques. The authors suggested that farmers should increase investment in specialised education and strengthen on-farm policies. However, consideration of the benefit of green financing to promote the sustainability of cocoa production and the moderating outcome of farmers' living income remains under-explored in the literature. Therefore, there exists an interesting space of information for future studies. Indeed, a holistic analysis of the relationships could be used to guide the development of targeted policies and schemes to strengthen the cocoa market and ensure its growth.

A study by Tran and Goto (2019) examining how sustainability certification impacts the farm income of small-scale speciality green tea farmers in Vietnam found that although the results showed that sustainable certification led to large increases in retail price and bottom lines, neither sales nor cost changed much. The study's limitations include its small focus (one product and one location) and lack of assessment of how sustainability certification might impact the environment and society in the long term. Other studies might look into the implications that sustainability certification might have on environmental and social sustainability in the long term. Future studies might look at the effects of sustainability certification on a wide range of products and regions.

Setsoafia et al.'s (2022) research aimed to study the influence of sustainable agricultural techniques on farm revenue and food security in northern Ghana. Their theory is based on the theory of sustainable livelihoods, which emphasises the dynamic interaction of capital, activity, and agency. Three hundred twenty-five farmers in northern Ghana filled out questionnaires for this data. Then, the data was put into regression analysis and descriptive statistics. Sustainable agriculture was a set of techniques that improved economic growth and food security, two key development measures. More specifically, two techniques, crop rotation and organic fertilisation, were shown to increase farm profitability and reduce food insecurity

(two of the study's key findings). The study shows that sustainable agricultural techniques lead to crop yields, economic growth and food security. The study is limited in scope to analysing only a specific region in Ghana, which may have limited the generality of its findings outside the area chosen. The study also assumed a disconnect between the environmental effects of agriculture and sustainability. Therefore, it did not consider the possible role that sustainability in agriculture might have in ensuring long-term ecological stability. Future research can consider how sustainable agricultural techniques might promote environmental stability and whether smallholder farmers in other regions can be encouraged to embrace these techniques.

Another example is a study done by the South African researchers Sikwela and Mushunje (2013), focusing on smallholder farming to assess the impact of farmer aid programmes on the sustainability of agriculture in the Eastern Cape and KwaZulu-Natal provinces. This method is based on a theoretical framework for sustainable lifestyles that includes a fluid and dynamic understanding of the relationship between resources, plans, and organisations. The sample size of 198 small-scale farmers was of an adequate magnitude that allows us to make reliable estimates: half of the sample (n = 99) were supported in their farming through farmer aid programmes, and the other half (n = 99) were not. The frequencies were analysed using a descriptive statistics cluster, and regression analysis was used to parse the relationship of the explanatory variables with the outcomes. The results of the study show that farmer aid programmes had a positive impact on income and the long-term viability of livelihoods. Farmers receiving aid experienced increased income and improved access to key resources: water and land. The data showed that homes where the main breadwinner was a woman benefitted more from farmer support programmes. The main shortcoming of the study was that it was perhaps carried out only in one region in South Africa, reducing the generalizability of the results. The environmental impacts of agricultural assistance programmes were not assessed in this study. Future research could investigate how to foster

sustainable agrarian methods among small-scale farmers and how farmer assistance programmes could impact environmental sustainability.

Hediger (2003) was concerned with the question of sustainable farm revenue under the pressure of soil erosion. Soil erosion was used as the analytical concept while accounting for the interplay of assets, strategies and institutions in developing the theoretical framework, following the idea of the sustainable livelihood paradigm. Since the approach taken was theoretical, no information on data, context or background was provided. The analytical tools deployed included mathematical models and simulations. The study's main result shows that sustainable farm income can be reached by adopting sustainable land management strategies and reallocating resources from consumption towards investment. Other relevant, sustainable land management strategies were discussed in the study. The theoretical thrust of the research and the lack of specific context-based empirical data were its shortcomings. The study did not address the role of other factors, such as climate change, which might have exerted pressure on soil erosion and, in turn, affected agricultural profits. In future studies, the likely impacts of climate change on soil erosion and agrarian revenue should be investigated, as should appropriate strategies or measures that will encourage farmers to adopt more sustainable land management practices under the influence of climate change.

Sustainability trade-offs to living income difference (LID) of cocoa: The role of global and local stakeholders in implementing the livelihoods and Incomes of Diversified Cocoa Farmers (LID) programme. Ghana’s population lives on less than $1.90 per day. As cocoa is the second most important import for the country, this study examines LID strategies in the cocoa sector to assess the sector’s potential to contribute to sustainability issues and the cause of moving into a new era where cocoa farmers can earn a sustainable income. This research uses the stakeholder viewpoint idea as a theoretical framework because it demonstrates the importance of stakeholder participation in contributing to sustainable development projects.

The study adopts a qualitative approach through in-depth interviews and focus groups with representatives from the industry, including cocoa producers and merchants. Our primary findings showed concerns that the LID programme would come with trade-offs. On the whole, stakeholders are concerned about potential trade-offs between the objectives of the Livelihoods and Incomes of Diversified Cocoa Farmers (LID) programme and the reduction of income poverty of cocoa farmers. There were also concerns about the potential of increased deforestation and, for example, the need for effective governance and accountability to transmit LID benefits to cocoa farmers.

To provide financial stability to the farming sector and also convince the farmers to use environment-friendly farming techniques in India, Devi et al. (2017) studied the impact of Payment for Ecosystem Services (PES) on the Indian farmers' theoretical concepts to explain patterns of sustainable lifestyles are based on the dynamic interactions between assets, tactics and institutions. This study was a commentary that reviewed existing studies and subsequently analysed them. Therefore, it missed the context and the data, so it used a literature search and a qualitative study analysis for its analytic methods. Its results indicate that the problem of farmer suicides in India can be reduced if programs to pay farmers for ecosystem services (PES) are implemented more widely. One way in which PES programmes have been found to result in increased instances of sustainable agriculture is by providing incentives to farmers to use eco-friendly land management techniques. Since this was a study based on a meta-analysis of the existing prior studies, it did not give the actual numbers from a given context. Moreover, it did not consider the probable issues and barriers hindering the implementation of PES programmes in India. Future studies can examine incentivising farmers to use sustainable land management techniques and possible obstacles to India's Payment for Ecosystem Services (PES) programmes.

In their work ‘Exploring the effects of NGOs’ Extension Programs on Cocoa Production and Sustainable Livelihood of Cocoa Farmers in Ghana, ’ Attipoe et al. (2021) considered how the extension programs run by NGOs influenced the income of cocoa producers and the sustainability of cocoa production in Ghana. The theory is grounded in the framework of sustainable livelihood, emphasising the interplay between resources, plans, and authorities. They obtained their information from 400 cocoa farmers in three regions of Ghana using descriptive statistics and regression analysis (Attipoe et al., 2021).

The research by Attipoe et al. (2021) reveals that NGO extension activities decreased cocoa output while increasing family income. The study's findings are that cocoa output increased by 14.3% among the participating farmers in the two locations where the NGO extension programmes were implemented. Also, the total revenue from agricultural operations increased by 25.1% and 42.9% in such regions. We observe that access to credit and membership in farmer associations had a favourable impact on family income. Despite its commendable quality, the research has some limitations. First, given that the paper is based on a single location, it is not certain that the findings can be generalised to other parts of Ghana.

Moreover, considering the very small sample size, the research results might not entirely represent what is taking place at the national level (Olanipekun, 2019). The analysis does not focus on the NGO extension programmes' role in achieving ecological sustainability. The extent to which NGO extension initiatives can foster environmental sustainability and how small-scale farmers in different regions can be persuaded to utilise their farms to preserve the ecological system remain unexplored areas that make for possible topics for future research. In Ghana, Amoah and Asare (2020) examined the impact of farmers’ annual income on the nexus between green financing and sustainable agricultural output. In this study, researchers collected primary data using a questionnaire administered to Ghana's 267 smallholder (subsistence) farmers. Using analytical methods such as hierarchical multiple regression analysis, they tested

hypotheses. The study by Amoah and Asare (2020) reveals that the farmers' annual income significantly influenced the relationship between green financing and sustainable agricultural output. They found that higher-income farmers were likelier to engage in green funding and implement eco-friendly farming practices. The applicability of this study is constrained by the use of cross-sectional data and a rather small sample size.

Netto et al. (2023) encouraged the use of longitudinal data and bigger sample sizes to establish the generalizability of the study. The study exposes how crucial it is to remove monetary obstacles to help Ghana's low-income (small-scale) farmers embrace sustainable farming methods. Politicians and development practitioners can fast-track the adoption of sustainable farming methods by making green financing accessible to smallholder farmers. It will likely increase agricultural output, reduce poverty, and lead to long-term growth. To explore how agriculture contributes to the ecosystem and how income could moderate this effect, Olanipekun (2019) researched the interactions between agriculture and the natural environment. Sustainable development underlies the theory behind this research. The theory advocates that agriculture is a policy instrument that achieves economic growth and environmental preservation together. Olanipekun (2019) consults several organisations, such as the World Bank and the Food and Agricultural Organization of the United Nations, to provide data for this study. The analytic methods used are the two-stage least square with panel regression analysis and fixed effect model. The data indicates that agriculture contributes to the negative environment to some extent, but this is partially alleviated by the direct impact of the sector's contribution to economic growth. In addition, agriculture's negative effect on the natural environment can be mitigated as society's wealth increases (Hickel & Dorninger, 2023). In rural cocoa-growing regions of Ghana, a living income is calculated by first establishing, through estimation, the cost of a nutritious diet that a household can afford. This may comprise maise, plantain, cassava, vegetables, and protein sources like eggs or beans.

Assuming the monthly cost of food is projected to be GHS 900. The next step is to determine the housing costs, which include rent or maintenance for basic housing, which may be up to about GHS 300 per month. Other costs such as education, healthcare, clothing, and other essential items might add up to a total GHS 500 monthly. The total cost of a decent standard of living would be GHS 1,700 per month, or GHS 20,400 annually. To arrive at this income, a household or family would need to earn this amount after taxes and production costs. In the case of a family that is into the growing of cocoa, the calculation would then factor in their average yields, cocoa price per kilogram, and the number of trees that are productive and needed to generate the required income.

In conclusion, the study suggests that sustainable agricultural policy advocates further emphasis on encouraging economic development to boost income levels and thus reduce agriculture's negative environmental impacts. However, several caveats to the current study need to be taken into consideration. These include the scope of the research and the need to investigate the impact of other factors on the link between agriculture and the environment.

Boeck et al. (2020) conducted this study to determine the difficulties of achieving a sustainable intensification of cocoa systems in poverty and climate change. A sustainable intensification framework and a mixed-methods research design are applied to explore the interlinkages between poverty reduction, climate change adaptation and sustainable cocoa production in West Africa. The key objective is to identify the potential trade-offs between these issues. The current study by Boeck et al. (2020) applied both quantitative and qualitative analysis methods. They will review the existing literature, conduct a survey among 150 cocoa farmers and conduct focus group discussions with the various stakeholders in Ghana and Cote d'Ivoire. The main findings will highlight the important role of multi-stakeholder inclusive strategies to enable the sustainable intensification of cocoa growing, acknowledging the complex interlinkages between poverty, climate change and cocoa production. The research

highlights the insufficiency of the current certification methods and suggests a more open, transparent and collaborative way to encourage the production of sustainable chocolate. The study by Boeck et al. (2020) highlights the difficulties of harmonising development projects' different and often conflicting economic, environmental and social goals. This new study will join the large and growing body of academic literature on sustainable agriculture. Future studies should focus on the feasibility of scaling up sustainable intensification methods, the effectiveness of different policy instruments designed to support adaptation by low-income cocoa farmers and the potential role of certification as one such instrument. The sustainability of cocoa farming in Ghana is an important issue, and the role of green financing and its impact on farmers' living incomes could be an interesting new area of study.

Living Income of Cocoa Farmers in Ghana

Many smallholder farmers depend on cocoa farming as their major source of income and food. The industrial sector is important to Ghana's economy, providing jobs and money to many people. Despite the important role of the cocoa industry in the Ghanaian economy, many cocoa-farming families live below the poverty line (Amanor, 2023). The low earnings of the cocoa growers have a major impact on the long-term future of the cocoa sector and the cocoa communities. Various factors can impact the supply and demand for the cocoa value chain so that the Ghana cocoa farmer earns little. The most important issues on the supply side are low productivity due to ageing trees and poor soil fertility, lack of inputs, limited access to extension services and training, and poor adoption of best-bet agricultural practices. Low productivity leads to low cocoa yields, which results in low incomes. Further issues for farmers are the high production costs of cocoa and the price volatility of the final product on the market.

Poor production is another major challenge for cocoa farmers in Ghana. The age and size of trees influence cocoa production. The Cocoa Research Institute of Ghana (CRIG)

explains that the national average for a 1,000 square metre (1,000 kilograms per hectare) plot is 400 kilograms per hectare (Ghana Cocoa Board, 2020). It is not because the soil cannot produce more, but rather the result of trees getting old, poor nutrition for the soil, lack of resources and suboptimal agricultural practices. Most cocoa trees in Ghana are more than 30 years old. When cocoa trees grow for over 25 years, they become ‘old’ trees. Older trees are more prone to attack from pests and diseases than younger trees. Hence, a larger effort is usually needed to obtain the maximum harvest.

Reduced productivity and declining cocoa yields could also be caused by low soil fertility. Most of Ghana’s cocoa crops are grown in areas with low soil fertility. Moreover, the majority of farmers do not have access to soil-improving fertilisers, so their cocoa plants are not getting the nutrients they need to grow and produce more chocolate (Osei & Teye, 2024). Producing cocoa in Ghana is also hindered by a lack of inputs, such as fertilisers, herbicides, and high-yielding seedlings. Not many cocoa farmers have the financial resources and access to buy fertiliser, insecticides, etc. Moreover, these farmers are stuck in the past regarding the most efficient methods to combat attacks on their cocoa by insects and other pests. Another problem hindering cocoa production is that many farmers use ‘old’ planting materials in terms of technology and the yield they produce.

Apart from that, major shortages of extension services and training on cocoa production are a major constraint to cocoa cultivation in Ghana. To tackle this situation, extension services and training are recommended to ensure proper cultivation of cocoa, pest and disease management, control and adequate organisation of post-harvest practices (Boeck et al., 2020). Lack of knowledge and skill is ranked as the number one factor hindering farmers from increasing their productivity, crop yield and revenue soon. A serious challenge facing cocoa production in Ghana is the poor utilisation of appropriate farming practices. Many cocoa farmers do not even consider simple farming practices such as pruning, shed management and

fertilising. The cocoa business in Ghana is threatened with sustainability due to poor farming practices, which have been confirmed to reduce yield and earnings.

It is hard to plant and rear cocoa because of the high demand factors of production cost and price volatility. The cost of production of a kilogram of cocoa in Ghana is estimated to be $1.48, according to a report by Fairtrade International et al. (2018). The Ghana Cocoa Board estimated that in 2020, the farm gate price for cocoa would be $2.45 per kilogram, which makes this price nearly 60% of the previous figure. This volatility in the costs of producing cocoa shows that the cost of producing cocoa is a real threat to the lives of cocoa farmers and negatively impacts their incomes. Therefore, cocoa farmers face the problem of price volatility, which leads to uncertain income for them.

A key long-term problem for the viability of Ghana's cocoa business and the viability of cocoa communities is that the low earnings of cocoa growers lead to insufficient revenue to bridge vulnerabilities. Cocoa farmers are financially poor, and so they are less likely to have the ability to invest in their farms, adopt sound agricultural practices, increase productivity and quality, and bridge against the uncertainties of climate change, pests and diseases, and price fluctuations (Jaffee et al., 2019). As already expressed, low wages contribute to serious environmental problems, such as deforestation and loss of biodiversity. The lack of adequate revenues also undermines social and ecological viability. The Ghana Statistical Service (GSS) found that in 2018, cocoa farmers with low incomes often 'needed to exploit children to make ends meet.' Ghana and many other cocoa-producing nations also have serious problems with child labour. More than 2 million children as young as 15 works on cocoa farms in West Africa, according to a 2018 study by the International Labor Organization. Ghana is among the nations where this is a widespread practice – it is the second-largest cocoa producer in the region. The Ghana Statistical Service (2018) also found that 'women and children, especially in cocoa areas, were disproportionately poor.' Low wages exacerbate inequalities of gender. Cocoa

farmers who lack adequate revenue engage in unsustainable agricultural practices to increase crop yields and income, contributing to deforestation and biodiversity loss (Messerli et al., 2019).

Consequently, potential new farmers might be less willing to enter the sector if financial returns decline. Instead, they will consider the opportunities in cities or other professions where they can flourish. Asante-Addo et al. (2018) observe that Ghana's youth are not keen on cocoa farming, which they identify as a potential threat to the sustainability of Ghana's cocoa industry over the long term. There is no denying that the low earnings of cocoa farmers are a major issue in Ghana, and an individual participant cannot solve this; rather, all participants, including the government, NGOs, and corporate sector, should work together to solve this problem. However, Jaffee et al. (2019) also recommend that all stakeholders collaborate to boost yields, reduce production costs, and ensure that cocoa farmers earn a decent livelihood.

According to Gockowski et al. (2018), government subsidies can lower the price of fertilisers and other agricultural inputs. In addition, the government can encourage farmers to adopt more sustainable agricultural production methods and provide funding for education and training. The Ghanaian private sector can also invest in cocoa-processing infrastructure, creating new value-added cocoa products and jobs. Fundamental-building programmes, easier access to finance, and new access to market channels are ways NGOs can help cocoa farmers (ILO, 2020).

Finally, cocoa farmers in Ghana earn a poor income, which creates significant barriers to the sustainability of the sector and the economic future of cocoa-producing communities. To address this, stakeholders must work together to improve the efficiency of cocoa growing, reduce production costs, and ensure that cocoa farmers receive a fair return on their crops. The proposed solutions should consider the social and environmental dimensions of the

sustainability of cacao farming. They should aim to reduce reliance on child labour and other forms of exploitation, as well as promote gender equality. Gockowski et al. (2018) concluded that implementing sustainable cocoa farming in Ghana is vital to ensure the sustainability of cocoa growing as a viable livelihood for future generations.

Role of Farmers' Income

The research conducted by Guo (2022) aimed to analyse the effect of green financing on carbon emissions in China's agricultural sector. More precisely, the study used environmental economics theory to evaluate panel data relating to 28 Chinese provinces from each year between 2005 and 2018. For these analyses, I applied fixed-effects and instrumental variable regression methods. My results show that this sector can significantly reduce carbon emissions by employing green financing in the agriculture industry. Applying green financing might encourage people to make more eco-friendly decisions, such as using renewable energy. In terms of this context, the reduction in the number of applications of green financing may impact agricultural operations by contributing less to rising global temperatures and, therefore, reducing the overall carbon footprint of the farm sector of China. Overall, some limitations of my research are that I only used aggregated data and that the result of my research might not be generalisable outside China's agricultural sector. New directions for research on this topic include exploring what is preventing individuals from applying more eco-friendly methods in farming and, by using green-financing systems, how much impact it makes on agricultural carbon footprints in other locations worldwide.

Kehinde et al. (2021) examined the effect of social capital on agricultural productivity and the food security of cocoa farmers and their families in Nigeria's southwest region. Kehinde et al. investigate how the social capital of cocoa farmers in Nigeria's southwestern region affects the economic success and food safety of cocoa farming families. A multistage

selection technique was employed to obtain a representative sample of 300 cocoa-farming families. Social capital, agricultural productions and food security were estimated using a two-stage Heckman and three-stage simultaneous models. The findings revealed that social capital significantly determines cocoa farming families' economic success and food safety. The findings further revealed that the economic success of cocoa farming families could be improved if they are qualified for rural lending based on their social collateral. Access to productive resources and financial leverage would increase the beneficiaries' agricultural production and food security. The study has certain caveats; for example, how the sample was sourced from one region of Nigeria has some limitations. Future studies on how social capital affects the agricultural output and food security of cocoa-based farming families in other parts of Nigeria and other developing countries should also consider this and other factors. It is recommended that future studies try to obtain larger samples.

The authors will investigate the prospects for green investments in Europe's agriculture and food industry, where the COVID-19 epidemic negatively impacted business processes. Theoretical foundations are built in the area of sustainable investing and investment theory. The information was acquired through literature analysis and expert interviews. The analytical tools have a diverse range, from qualitative research to developing a list of financial instruments to giving recommendations for investing in environmentally friendly farming. Despite the obstacles, such as a lack of standard measures or a changing market landscape, the study suggests that sustainable agriculture has enormous investment potential for both government and environmentally-minded investors.

The study's main weakness was the narrow focus area and the use of expert opinions. For further studies of sustainable agriculture's future, it could be recommended to research new areas of agricultural financing, especially the development of standard measures to make a balanced analysis of the changes and further tendencies in this sphere. Sustainable development

and green economy are two sides of the same coin in this study conducted by Munitlak-Ivanovic et al. (2017), emphasising the role of green finance and banking. The theory behind the framework rests on the interdependence of economics, society and the environment. A thorough analysis of the academic literature on sustainable development, the green economy and green banking and finance provided data and context for this discussion. The study of the relevant literature requires analytical methods, enabling the analysts to identify the most attractive ideas and principles in the field. The data obtained indicates the study's main conclusions, showing that green banking and finance might make a difference in achieving sustainable development improvement and environmental targets. Among severe measures of disproportion, lack of standards, and the necessity for regulatory frameworks, the study develops several conclusions based on secondary data, known for being constrained. It has a potential for bias introduced by the literature review process.

Green finance and banking might have a significant impact on sustainable development. However, this impact must be measured more thoroughly to determine the degree of influence. According to the study 'Green Finance and Long-term Prosperity in Europe', Afzal et al. (2022) explored the potential link between green, Green Finance and long-term prosperity in Europe. This study draws on perspectives of intergenerational equity, boosting long-term capital preservation and economic growth. The investments flowing across different European economies are analysed, followed by a discussion of the institutional frameworks and European environmental laws to present the statistics for this study and focus on the context.

Furthermore, an econometric analysis is employed to find the causal relationship between economic growth and environmental degradation. For instance, advanced financial systems may foster green development, especially through the wider supply of eco-friendly financing and investment. However, financial growth may harm the environment without proper institutional structures and rules. The limited data collected and the challenge of finding

the causal relationship between economic growth and environmental degradation may be the potential limitations of this study. Future research may study the best practices to encourage sustainable development through financial systems and explore alternative green finance instruments.

Bhattacharyya (2022) is a detailed study of green finance principles, their adaptation in real life, problems in implementing them, and their role in the de-carbonization of the energy sector, climate action and other sustainable development goals. The theoretical framework of the research is based on a long-term investment plan, socio-political factors and a monetary plan. Literature research has been conducted on green finance and sustainable development. The term 'analytical procedure' is used in the paper to describe the qualitative study of the relevant literature to derive the core ideas and concepts.

Green Financing has the potential to speed up energy transition, climate action, and sustainable development due to its ability to provide financial incentives for making green investments and institutional reforms. However, the study has highlighted a few roadblocks, such as a lack of KPIs, regulatory frameworks and investor awareness. The secondary data and possibility of subjectivity in evaluating literature are the parameters that go against the study. In the future, the researcher may look at novel financial instruments and standard measures to assess the impact of green finance on sustainable development. In their research into the effects of green financing on the sustainable evolution of the structure of China's regional industry, Wang and Wang (2021) focused their theoretical framework on the concepts of sustainable development and green finance. This organisational structure is recognised as the most effective way of funding green projects and technological development and growth into a non-polluting and sustainable economy. The authors referred to data and background information obtained from a careful analysis of the published literature on green finance and the regional structure of China's industry.

Using analytic methods to explore the relationship between green financing and the evolution of the regional industrial structure in China in a systematic manner, they focused on human capital, green technology and public spending, the use of which is only a small part of the variety of factors taken into account. Their research findings indicate that China's regional industry structure might benefit from introducing green financing, especially with abundant human capital and green technology. This study has a few limitations, including the complexity of green funding and sustainable development and the possibility that the data might be imperfect. Future studies may focus on various green financing frameworks and the most effective ways to advance the development of a sustainable economy through a better regional industrial structure.

In Hunjra et al.'s (2023) paper, "An analysis on the relationship between green Finance and environmental degradation in developing countries to achieve sustainable development: Evidence and policy implication", the authors examine all types of environmental degradation and sustainable development in developing nations in detail. The theoretical frameworks of this research include sustainable investment, ecological deterioration, and monetary efforts. The authors use panel analysis and the moment's technique to draw a line between green money, environmental decline, and long-term prosperity. The authors assume the panel dataset from 42 developing nations as the data resource for this study. Hunjra et al.'s (2023) main conclusions from this study are that green money can help achieve sustainable development by decelerating the speed of environmental deterioration in countries with high carbon dioxide-producing power. The relationship between green money and ecological damage is complex and country-specific.

Nassani et al. (2021) investigated the association between finance and trade policy and how they can promote sustainable development. The theoretical framework of the current research is based on the concept of sustainable development and the Environmental Kuznets

Curve (EKC), which explains the positive relationship between cumulative wealth GDP per capita and its consequence CO2 emissions. A panel dataset for 78 developing countries was used to collect data and background information. Through this dataset, an econometric model has been designed to analyse how green regulation affects long-run growth.

Based on the findings, we can get some good effects on sustainable development under a high level of trade openness and export credit. However, findings also indicate that where green policy might have a positive impact on sustainable development, ecologically friendly measures depend on the specific condition of each nation and the relationship among money, business and sustainable development that is correlated to each other and are also limited in the data size and complexity of the relationship, this type of research also has limited applied abilities. To follow up the research, finding a potential policy replacement and a better way to promote sustainable growth via green measures is imperative.

Liu et al. (2022) consider how energy efficiency financing relates to improving green economic performance and financial inclusion. Green economic performance and financial inclusion are the theoretical foundations of this investigation. Moreover, green economic performance and energy efficiency financing are measured in the paper through a panel data regression analysis better to understand the effect of financial inclusion on both. Throughout this paper, the authors use the same panel data set and extract the information and contextual features from a sample of 51 countries. This paper's main results suggest that including financial services helps us improve energy efficiency funding and green economy performance.

Furthermore, this paper also suggested that countries that invested more in renewable energy are the ones that were more impacted by financial inclusion in terms of energy efficiency financing. The weaknesses in this paper likely come from data constraints, and many processes are going on in the vortex of relationships among financial access, environmental impact and green growth, which the authors tried to detail. Future research must explore how

other types of financial inclusion can be achieved and what kind can better facilitate sustainable development by improving eco-efficient economic performance.

Alieksieiev and Mazur (2022) explored the concepts of sustainable banking and the environmental policies of banks in terms of the allocation of resources, which would lead to sustainable economic development. The theoretical foundation of the article is the background of sustainable development, green policies, and the implementation of environmental policies in the financial sector. The quantitative methods were applied in a study conducted in the financial institutions of Ukraine. The results of a survey of Ukrainian financial institutions and the background information provided by the authors were used to achieve the study's goal. The main results of the survey are the recommendations (tips) for the financial intuitions they received. According to the survey, environmental issues have become more crucial, but this still does not impact the concept of sustainable banking in the Ukrainian financial industry. The authors suppose that some incentives for sustainable lending practices and standardised reporting systems will increase the impact of the environmental policy.

The study's caveats are the risk of response bias in the survey results and the use of data from one country. The researchers want to learn more about the best practices for sustainable banking and how to standardise environmental policy reporting in the future. The research conducted by Agarwal et al. (2021) explained the role of green banking in India's commercial banking activities regarding sustainable development and green bank practices. The authors have used text analysis as a research method after researching the Indian banking sector through a literature study. Their main findings indicate a small but positive trend in terms of the way commercial banks in India are following more environmentally and socially responsible business practices. A possible higher performance in those activities may be achieved due to the proposed guidelines and frameworks and encouraging factors that promote more planet-friendly lending. However, this study brings along some drawbacks, such as the potential bias

in assessing the literature and the fact that it focuses on a single country. Regarding possible future studies, various topics could be considered, such as the most effective strategies for green and sustainable banking and the design of evaluation frames of interventions concerning sustainable banking policies.

Li et al. (2022) aim to reflect on the correlation between digital finance, ecological inequality and green growth outlook in China. The theoretical basis is mainly composed of sustainable development and environmental justice. Digital finance and environmental inequality are explored using statistical measures such as the Gini coefficient, Theil index and spatial econometric model. The study is based on panel data from 2011-2018 from 286 Chinese cities. The main conclusions show that digital finance could ease environmental inequalities and promote sustainable growth by increasing the reach of eco-friendly technology and monetary comfort. Promoting digital banking can be a way to help governments achieve environmental justice; therefore, it is important to push for new forms of financial practices, implement measures to upgrade the existing economic system and tighten up financial regulation. The study's main limitations are a possible omitted variable bias and a lack of generalizability to other countries. Further studies can extend the analysis to different areas of sustainable development that could be impacted by digital finance, such as food and agriculture, settlement, human health, biodiversity, and more. The role of financial institutions in fostering Green Finance development is another area that could be analysed in future studies.

The study by Zhou and Li (2022) was intended to estimate under what circumstances the country's pledge towards green financing and renewable energy resources will help China achieve sustainable growth in the clean energy sector. The authors employed panel data analysis to explore how funding green and renewable energy sources can help reduce carbon emissions and increase sustainable power usage. The result of the study indicated that China's goal of achieving sustainable growth in the clean energy sector is facilitated by its shift towards

green financing and renewable energy sources. However, the article did not cover the study's limits associated with data availability and quality. However, it can be improved (Zhou & Li, 2022).

Wen et al.'s (2023) research examines the impact of financial agglomeration on green growth in the Yangtze River Delta, an area in China. The authors use panel data from 41 regional places from 2005 to 2018. Their research is conducted by applying the spatial econometric and fixed-effects models. Their findings showed a promising association between urbanisation and environmentally friendly growth in the study area. The association mentioned above may be moderated by environmental legislation, human capital, and technology innovation. Two study limitations were the reliance on secondary data and the possibility of endogeneity of influencing factors. The finding of this study is a great road for further research into heterogeneity in the relationship between financial agglomeration and green development.

Lan et al. (2023) attempt to quantify the relationship between green funding and industrial pollution emissions in China. The authors use various econometric methodologies applied to panel data from 30 provinces between 2003 and 2017 to elucidate the relationship. The main results demonstrate that green funding effectively lowers industrial pollution output. However, the significance of this relationship may vary according to geography and sector. The release of green funding remains constrained by insufficient regulatory processes and institutional frameworks, which limit its strongest potential to reduce pollution. According to the study, the Kuznets curve, which reflects an inverse U-shaped relationship between economic prosperity and pollution outputs, exists only for certain geographies and industries. The study contains numerous flaws: the methodology is too simplistic, the focus is too narrow, and it purports to explain the association between two factors despite failing to account for numerous potentially important intervening or moderating factors. Future studies may explore

the impact of green cash on other forms of environmental pollution, controlling for a wider range of factors.

Aslanishvili (2019) researches the availability of credits in Georgia, first and foremost, non-traditional types of funding, such as crowdfunding and microloans. He analyses the difficulties of business enterprises trying to get financing for sustainable development projects and examines alternative funding sources like institutional investors and project bonds. The theory is based on the well-established concepts of green economics and project management. Experts and professionals from the field were interviewed to get information for the research. Content analysis and case studies are among the analytic methods. Even in the poll, commercial banks dominate Georgia's economy; however, respondents show an increasing interest in ecological financing. However, certain challenges ought to be overcome; for example, Georgia's investment ecology lacks acceptable financing resources. Lack of awareness and knowledge of Green Finance is another obstacle. According to the paper, promoting Georgia's green economy necessitates the coordinated effort of experts and professionals from the public and private sectors. The most significant flaw of the research is that it uses a small sample, which cannot be generalised to the whole population. Future research will need to determine the effect of the various funding methods on Georgia's long-term growth and sustainability.

The research paper 'Green Islamic Finance Faces Key Challenges' by Lai (2021) argues that the push for developing the Islamic finance sector requires sustainable Islamic finance taxonomy and a case of exemplary corporate success. The paper delves into the Islamic finance sector's dilemmas and the necessary steps to overcome these. Lai argues that the Islamic banking industry needs to develop uniform taxonomies to help demarcate the scope and form of the parameters or thresholds for labelling some financial products as 'green' or 'sustainable'. Besides, firms with impressive products or services could serve as exemplars of some standard

or benchmark for others to follow. The paper highlights that such efforts are critical to developing the Islamic finance industry.

Rahman et al. (2022) have rightly emphasized the need for information on the economics of ecological sustainability. It is why green finance has gained international momentum and is taught in numerous universities and colleges in countries worldwide. Disturbingly, the development status of green funding has been one of the areas to be studied in the growing body of literature on green finance. The authors have provided a precis and a critical assessment of the current status of green finance in developing country banking sector. They have explored the situation of green finance theoretically and empirically and have outlined future possible research avenues. They highlighted the need for research on green financing in developing countries due to the long-term desire towards economic progress.

As part of the COVID-19 epidemic and the global economic crisis, the relationship between the green economy, sustainability, bitcoin, and oil prices was observed by Sharma et al. (2023) in Resources Policy. The authors stated that the Granger causality test was used to examine the correlations between the related variables. The analysis showed that the association between the green economy and oil prices is not statistically significant, unlike the correlation between bitcoin and oil prices. This essay emphasizes the importance of sustainability in the new world after the COVID-19 epidemic and encourages the government to prioritise this concept in their economic recovery activities. However, it is important to note that this research has limitations due to the small sample size and limited time. Therefore, it is suggested that future studies should have a wider area to investigate by considering more countries and periods.

Tverezovsk et al. (2022), in their article “The Role of Green Project Financing in the Economic Development of Ukraine” discuss the potential role green project finance can play in developing Ukraine’s economy. In this report, the authors analyse the prospects of green

project financing to boost Ukraine's economy. The authors admit the serious obstacles that the process of expanding green project finance faces in Ukraine due to the lack of clear legislation, the deficient infrastructure of certain institutions and the increasing cost of borrowing. Further research, the authors suggest, should focus on the possibilities for public-private partnerships and global financial instruments that could solve the constraints.

As expected in today's world, Ronaldo and Suryanto (2022) point out that governments pay significant attention to sustainable development goals (SDGs), especially in ecological and financial sustainability areas. The Sustainable Development Goals (SDGs) of the United Nations, consisting of 17 global goals that challenge 'our world to act with urgency and transformations', became the central point of their study. The researchers used a 'qualitative method', reviewing the literature available and conducting in-depth interviews with the relevant stakeholders. The research indicated that using green money to offer eco-friendly funding and increasing access to finances could be an important step for the Fund Village on its way to sustainable development.

The authors state that to be more foundational, several problems need to be solved, such as a lack of eco-friendly funding and a lack of education and awareness of sustainable financing. The research also cites the necessity for laws supporting green funding and increasing public awareness of sustainable economics. The paper, "Determinants of Green Finance Spillovers on Agricultural Growth: The Case of China" by Yuanyuan Mo et al. (2023), passed through peer review in Progress in Earth and Environmental Sciences. A graph shows rises and falls in agricultural growth over a long time. This research studied the impact of green lending on China's agricultural sector over time—the research aimed to identify green finance's impact on agricultural growth. The secular trend of green finance extension and its impact on the purpose of cultivating "green agriculture" usage is assessed in this research. 2005 – 2019 is covered by the data collected from China Statistical Yearbook and China Financial Statistical

Yearbook and analysed. The hypothesis is proven using statistical methods, regression methods and structural equation modelling. Green finance positively affects China's agricultural growth, as measured by increased resource allocation efficiency, faster technology improvement, and more efficient agrarian structures. The paper emphasizes the necessity of further legislative support and financial incentives for environmentally Green Finance in the agriculture industry.

Du and Wang's (2023) study serves to evaluate the environmental impact of several factors, including progress, geopolitics resources, on both human authors collected their data in 30 Chinese provinces, spanning from 2010-2018. The authors employed a statistical method called panel data regression analysis to explore the interrelations between variables. One of the main takeaways from their research was that slashing pollution is one of the main unintended outcomes of green projects. On the contrary, they discovered that the development progress in agriculture and the population's natural resource utilization positively impact the planet. Contrary to what was said before, the paper reports that geopolitical risk does not play any role in ecological degradation. The paper concludes that green finance plays a pivotal role in fostering the environmental sustainability of China, and Chinese authorities should prioritise green financing in determining which projects they should fund to curb pollution.

This study is limited in some aspects, as the authors did not consider other variables potentially affecting environmental contamination, like the country's industrialization or urbanization. The authors emphasise that more studies should be conducted to investigate the relationships between the variables and clarify the factors contributing the most to environmental degradation in China. Palmer (2016) researched the constraints and opportunities for leveraging climate financing to support sustainable agriculture. The paper is grounded in a conceptual framework incorporating the core themes of climate financing and sustainable agriculture. To achieve this, the study integrated primary literature reviews and

regional case study analyses. The study identifies the key factors that impede farmer and SME access to climate financing, such as limited knowledge and awareness, exorbitant transaction costs, and limited capacity. One key recommendation to effectively leverage climate financing is to aggregate the efforts of smallholder farmers with the support of local financial institutions. The research is limited in its concentration on the area of smallholder producers and lacks case studies.

Public climate finance as a means to catalyse dairy farmers in Kenya adapt to climate change and reduce their emissions using sustainable agriculture: Preliminary insights into prospects and barriers for accessing climate finance (Odhong et al., 2023). The study gives an overview of the current-day situation and the challenges of dairy farming in Kenya. The study aims to explore the prospects of public climate finance in funding extensive mitigation activities in the dairy sector in Kenya and contributing to the smallholder farmers adapting to climate change while reducing their emissions using sustainable agriculture. The researchers used a qualitative content analysis methodology to scrutinize the data and identify the barriers and prospects of accessing climate finance. As this paper is qualitative, the authors relied on interviews with key stakeholders actively involved in Kenya's dairy industry. The authors used grounded theory, and the theoretical framework is based on the foundations of sustainable agriculture and climate finance. To develop the framework, the authors used a purposive sampling of stakeholders. The paper reveals that public climate finance is pivotal in funding mitigation undertaken by smallholder farmers. However, barriers must be addressed, such as poor knowledge and awareness, lack of technical and organisational capacities, and high transaction costs. The authors` findings emphasise that public climate finance does not encourage smallholder farmers to use low-emission agricultural practices. Instead, they suggest that technical assistance and capacity-building on sustainable agriculture practices should be provided along with public climate finance to ensure the farmers can implement low-emission

practices. This study had a small sample size focused on a specific agricultural sector in one country, Kenya. Therefore, the authors do not claim that their results are generally applicable. However, with further empirical studies, it might be possible to explore the potential of public climate finance on a larger scale for promoting low-carbon agriculture in a broader range of sectors and countries. It is also important to examine the role of different types of support in encouraging small-scale agricultural producers to adapt to climate change and reduce their emissions using sustainable agriculture.

Pettengell (2015) analyses the barriers faced by smallholder farmers in Africa in adapting to the effects of climate change, including changes in precipitation patterns, pests and diseases, and land degradation. It emphasises how the needs of female producers must be at the centre of adaptation solutions and outlines gender-responsive adaptation strategies that reflect the realities of female producers. The authors used three case studies, interviews involving subsistence farmers and other key stakeholders, and a theoretical framework to inform their understanding of climate adaptation and gender equity. The book notes that national governments and international climate finance should provide smallholder farmers, including female producers, with capital, technology and knowledge to adapt to climate change while developing their agricultural businesses. The needs and methods for adaptation differ for different kinds of farmers (small, medium, and large). The book's final section argues that more financial resources should be provided to subsistence agriculture and gender-sensitive adaptation in Africa to increase resilience and promote sustainable development.

Migliorelli's (2019) study aimed to find out the possible role of green finance in the agricultural sector in achieving ambitious environmental goals; the theoretical basis of his research lies in the development of sustainable agriculture and the use of green finance as a policy tool to achieve green growth, i.e. environmentally sustainable economic growth. The theoretical framework is developed through the empirical basis of secondary data from

different sources such as the Food and Agriculture Organization of the United Nations (FAO), the World Bank, and the European Investment Bank. The methodology used was a literature review and case studies. The research findings reveal that the development of green finance in the agricultural sector holds the promise to play an important role in achieving environmentally ambitious goals, such as reducing greenhouse gas emissions, improving soil and water quality, and sustainably using land. It also found that green finance can provide financial solutions to smallholders and promote the development of sustainable agriculture value chains.

Some limitations of this study are related to the lack of empirical proof and the fact that additional inquiries need to be made to evaluate the effectiveness of green finance policies in promoting sustainable agriculture. Future studies may focus on assessing the effects of green finance policies on sustainable agriculture practices in different areas and countries. The study aimed to test the allocation of green finance resources in the agricultural sector and its potential to reduce climate change. Theoretically, this study was developed under the political ecology paradigm, which assumes that the natural environment does not solely determine people's choices but is also affected by social and political factors. Various types of information have been used in this study, including original data from the Climate Policy Initiative, the Food and Agriculture Organization of the United Nations (FAO), and the World Bank. Numerical and spatial tools were used for methodological analysis as well. The study suggests that the distribution of green finance in the agricultural sector is unlikely to concentrate where it can have the greatest climate impact. Instead, it is more likely to concentrate in regions disassociated from the unpredictability of nature. The study also noted that social and political determinants, such as institutional capability, economic development, and market dynamics, determine the location of green financial resources. Although it contributes to the study of green finance and climate change, the study has limitations, such as the limited area of research and the fact that more research is needed to assess the impact of green finance on sustainable

agriculture and climate change mitigation. Future research could focus on exploring the effectiveness of policies related to green finance in developing sustainable agriculture and greenhouse gas mitigation across regions and countries.

The research by Jiang (2020) aimed to investigate the relationship between green finance and poverty alleviation in China. The study's theoretical framework was based on the principles of sustainable development, and green finance was regarded as an important policy tool for achieving environmental protection, economic growth, and poverty alleviation. Different data sources were used for the research, including the National Bureau of Statistics of China and the China Statistical Yearbook. The analytical methods were panel regression analysis and the Granger causality test. The research found a significant positive relationship between the development of green finance and poverty alleviation in China. The research also found a positive relationship between the degree of development of green finance and the alleviation of poverty. The reason may be that green finance policies can alleviate poverty by providing financial resources for sustainable development and green technology and creating more employment and better economic conditions for people in low-income areas. The research has certain shortcomings, such as a lack of research on the impact of other factors, such as institutional quality, market forces and technological innovation, on the relationship between green finance and poverty alleviation.

Shaumya (2017) explored how green banking practices influence the ecological performance of financial institutions. The research was theoretically structured on sustainable development, which suggests that economic growth and environmental protection are simultaneously possible. Therefore, the study aimed to utilise green banking practices as a policy tool to achieve sustainable development. Primary data was collected through a paper-based questionnaire from Bangladesh's banking industry. The study used the analytical tools of descriptive statistics, factor analysis, and regression analysis. The research result shows that

green banking practices are eco-friendly and significantly impact the ecological efficiency of financial institutions in Bangladesh. The research also revealed that institutional quality, market conditions and technological advancements influenced the effectiveness of eco-friendly banking procedures. However, the research is also characterised by limitations, such as the limited scope and the need for more studies to judge the effectiveness of eco-friendly banking techniques to achieve the sustainable growth of different regions and countries.

In the research done by Jiang (2020), the correlation between green finance and poverty reduction was investigated through the panel regression analysis method and the Granger causality test based on the theory of sustainable development, green finance as a policy tool to achieve ecological conservation, economic progress and poverty alleviation. The data used on the development level of green finance and the decline in poverty came from the National Bureau of Statistics of China and the China Statistical Yearbook. The research results showed that the development of green finance has an obvious positive relationship with alleviating poverty in China. The research also found a positive correlation between the extent of the development of green finance and the extent of the decline in poverty. The implementation of green finance policies can act as a link to poverty reduction because, with the development of the policy, the volume of funds for the promotion of ecological technology and ecological operations can increase, job opportunities can increase, the income of the low-income group can increase, and thus there is an increase in the promotion of poverty reduction.

However, there are still some shortcomings in the research, which need more analysis of the influence of other variables, such as institutional quality, market forces, and technological innovation, on the correlation between green finance and poverty alleviation. In their study, Louman et al. (2020) investigated the potential of innovative finance for greening landscapes and aiding agricultural growth by focusing on green bonds. The theoretical background of this study is related to the concept of sustainable landscapes, means of

innovation as a financial mechanism for promoting sustainability, and the geographical contexts of countries with terrains located in less developed countries. The scope of the document is the analysis of different innovative financing mechanisms and means of innovation, such as green bonds, with a view to their possible application in the context of sustainable landscape developments. Several analytical methods were based on scrutinising case studies and existing literature. The main conclusion remained that green bonds have considerable potential to finance projects in the context of developing sustainable landscapes. Still, the potential is hampered by bottlenecks such as a lack of standardisation and transparency in reporting. The scholarly literature emphasises that further enquiries may be necessary. Thus, all relevant actors need the willingness to get involved and collaborate for the innovation of financial instruments to contribute to creating sustainable landscapes. The limitation surfaced from the focus on landscapes in underdeveloped countries, as opposed to landscapes in developed countries, and the lack of empirical data on the effectiveness of innovative financing approaches. The recommendations for further research were related to developing standardised and certified green-bond frameworks and identifying optimal ways to implement green bonds in the context of sustainable landscapes.

The study conducted by Cui (2020) focused on how the quality of the green financial system can influence the process of advancing sustainable development and environment-friendly production in China's manufacturing sector. The research was conducted through the lens of stakeholder theory, and in addition to supplementary literature, a questionnaire survey of 345 Chinese enterprises was conducted to gather empirical data. The research collected quantitative data that was analysed through regression analysis and structural equation modelling tools. The results show that the degree of soundness within the green financial system positively impacts sustainable development and eco-friendly production. Also, the research suggests that environmental regulations function as a conduit between the eco-friendly

economic system and the advancement of the axis of sustainability. The study's limitations include its dependence on self-reported data collected from the enterprises and its lack of generalizability to the manufacturing sector in China. Future research directions may consist of exploring the impact of differing financial systems and regulatory frameworks on advancing sustainable development in different contexts and sectors.

Chapter Summary

Chapter two's conceptual and theoretical framework included an introduction to the study. It outlined the rationale for the research and highlighted the study's objectives. The chapter emphasised the theoretical foundation of the study. The study made use of green financing and innovative agricultural approaches. The theoretical frameworks revealed include the Sustainable Livelihood Approach, Agriculture Innovation Systems Framework, Social Capital Theory and Resource-Based Theory; a conceptual framework that combines the aforementioned approaches for sustainable livelihoods and green financing in agriculture is proposed. Agricultural sustainability and its challenges were introduced. The chapter also focused on green financing instruments, including ESG considerations, green bonds, and sustainable investments, as well as green financing in Ghana’s cocoa farming sector. It discussed the challenges and opportunities for access to green financing. How cocoa farmers’ living income shapes their ability to ensure the basic needs of their households was highlighted. The chapter further discussed the factors that affect the income of cocoa farmers in Ghana and examined how their income determines their access to green financing and sustainable practices.

CHAPTER 3: RESEARCH METHOD

Introduction

This section summarises the approach to data collection and analysis used in this study. Ghana's researchers seek to create more sustainable cocoa production using eco-friendly farming methods that protect soil quality, use fewer resources, and increase farmers' financial security. The 2018 Cocoa Barometer study shows that world cocoa markets generate 40% of Ghana's foreign currency profits (World Bank, n.d.), contributing around 6% to the GDP (Cocoa Barometer, 2018). However, cocoa farmers' living incomes have been significantly reduced due to deforestation, soil erosion, lack of essential sunshine on the trees and poor yields caused by industrial farming methods (Cocoa Barometer, 2018). Many problems in the Ghanaian cocoa sector have been linked to reduced yields, damaged or dead cocoa trees and meagre payments to farmers (Cocoa Barometer, 2018). World Bank (n.d..) reports that Ghana is being called upon to reduce its carbon emissions and combat climate change due to pressure from other countries.

This form of financing could give farmers the tools and incentives they need for production through sustainable and eco-friendly methods, which has great potential to promote sustainable cocoa production. For instance, the World Bank's Forest Carbon Partnership Facility (FCPF) enabled Ghana's cocoa industry, according to the World Bank (n.d.), where the FCPF solidified the business model for sustainability with seedlings and training in sustainable farming practices. The FCPF has promoted ecological farming methods through a mechanism that trades in carbon credits (Forest Carbon Partnership Facility, n.d.). From inadequate funding for renewable energy to low access to clean energy and old infrastructure, there are a few factors contributing to the African emission gap, according to Tsitati (2023). For instance, joint statistical efforts between the World Bank and the International Energy

Agency estimated ‘low access to clean energy’ in 2017 to be 57% in Sub-Saharan Africa. In addition, the International Renewable Energy Agency and the UN Environmental Programme estimated a funding shortfall for renewable energy to be about $1 trillion from 2020 to 2030 (Tsitati, 2023).

Improving sector infrastructures may, in turn, increase the farmers’ living income potential, which is a common problem in the African cocoa industry. The African Development Bank estimated that $50 billion is required annually in Africa to combat the climate change adaptation challenges. With an annual budget of below $5 billion, which is a funding gap of about $45 billion designated to combat climate change impacts, as stated by Tsitati (2023), ‘ this presents a serious shortfall in funding for the range of green programmes which are aimed at combating climate change and ensuring their sustainability in the long term’. The situation has also impeded initiatives in the agriculture sector aimed at bettering the financial conditions of farmers (Tsitati, 2023). According to Tsitati (2023), there are ‘several causes of the adaption gap, ’ which he pointed out to be unequal power stances, poor knowledge and skills, insufficient funding, inefficient government policies on green finance and lack of international cooperation.

Green funding will also support sustainable land use and make it easier to access funds to establish renewable energy, such as solar irrigation systems, sprayers and pruners. According to Tsitati (2023), reducing the dependence of cocoa production on fossil fuels, controlling population growth and reducing emissions are the keys to making cocoa production more sustainable. While green financing can help create sustainable infrastructures and renewable energies, Ghana might face challenges getting the funds needed. Studies, such as those conducted by Asante-Poku and Angelucci (2013), Aneani and Ofori-Frimpong (2013) and Peprah (2019), have linked green finance with sustainable development. Still, no specific research has been conducted in the Ghanaian context. However, it is difficult to assess the exact effects of green funding on economic growth due to the lack of adequate data. According to

Asante-Poku and Angelucci (2013), more data on green finance and its possible effect on economic development should be available to the public. Thus, research is needed to fill in an information gap on the relationship between green funding and eco-friendly cocoa farming, given that the studies cited above are scarce and do not present specific research in Ghana. These pieces of research also ignore the social and environmental impact in favour of the financial aspect of eco-friendly cocoa production. Hence, this area also requires more research.

This research investigates whether green finance can sustain cocoa production and improve farmers' living income in Ghana using a mixed approach with quantitative and qualitative methods. A mixed-methods approach can enhance the validity and reliability of the research. Validity demonstrates the level of truth, while reliability determines the consistency of a study (Creswell & Clark, 2018). A mixed-methods approach may increase data triangulation (Creswell & Clark, 2018). A mixed-methods approach is useful in exploring a complex problem using qualitative and quantitative techniques, enabling the researcher to acquire expertise in the selected topic area (Creswell & Clark, 2018). A mixed methods approach may allow the researcher to become more flexible, consistent and comprehensive (Robert et al., 2011).

The combined results are more convincing than working with just one approach to data gathering. 'Convergence between results from qualitative and quantitative approaches is considered a result of both meeting your study objectives and using an integrated design' (Harrison et al., 2011). Onwuegbuzie et al. (2010) say: 'Qualitative–quantitative paradigms make it easier for readers to understand the results, with qualitative data helping to explain the more impersonal quantitative data, and qualitative data having a richer portrayal of the problem.' The combined data in an exploratory sequential design is more valid when the quantitative results are consistent with what the qualitative discoveries have found. The investigation aligns with a pragmatic research philosophy, which 'accepts that there is more

than one reality and, therefore, more than one way of understanding these realities' (Wilson, 2010). This technique shows several ways to understand these facts (Collis & Hussey, 2009; Saunders et al., 2012; 2014; Wilson, 2010).

One technique used was focus group discussions (FGDs) (Creswell, 2014). The researcher also used a pilot survey to see how well the survey tool worked, determine whether the research technique had any problems, and fix any errors in the study before beginning the full research (Yin, 2014). The early findings from the pilot survey may be useful in attracting funding for additional studies (Saunders et al., 2012). We designed the survey questionnaire to understand better if and how farmers' living income influences the relationship between green financing and producing more environmentally friendly chocolate. Findings show that green financing's potential to promote sustainable behaviours in the cocoa business significantly relies on the monetary stability of farmers (Zhang, 2020). We found it necessary to reach out to key informants to ensure the validity and reliability of the results, confirm that the survey description of the study's background, limitations, and demographic information was accurate, and outline our research objectives. Therefore, the researcher could choose individuals with years of experience in cocoa-related finance and who had a meaningful impact in cocoa-producing regions.

For their data on Ghana, the researchers contacted commercial banks, small-scale cocoa farmers, and officials from the Ghanaian ministries of finance, food, and agriculture. The research focused on eight commercial banks chosen in a sampling procedure. It studied small-scale farmers' profitability associated with different environmental activities such as farming, land restoration, renewable energy, and cocoa production. Since the production environment is very difficult, with a lack of input from farmers, low farming skills, and environmental degradation, the main focus of research was the sustainability of cocoa production. What does green financing mean in this context? Based on expert opinion, it was predicted that to make

space for planting more cocoa, Côte d'Ivoire's rainforests will be cleared out totally by 2034. Many countries in West Africa, including Ghana, have raised the same concerns. For example, the research by Takyi and Amponsah (2020) expressed concerns about the sustainability of cocoa in Ghana. Research by Laven and Boomsma (2012) and Ismoyanto and Mukti (2008) voiced similar concerns in Ghana.

Negative impacts of climate change, falling incomes and employment, declining essential flora and threatened supply of chocolate goods all add up to a dim picture of the long-term viability of cocoa production. The issues around ensuring the long-term viability of cocoa production are manifold and multifaceted. This paragraph provides an extensive summary of the study's methodology. It covers all the necessary bases: research strategy and design, sample size and population, research instruments, research variables, sampled and defined, study procedures, ethical considerations, and finally, data collection and analysis.

Research Approach and Design

Research Approach

Research Approach was defined by Fisher et al. (2018) as all that a researcher does to the problem at hand during an inquiry. Everything a researcher does to try to understand and learn more about the research topic being explored is part of their research methodology. Methods are the structured procedures and tools that a researcher utilizes to enquire. This study took a mixed-methods approach, intending to investigate the intricate web of relationships between green finance and sustainable cocoa production in Ghana. The focus of the study was mainly on exploring the role of farmers' discretionary money in this complex web. The study fitted well with the data collection tools (questionnaires and interviews).

Researchers have several alternatives (Amaratunga et al., 2022). Importantly, however, there is not the best way to respond to a research problem because every study strategy has pros

and cons. The rationale here is that every study methodology is how Creswell (2009) defines it: a broad description of the techniques and methods a researcher adopts to execute the entire research project, from developing theoretical ideas and working through possible research questions to gathering applicable real-world information and producing its analyses. In this case, the most important part of the methodology is finding the right way to carry out a study. To Creswell (2014), the nature of a research problem and the researcher's beliefs, which constitute their philosophical worldview, collaboratively led to a research strategy. How the research project turns out conducted through questionnaires, interviews, or executing the script verbatim- are all ways of practising research strategy. Research methods are how individual investigators uncover, analyse and interpret data. It is a sub-process of the entire research strategy. There are three primary ways to practise research: qualitative, quantitative and mixed methods (Flick, 2017).

In the conduct of research, the researcher needs to adopt a research approach, a research approach as defined by Creswell (2013): "the various plans and procedures, used by a researcher from the assumptions through data collection and analysis methods used in the conduct of the research". In this study, the researcher approached the study by using both qualitative and quantitative research approach which is sometimes referred to as the mixed methods approach. In other words, they are the researcher's various activities to understand the research topic clearly. This approach was adopted in line with the recommendation of Mehrad and Zangeneh (2019), who posit that in studies in which both quantitative and qualitative methods are applied, the research needs to adopt the mixed methods approach, which combines both the quantitative and qualitative methods. In this study, based on the objective of the study, which seeks to examine the problems that cocoa growers have to deal with in Ghana to obtain environmentally friendly finance and to understand how sustainable financing affects cocoa production in Ghana, the researcher adopted a qualitative approach to address these two

objectives. In the context of qualitative research, the main emphasis is on describing the salient qualities of the data. Hence, frequencies, tables, and charts are used to present a better understanding of the data collected.

Data in quantitative form, which is measured in terms of numbers and statistics, are called quantitative data (Bryman, 2016). The reason behind using quantitative data is that it provides a quick way of interpreting the enormous amount of data and drawing some conclusions regarding their overall directions. It can help understand general tendencies and patterns of numerical data. However, it can miss some details about the information given, for instance, what the whole picture is, how to feel about it, or exactly the details of it. Mathematically and statistically literate people can make more sense of the given data (Rahman, 2020). When it comes to having an in-depth look into or understanding something, descriptive statistics such as bar graphs and pie charts, which are used to present the data, are usually not sufficient for providing proper information about the nitty-gritty of the matter; nonetheless, they are very informative, and it is very easy for a person to grasp the idea because they give a glance or sketch of the data that were sampled. They are, in other words, very informative and provide some insight into the given data. However, inference statistics are employed when more information about the entire population is needed.

On the other hand, remarks, opinions, feelings, and deeds encoded and transmitted through the oral medium constitute qualitative data (Alim, 2017). It will isolate certain individuals or groups even though the circumstances are complicated. It may not be easy to evaluate, but, generally speaking, it is not recommended to make sweeping assertions about large groups. The study's methodology is critical for a study’s ability to be objective. The way to assess the qualitative research is through the data-analysis process (Flick, 2018). If you are curious about the identification process, especially the basis for choosing certain subjects or groups while excluding others, you should read up on this. In any case, you should not make

quick assessments about the validity of generalisations from small studies. Adosi (2020) explains that high-quality qualitative research is based on a large body of prior knowledge, has similarities to other studies, and entails abundant rich information, perhaps with quotations or examples, which will clarify the stance. Therefore, you must read the findings section thoroughly to see how well your theory matches the facts.

Instead of adopting either the quantitative or the qualitative procedures as their standalone research protocol, mixed methods research employs both in parallel with one another where qualitative data is used to inform the study of quantitative data, thus making mixed methods design a multistage research plan. The possibility of failure of mixed-methods research is much higher due to many risk factors. At least more than one writer has pointed to several flaws that pertain to the mixed-methods strategy. Data collection and analysis might take a significantly long time, according to Alim (2017). As a consequence, the overall cost might be much higher. At the same time, as Reaves (2022) and Watson (2015) state, investigators often report their difficulties in designing an investigation within a time and money budget. Hsieh and Shannon (2019) reported that data collection usually consumes much physical energy and time. Abdulaziz et al. (2018) argued that combining qualitative and quantitative data is challenging for many studies. Alim (2017) reported that she was not sure how to integrate data from two different sources, namely qualitative data (interviews and diaries) with quantitative data (from surveys), as stated by Gallaher and Winkler Prins (2016). Even Creswell (2015) reported that they could not decide on the data integration plan. Furthermore, they demonstrate that the current literature provides very few guidelines on integrating data from different sources.

Like Sale et al. (2023) and Watson (2018) observe that both methods are given equal weight and importance regardless of a researcher's choice. Their complementarity, however, becomes a big problem when the results of one method contradict the results of the other. In

such cases, the validity and reliability of the first method is questioned. Sukamolson (2007) states that the most common outcome produced by researchers who engage in mixed methods is results that are incoherent or inconsistent across qualitative and quantitative measures. Second, combining two data types can make it challenging for the researcher to conclude. According to Antwi and Hamza (2019), it is up to the researcher to present the results so that the combined approaches do not deteriorate the credibility and legitimacy of the overall study.

Structured questions are directed to numerical hypotheses (testing), and unstructured questions are used for qualitative interview protocols (linguistic expressions). Since, at its most basic level, qualitative research results cannot be measured or quantified, it should be used with small samples, as stated by Mehrad and Zangeneh (2019). One of the major benefits of qualitative research is that it, in the words of Winter (2020), allows for a more holistic representation and examination of the target phenomena. Moreover, it enables unrestricted exploration of the study area and thus permits responses from a broader range of participants. Quantitative research measures and quantifies observable events (Brondz, 2019). According to Sobh and Perry (2016), mixed methods are methodologically conscientious and systematic combinations of qualitative and quantitative approaches.

This study used a mixed-method approach based on the rules issued by Creswell (2003). It is a research method combining qualitative and quantitative data to analyse the issue comprehensively. Mixed methods approaches can also produce better results than the preceding qualitative and quantitative methods alone, at least according to Bazeley (2015). When we combine quantitative and qualitative techniques, we can study complex human occurrences, as the mixed methods allow researchers to gather rich data and, therefore, gain a clearer understanding of their subject. By combining qualitative and quantitative, the mixed methods approach to research can benefit from the advantages of the quantitative and qualitative techniques without the disadvantages that come with them. This additional method

assists researchers in clearly understanding their subject and understanding it better and to a greater extent (Liu, 2021). In 2004, Creswell et al. outlined the mixed methods approach, which is more than just the collection of different data from different sources. Rather, the focus is not on data collection but on integrating these data sources later in the study. According to scholars, the reason for using mixed techniques is that you cannot grasp all the nuances and structures of a situation using either of the two single approaches. However, if we combine the two very different approaches, we can learn more about the phenomena we are investigating since the strength of the one complements and enriches the other.

Research Design

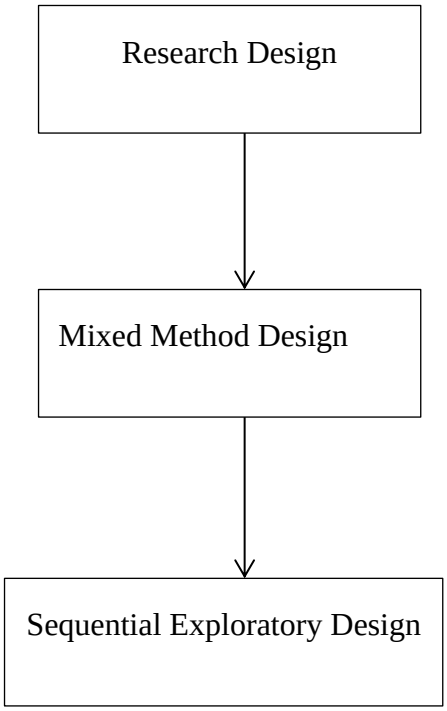


Figure 3.1 – Research Design

A research design is a plan for gathering and analysing data that aims for efficiency without sacrificing relevance to the study's stated goals. Allsop and Saks (2019) state that the design should comprise a framework outlining the researcher's planned actions, beginning with formulating the hypothesis and continuing to analyse the collected data. It is the plan for how

information will be gathered and evaluated. Clark (2019) added that the research design is the blueprint for data collection, measurement, analysis, and the conceptual framework within which the research is conducted. The mixed-methods research strategy encompasses quantitative and qualitative data collection and analysis within a single study. Common mixed methods studies include the convergent parallel, explanatory sequential, and exploratory sequential approaches.

Based on a realistic theoretical assumption, the convergent design is a popular and efficient strategy for combining different types of mixed-methods studies (Dawadi et al., 2021). Triangulated findings result from combining qualitative and quantitative methods in this way. It is a two-step process: first, two independent datasets are collected simultaneously; second, quantitative and qualitative analytical approaches are applied to each dataset separately. The flexibility of this theoretical framework allows for a wide range of potentially surprising and even conflicting (Hong et al., 2019; Kelle, 2022; Pilgrim & Bohnet-Joschko, 2019). In the convergent design, we combine two datasets to learn more than either one could (quantitatively or qualitatively). This method aims to strengthen the validity of each dataset's conclusions by incorporating information from the other (Guo et al., 2020). To learn more about how teachers and students interact with digital tools, a researcher can administer a survey and conduct interviews. Researchers can get quantitative and qualitative information by combining a study with in-depth interviews (Hong et al., 2019). It enables the investigator to compare and contrast the results obtained using the various data sets. The quality of a dataset can be improved by conducting additional research into discrepancies, collecting further data, or providing explanations (Noyes et al., 2019).

According to Pham et al. (2019), the primary purpose of integration in a convergent design is to produce results and interpretations that validate and confirm the findings while promoting a larger and more thorough knowledge. Mertens (2019) argues that integrating

convergent investigations is optimal since the outcomes of both sets of data can be interpreted immediately. This layout is ideal for specific uses, as Sileyew (2019) stated. Time constraints, the need for both qualitative and quantitative data from participants, and the availability of a researcher or team with the requisite expertise to effectively manage both approaches are all situations in which this hybrid approach can prove useful. In addition, they stress the difficulties of convergent design, such as varying sample sizes, the need to merge textual and numerical databases, and the significance of explaining discrepancies when comparing results (Tashakkori & Teddlie, 2021).

The next step was to adopt a sequential layout, in this layout there are two stages of interaction in this design. Quantitative data is first gathered and analysed for use in further quantitative analysis. Based on these results, the next stage will use qualitative approaches (Hong et al., 2019). To explain their quantitative findings in greater depth, researchers use qualitative information in this design (Tomaszewski et al., 2020). This qualitative aspect provides context for incongruous quantitative findings (Timans et al., 2019). According to Siedlecki (2020), to get the most out of this layout, you should abandon your postpositivist assumptions in favour of constructivist ones. After selecting instruments from a postpositivist stance, researchers switch to a constructivist stance to value multiple views and dig deeper into the topic.

The design has three steps: first, the quantitative component is applied; second, specific quantitative findings are selected for explanation; and third, the design is finalised. In addition, a qualitative element is included to shed light on these numerical results. The quantitative findings have been analysed and summarised. When the qualitative phase is over, the quantitative findings are linked with the qualitative data collection, and conclusions are drawn after integrating the results. This layout works well for researchers and research problems that lend themselves to quantitative analysis. However, Shi et al. (2020) highlighted the difficulty

of sampling in this system. Reviewers have questioned the reliability of the qualitative sample as a reflection of the phenomenon discovered in the quantitative sample. There are additional obstacles to consider, such as the increased time needed to complete the task, the complexity of planning for the qualitative phase, the need to locate quantitative results for further analysis, and the necessity of identifying which participants can provide explanations. Because of the difficulty of foreseeing the qualitative phase, researchers may also have trouble gaining approval from institutional boards. Additionally, decisions must be made regarding the criteria for picking samples and the quantitative data to prioritise (Guetterman et al., 2019).

Furthermore, using the constructivist method, a researcher conducts a three-stage study using the exploratory sequential design. After conducting extensive background research on a topic, researchers go on to phase two, where they apply the post-positivist principle to discover and quantify relevant factors and trends in data (Clark, 2019). The qualitative information is compiled and examined first, followed by the quantitative information (Guo et al., 2020). Gathering and interpreting qualitative data is the first step in the design process. Quantitative measures or instruments are created by researchers based on qualitative findings (Creswell & Hirose, 2019). The next step is to use statistical methods to evaluate the hypothesised variable and to analyse the extent to which the quantitative data confirms and expands upon the qualitative results (Noyes et al., 2019).

When a qualitative focus is needed, the exploratory sequential design is useful. It is also a good option when there is adequate time to split the research into three sections. Furthermore, this strategy is suitable for researchers who care about the generalizability or transferability of the results. Lastly, it is helpful when a researcher has found a problem with a small sample and wishes to verify the problem with a bigger one (Creswell & Hirose, 2019). They also say it is simple to apply and explain and that including quantitative data makes qualitative findings more convincing to sceptics. The proponents of this layout claim that it allows for the creation

of a novel research tool simultaneously with the study itself. They also note obstacles like needing to allocate much time to complete the task, needing to provisionally specify the quantitative phase in advance, potentially needing to identify two separate samples, needing to decide which qualitative results to use, and needing an experienced researcher (Dawadi et al., 2021). It would take a long time for a researcher to finish this plan. The challenge of deciding on the quantitative phase for the institutional board review is similar to that of the explanatory sequential design. Researchers should start with a small, well-defined sample in the first stage. The second phase calls for a larger sample size to get more in-depth results, which can be difficult to achieve. The next step is to identify the qualitative result that will inform the development of the quantitative scale. They should be well-versed in instrument creation and qualitative, quantitative, and mixed methodologies research (Tashakkori et al., 2020).

This study used a mixed-methods design known as sequential exploratory. This method entails gathering qualitative and quantitative information simultaneously and then merging the two for in-depth analysis (Pilgrim & Bohnet-Joschko, 2019). It is generally agreed that the phrase "mixed-method research" refers to a research approach using qualitative and quantitative data in a single study (Kelle, 2022). This study used the concurrent mixed methods approach to collect data that would otherwise be difficult to collect separately but would be useful in achieving the study's goals. Both qualitative and quantitative information are given equal weight in this mixed research method (Kelle, 2022). After the adoption of qualitative and quantitative methods, the researcher used both qualitative and quantitative data collection methods, which aligned with the sequential mixed methods design. In order to specifically address objective one, which sought to evaluate the effectiveness of green finance policies, and objective two, which sought to identify the challenges faced by cocoa farmers in accessing green finance, the researcher used an in-depth interview to elicit the data needed. This was analysed thematically, focusing on key themes relevant to establishing a pattern or information

relevant from the data: this involved transcribing the respondent's responses to ensure that there is some level of accuracy in the responses, then coded into recurring themes and patterns that communicate some knowledge. The structured interview was done with key stakeholders in charge of policy development from the government, especially those in charge of developing policies tailored to green finance; and officials working in financial institutions such as banks who provide green finance relevant to supporting cocoa farmers in their farming activities, as their activities are directly affected by policies relating to green finance.

The next phase was the quantitative phase, in which the researcher designed structured questionnaires and administered them to a larger sample of cocoa farmers and key employees of financial institutions. The aim of using the questionnaires was to obtain numerical data on variables, which include accessibility of the farmers to green finance, the impact of financial support on cocoa production, and finally, the nature and role played by farmers' living income in the relationship between green finance and sustainable cocoa production. The researcher analysed the collected data using regression analysis and mediated regression analysis. Regression analysis was used to examine the direct association between access to green finance and sustainable cocoa production; this helped to provide an understanding of whether green finance significantly contributes to improving cocoa production levels. The next step was mediated regression analysis; this was applied to assess whether other factors, such as financial literacy, interest rates, or policy awareness, influenced the effectiveness of green finance in supporting cocoa farmers. The aim of these methods (i.e. thematic analysis and statistical analysis regression methods) was to provide a more comprehensive understanding of the policies regarding green finance, the effectiveness of the policies and the challenges that cocoa farmers face when accessing green finance.

Population and Sample of the Research

Population

The target population consisted of all the banks, financial institutions, corporate organisations, and cocoa farmers located in the Western Region of Ghana. The study targeted this category of people because they know more about cocoa financing within Ghana. The study selected the population of cocoa farmers due to their prominent role in cocoa production and the direct impact of their behaviours on the sustainability of cocoa production. Examining this group offered an immediate understanding of the difficulties and possibilities associated with sustainable cocoa cultivation and the significance of farmers' livelihoods.

Additionally, cocoa growers play a crucial role as important participants in the cocoa supply chain. Gaining insight into their viewpoints, difficulties, and incentives was essential for identifying efficient green finance projects that aim to promote ecologically sustainable and socially conscientious behaviours. The success of such efforts relies heavily on cocoa farmers, who play a vital role in cocoa production. Directly examining this demographic was essential to investigating the study's main objective of analysing the impact of green finance on sustainable cocoa production. The research places great importance on ensuring farmers earn sufficient income to sustain their livelihoods. Cocoa farmers, in particular, are significantly affected by changes in their income levels. By examining the financial elements of cocoa cultivation in Ghana, we could ascertain the obstacles that farmers face in attaining a sustainable income.

Sampling and Sampling Technique

A sample is a subset of individuals selected from a statistical population using specified methods. Sampling offers several benefits to the practicality and overall trajectory of the research. (Andrew et al., 2019). Firstly, it enables expedited data collection. Since the

researcher will not need to analyse the entire population, this reduces the workload. Furthermore, it allows the data to be structured most appropriately for addressing the research questions, hence minimising the likelihood of straying from the intended objective. (Andrew et al., 2019). Moreover, gathering data from a smaller number of instances enhances the level of control over the specificity and pertinence of the information (Saunders, 2000). The considerations mentioned earlier highlight the significance of sampling in reducing the time and expenses associated with doing research and providing the researcher with greater control over the timeliness, efficiency, and relevance of data collecting. The study utilised both non-probability and probability sampling methods. Non-probability sampling is a purposeful strategy in which the researcher intentionally selects objects for the sample. Probability sampling is a method of selecting units from a population in which each member of the population may be identified and chosen. (Conlon et al., 2020). In this sampling method, each sample is picked with equal probability. (Bhardwaj, 2019).

The qualitative part of the study used snowball sampling, a method that does not rely on randomness. Snowball sampling is useful when we need to connect with hard-to-find Individuals. The process begins with a tiny set of individuals. The beauty of snowball sampling is its ability to reach those typically off the radar, like people with rare diseases, individuals who are part of unique cultures, or individuals engaged in sensitive or banned stuff. The utilisation of snowball sampling in the qualitative component of the research study on "Green Finance and Sustainable Cocoa Production in Ghana: The Role of Farmers' Living Income" is necessary due to the need for insights from individuals possessing specialised expertise in cocoa farming, sustainable agriculture, and the financial aspects on farmers' living income. Purposive sampling enables the researcher to intentionally choose individuals who possess the necessary knowledge and expertise in these domains.

The primary objective of focus groups is to get a wide array of viewpoints for the study. The study guarantees a thorough and all-encompassing comprehension of the subject matter by deliberately choosing participants from diverse demographic backgrounds, farm sizes, and sustainable farming techniques. Furthermore, considering the particular emphasis on environmentally friendly finance and the sustainable cultivation of cocoa, the researcher could have restricted resources, and the study could gain advantages from a judicious distribution of those resources. Snowball sampling enables the deliberate selection of individuals who can offer comprehensive insights, hence maximising the amount of information obtained from each participant.

A sample size of 24 for the focus group was deemed appropriate to get data saturation, allowing for a comprehensive investigation of participants' viewpoints on "Green Finance and Sustainable Cocoa Production in Ghana: The Role of Farmers' Living Income". This particular size achieves a harmonious equilibrium between the level of detail and the efficient use of resources, guaranteeing a thorough understanding of the study's boundaries. A more compact yet varied group enables thorough discussions and significant contributions, which align with the qualitative character of the research. Furthermore, considering practical factors such as limited time and availability of participants, a sample size of 24 was ideal for conducting a comprehensive analysis of the study's objectives.

The cocoa farmers, who are the main stakeholders, were selected using a purposive sampling technique that considers regional diversity, farm size, and sustainable practices. This technique encompasses a comprehensive spectrum of experiences within the cocoa farming community (Trotter, 2012). Key informants, such as agricultural extension officials and community leaders, will be selected using deliberate sampling to ensure their knowledge contributes to focused and meaningful talks. In addition, community members will be included

through convenience sampling, which enables the selection of participants who are easily accessible and eager to provide insights from the local context.

Financial specialists who possess essential knowledge about the complex financial aspects of cocoa cultivation were selected using a snowball sampling approach. The selection process commenced with recognised authorities in the domain, additional members were added through recommendations, and a network was established with a wide range of financial viewpoints. Sustainability advocates were included using a purposive sample method, which involves picking individuals recognised for their dedication to sustainable agricultural techniques. This qualitative focus group study helped the researcher to understand how green financing, living income, and sustainable cocoa production are interconnected in Ghana's cocoa farming context. An understanding was achieved by meticulously sampling each data source.

Although snowball sampling is considered effective for reaching individuals with specialised knowledge in cocoa farming, sustainable agriculture, and financial aspects of farmers' living income, the strategy suffered several limitations during the study. One important limitation was the lack of randomness, which has the potential of introducing selection bias. This is due to the fact that the sampling process relies on recommendations from initial participants; the sample may become homogenous or more of familiar friends and family, which does not allow for diversity in respondents' perspectives and experiences. This means that there is a potential danger of overrepresentation of certain or skewed viewpoints and excluding others with requisite knowledge, potentially skewing the findings. Put more concisely, in the use of snowball sampling, there is a danger that when it comes to depending heavily on the readiness of participants to refer others, when this happens, it may result in difficulties in accessing a broad range of respondents. Additionally, some potential participants may be unwilling to participate due to apprehensions about confidentiality or skepticism regarding the research. Furthermore, one of the key limitations of this method is

representativeness and generalizability: the use of the snowball sampling method does not usually allow for the generalisation of findings to the broader population of cocoa farmers in Ghana, as the sample is not representative. The study also suffers limitations as it may exclude key stakeholders who are not connected personally with the personal networks of the individuals who refer others. Finally, the researcher was limited on who to include and not to include as respondents in the recruitment process, which prolonged the data collection phase and affected the overall efficiency of the study.

The study used a stratified random sample approach for its quantitative component. The cocoa farming community in Ghana exhibits diversity, with variations observed in terms of geographical locations, farm sizes, and agricultural methods. Stratified sampling guarantees a fair and intentional choice of participants from diverse strata, enabling a thorough comprehension of the numerous contexts in which cocoa production occurs. This methodology improves the generalizability of the research by including the inherent variety within the larger population. The stratification was determined by important factors such as geographical location, farm size, and agricultural methods.

Every stratum represents a subgroup with unique features, guaranteeing that the sample consists of people from different settings within the cocoa-growing environment in Ghana. Stratified sampling was very applicable to this study since it allowed for the detection of trends and variations across various groups, resulting in a more detailed investigation of the influence of green finance on sustainable cocoa production. A random sample approach was used to choose participants from each stratum (Winship & Mare, 1992) as it guaranteed that each cocoa farmer in a certain category had an equitable opportunity to be included in the research. Random sampling reduces selection bias and enhances the probability of obtaining a representative sample from the whole stratum. This strategy improves the capacity to apply the

study's findings to a wider group of cocoa growers in Ghana, increasing the generalizability of the results.

Stratified random sampling is very important in this research, as discussed above, as it includes improving representation and enhancing the generalizability of findings. Despite these benefits, this study has numerous limitations. From the study, one key challenge is the complexity of implementation due to the fact that it requires precise categorisation of cocoa farmers based on geographical location, farm size, and agricultural methods. In the processes of categorisation, there is the tendency for misclassification of strata, and this can lead to sampling errors that affect the overall validity of results. Another limitation is that in situations where the strata have fewer eligible participants, there will be some difficulty in attaining a balanced sample size across all groups: this has the potential of affecting the statistical power of the analysis. Additionally, while stratification strategy minimises selection bias within each group, it may not eliminate bias, specifically when some farmers are reluctant to participate or are incapable of doing so. Last of all, ensuring random selection when it comes to each stratum may necessitate additional logistical planning: this may lead to a more complex sampling procedure compared to simpler random sampling techniques.

Sample Size Determination

In this study, the power analysis-sampling calculator by Cohen (1969) was used to arrive at a suitable sample size for the study. The reason for the adoption of the power analysis sampling procedure was to ensure that the survey produced a sample that was large enough to identify meaningful effects and could enhance the chances of observing a statistically significant result whilst also improving the chances of obtaining a valid result that was crucial in the decision making. The study further relied on the power analysis formula to determine the sample size as it could reduce type two errors, which could lead to undetected real effects.

It enhances the credibility of the results. A power analysis was performed to determine the required sample size for the study.

$$n = \frac{2(Z\alpha + Z\beta)^2 \times \sigma^2}{d^2}$$

This equation guarantees that the sample size will be large enough to obtain statistical precision, as measured by the margin of error (E). The Z-score captures that confidence level of 95%, a level at which a result is both replicable and generalisable. Moreover, the population standard deviation (σ) reflects the variability in the population, a condition that your sample will represent. Your sample size is now optimised, so you will not collect too much data, thus saving you time, money and resources.

Effect size (d): 0.5 (considered a moderate effect size).

Significance level (α): 0.05 (commonly used significance level). Desired power level (1−β): 0.80 (commonly used power level) and$\sigma^2 = 6.21$.

$$Now, let's\ substitute\ the\ values:$$

$$n = \frac{2(1.96 + 0.84)^2 \times\ 6.21}{0.5^2}$$

$$n = \frac{2(2.8)^2 \times 6.21}{0.25}$$

$$n = \frac{2 \times 7.84 \times 6.21}{0.25}$$

$$n = \frac{15.68 \times 6.21}{0.25}$$

$$n = \frac{62.72 \times 6.21}{1}$$

$$n\ = 389.49$$

Since the sample size cannot be decimal, the sample size for the quantitative study is 390 people.

Recruitment of Participants for the Study

The researcher used various methods to recruit participants for the study. The qualitative focus group research participants were recruited using a comprehensive and diverse strategy. Cocoa growers, the main stakeholders, were chosen using a purposive sample technique that guarantees a varied representation of geographical location, farm size, and sustainable farming methods. Key informants, such as agricultural extension officials and community leaders, were intentionally selected based on their knowledge and positions within the cocoa-growing community. Community representatives were chosen via convenience sampling, taking into account their accessibility and desire to take part. Financial experts were selected using a purposive sampling strategy, which involved initially choosing recognised experts and increasing the sample by asking for recommendations. Sustainability supporters were intentionally chosen based on their dedication to sustainable agricultural methods. The primary purpose of this comprehensive recruiting technique was to assemble a heterogeneous and inclusive cohort of participants, guaranteeing a wide range of perspectives and profound insights necessary for a full investigation of the study's goals.

In addition, a methodical recruiting strategy was utilised to guarantee a representative sample of cocoa growers for the quantitative part of the study. The sampling frame, encompassing the complete population of cocoa producers in Ghana, was initially determined using data extracted from agricultural census records and other government organisations. Subsequently, stratified random sampling is employed, wherein cocoa growers are classified according to geographical areas, farm sizes, and agricultural methods. Afterwards, a randomised sampling method was used within each group, ensuring that every cocoa farmer in the particular category had an equal chance of being included in the research. This method guarantees that the chosen sample effectively represents the many characteristics of the wider cocoa farming community, hence improving the reliability of the quantitative results.

After identifying the stratified random sample, participants are approached via existing communication channels, such as local agricultural extension offices, community leaders, and farming cooperatives. Effective and unambiguous communication is upheld, including comprehensive information on the study's goals, the advantages of participation, and the voluntary aspect of involvement. The primary objective of this methodical recruiting procedure is to promote active participation and confidence among participants while gathering reliable quantitative data to analyse the correlation between green financing, farmers' livelihoods, and the sustainable production of cocoa in Ghana.

Materials/Instrumentation of Research Tools

Materials Used for Research

The study utilises two primary instruments: the structured questionnaire and the focus group session. Bhat (2019) A research instrument is a tool employed by an investigator to gather data to address the research issues at hand. This method is suitable for both qualitative and quantitative research methodologies and can produce either quantitative or qualitative data. Halcomb (2019) Research instruments are used to gather factual information and collect research data. According to the author, the researcher must ascertain that the selected instrument possesses both reliability and validity. A project's reliability and validity mostly depend on the appropriateness of the instruments used.

Due to the scarcity of studies on green finance in the cocoa business, the researcher independently created questionnaires and a focus group guide. The process of making the focus group guide began with a comprehensive examination of pertinent theoretical frameworks, scholarly literature, and current research related to green financing, sustainable cocoa production, and farmers' living income. This initial phase guarantees that the guide is firmly based on well-established principles and is on the theoretical foundations of the research. After

a theoretical analysis, the study goals were precisely established, outlining the specific areas of green financing and sustainable cocoa production that the focus group investigated (Miles, 1990). Subsequently, guiding questions were devised to provide a coherent and systematic framework that promotes thorough conversations and the extraction of rich qualitative information. Moreover, to improve the content validity of the focus group guide, specialists in agriculture, finance, and qualitative research methodologies were consulted. Their feedback was extremely useful in enhancing the questions' clarity, relevance, and coherence. A pilot test was carried out using a small and varied group to detect any uncertainties, evaluate the progression of the conversation, and guarantee that the guide accurately represents the participants' viewpoints (Abiodun-Oyebanji, 2017).

Content analysis refers to analysing qualitative textual data by separating them to notice their outcomes before reassembling the data meaningfully, as stated by Creswell (2015). Coding is necessary because text data is dense and requires significant time to read and process. In this study, coding primarily entailed the process of organising data to create a summary of inconsistent information. It enabled the extraction of meaningful insights related to the research topics. Coding allows for identifying and tagging data points in an interview pertinent to certain questions rather than only considering the responses in the order they were given. The coding method referred to is indexing, as shown in the research conducted by Bhat (2019).

The focus group guide was improved based on expert comments after the pilot testing to enhance its efficacy in collecting detailed and comprehensive qualitative data. The language was tailored to ensure cultural sensitivity, with meticulous consideration given to the order and choice of words to prevent potential prejudices (Amanamah et al., 2018). The ultimate iteration of the guide was organised in a manner that fostered a favourable setting for open and frank conversations. The content validity of the focus group guide was evidenced by its congruence with the study objectives and theoretical underpinnings. Every question was methodically

connected to the study's broad objectives, guaranteeing that the guide thoroughly examined the aspects of green financing, sustainable cocoa production, and the influence on farmers' livelihoods (Akaranga & Makau, n.d..). Cognitive interviewing techniques were utilised to enhance the clarity and understanding of the guide: this entailed interacting with prospective participants to evaluate their comprehension of the inquiries, guaranteeing that the guide accurately collects the required information (Malmasi et al., 2010).

Reliability is the ability of a research instrument to produce consistent results when used consistently with similar methodologies; this includes how well the results hold up over time and how accurately they represent the whole population under study. (Creswell, 2009). Noble and Smith (2015) List three types of reliability in quantitative studies, which are related to: 1). the stability of an estimate when used repeatedly; 2). the stability of an estimation over time; and 3). the similarity of an analysis within a specific period. Andrew et al. (2019) Found that the test-retest technique at two periods might determine the consistency with which questionnaire test items are responded to. The author agrees with this view.

The survey questionnaire was prepared carefully to guarantee that it would capture useful and relevant information. The researcher took the first and most crucial step when conducting the investigation; they clearly defined the objectives. A comprehensive review of the study's aims was undertaken to achieve this. This review ensured the survey would be tailored to ask questions related to the study's aims. A thorough and systematic review of the pertinent literature was conducted after this initial phase. In addition to helping the research team better understand the topic, this literature review also helped identify key issues and factors that need to be included in the questionnaire. (Bai et al., 2022).

The third round of development focused on questions about the questionnaire's layout and structure. This could only be achieved by developing well-defined, unambiguous questions pertinent to the study's objectives. The language was carefully considered to clarify and prevent

responders from misinterpreting the facts. Furthermore, the questionnaire's design was thoroughly reviewed to ensure a smooth progression of questions; this led to more participation and activity from respondents and less room for bias.

Conducting pilot tests before implementing the questionnaire on a broader scale was crucial to the development process. This procedure included sending out the survey to a small but statistically significant subset of the population to check for clarity, identify any potential ambiguities, and establish a baseline for the survey's overall feasibility. Feedback from the pilot users was vital to fine-tuning the questionnaire and making any necessary adjustments before implementing it on a larger scale. This technique was designed to be iterative so that by its conclusion, the survey questionnaire was user-friendly and methodologically sound and could provide valid data to support the research aims. Ensuring that responders could use the questionnaire was the key to achieving this goal.

Quantitative research relies on validity to ascertain whether or not the study measures the intended construct or the veracity of its results. Researchers find out by asking questions and seeking answers from other people's studies. The authors acknowledge, drawing on the work of McEwan (2020)Validity in quantitative studies is defined as construct validity. Here, "construct" refers to the prior idea, hypothesis, or question that determines the data that can be collected and the methods used. (Hong et al., 2019).

Moreover, this research adheres to the quantitative paradigm, which states that to validate an investigation, there must be an active interaction between the construct and the data, as demonstrated by using tests or other procedures. So far, the definitions of reliability and validity in statistical studies have revealed two branches: first, regarding reliability, we learn whether the results can be reproduced; and second, regarding validity, we know whether the evaluation methods are accurate and if they are assessing the target variable. Hammersley (2008) states that the particular terms of a paradigm should be used to evaluate the quality of

research within that paradigm. According to Cameron's (2011) experience, the most important quality criteria in qualitative paradigms are credibility, neutrality, dependability, and applicability, whereas, in quantitative paradigms, validity and reliability are essential benchmarks for quality. The research's qualitative paradigm might be more consistently used with the help of an investigative audit to ensure the reliability of the research process and its results (Cameron, 2011).

Veracity in qualitative research relies heavily on trustworthiness examinations. According to Dawadi et al. (2021)Reliability and validity are traditionally examined in qualitative projects as criteria contributing to a research report's trustworthiness. It is done to ensure that studies are of high quality. Triangulation, supported by Patton (2002), is a method that enhances a study by combining several approaches. It might necessitate a wide range of information-gathering techniques, such as the mixed-methods strategy used in this work. The primary idea behind triangulation as a test is to improve research validity and reliability or assess its results. Since traditional scientific methods do not work with this alternating epistemology, research triangulation, which draws on the work of Cameron (2011)This has become an important topic in qualitative and naturalistic evaluation methods, as it is used to control bias and validate propositions (Golafshani, 2003).

Pilot Testing

In this study, a pilot test of the structured questionnaire instrument was conducted with some farmers and experts from the cocoa sector in Ghana. The group consisted of cocoa farmers who had been farming for more than five years, financial experts, and managers from COCOBOD who understood green finance and how it affected sustainable cocoa production. The pilot test was used in the study, and the aim was to examine the feasibility of collecting primary data on a broader scale using the structured questionnaire. The feasibility of recruiting,

randomising and the procedures for evaluating and executing the innovative intervention were also intended to be assessed. In addition, it sought to verify that the questionnaire was free of unclear language, assess if respondents had enough time to complete it, and gauge the level of comprehension of the questions. The structured questionnaire instrument's primary goal was to validate and guarantee the reliability of the collected quantitative primary data.

The pilot study results demonstrate that the questions were well understood and that the respondents gave their answers their full attention. As the pilot study shows, respondents have ample time to finish the surveys. Within two weeks, all four pilot test samples had been filled out and sent back. Two participants in the pilot study filled out the surveys digitally. They returned them to the researcher via email within a week, sparing the researcher the trouble of printing out hard copies.

In contrast, two other participants printed out hard copies and filled them out. Then, they contacted the researcher another week later to arrange for collection. They expressed concern that the researcher might be able to identify them from the questionnaires sent to their email addresses and partially blamed an issue with their internet connections for not completing the surveys digitally and sending them back to the researcher. On top of that, the survey does not seem to have any vague wording. Respondents were kindly asked to complete the surveys electronically to the best of their abilities. It will help to save time and money when administering the actual samples.

Operational Definition of Variables

Primary Construct

Independent Variable: Green Financing

This concept is operationally defined as the extent to which financial investments are directed towards projects and initiatives with positive environmental outcomes, such as

renewable energy production, energy efficiency improvements, and pollution reduction measures. According to Weber (2018), green finance encompasses a range of financial products and services that support the transition to a sustainable economy, including green bonds, green loans, and investments in sustainable infrastructure. These mechanisms are crucial for mobilising the capital required for large-scale environmental projects, thereby operationalising the broader sustainable development goals within the financial sector.

To measure green finance quantitatively, researchers have employed a composite index that aggregates various indicators reflective of environmental investment and funding activities. For instance, the volume of green bonds issued, the number of green loans disbursed, and the total investment in sustainable projects serve as quantifiable metrics for this purpose. Scholtens (2017) suggests that such an index, constructed on a ratio level of measurement, offers a nuanced understanding of the scale and impact of green financial practices. Aggregating financial data from diverse sources, including corporate financial statements and sustainability reports, enables a comprehensive assessment of green finance activities across different sectors and regions. Green financing is a crucial component of sustainability initiatives, particularly in Ghana's cocoa industry, as it encompasses financial mechanisms that support environmentally friendly practices, aiming to enhance the ecological footprint of cocoa production (Nkansah, 2019). Understanding green financing involves delving into its definition, measurement, and sources in the research context.

The measurement of green financing is typically at the nominal level, a categorisation approach that involves classifying financial support into distinct types or sources, as nominal measurement does not imply a quantitative order or hierarchy but allows for the identification of different forms of financial mechanisms (Peprah, 2019). In the case of green financing, these forms include grants, loans, or subsidies, each representing a unique category of support. This categorisation facilitates a nuanced analysis of the diverse sources contributing to sustainable

cocoa initiatives. Data on green financing can be sourced from various channels, including financial records, government reports, and international organisations' databases, because financial records of entities providing green financing offer insights into the allocation and disbursement of funds (Reuters, 2019). Government reports may detail initiatives and policies related to sustainable cocoa production, shedding light on the financial support associated with these efforts. Additionally, international organisations' databases compile information on various forms of financial assistance to support sustainability initiatives globally.

The categorisation of green financing into distinct types allows for the derivation of specific scores involving the assignment of numerical values for analysis. This numeric representation facilitates quantitative assessments and comparisons, enabling researchers to explore patterns, trends, and relationships associated with different types of green financing. By employing this approach, the study gains a structured framework for understanding the complexities of financial support in pursuing sustainable cocoa production in Ghana.

Dependent Variable: Sustainability of Cocoa Production in Ghana

Sustainable cocoa production has emerged as a critical area of focus within the agricultural and environmental sectors, aiming to address the myriad of challenges associated with cocoa cultivation, including environmental degradation, social inequity, and economic instability for farmers. Sustainability in cocoa production encompasses a multifaceted approach that seeks to balance ecological conservation, social responsibility, and financial viability for all stakeholders involved in the cocoa supply chain. According to Schroth et al. (2016), sustainable cocoa production involves practices that minimise environmental impacts, such as deforestation and soil degradation, while enhancing biodiversity and ecosystem services.

These practices contribute to the resilience of cocoa farming systems and the broader environmental sustainability goals. Measuring the sustainability of cocoa production involves

assessing the environmental, social, and economic impacts of cultivation practices. Environmental indicators might include biodiversity, soil health, and carbon sequestration metrics, while social indicators could focus on labour conditions, income equality, and community development. Economic indicators would measure the profitability and resilience of cocoa farming operations. Gockowski and Sonwa (2011) emphasise the importance of comprehensive metrics encompassing the triple bottom line of sustainability to evaluate the effectiveness of sustainable cocoa production initiatives accurately.

The transition towards sustainable cocoa production has been supported by a growing body of research that demonstrates its potential benefits, not only for the environment but also for the social and economic well-being of cocoa-producing communities (Diby et al., 2019). This provides evidence of improved livelihoods and reduced environmental impacts in communities that adopt sustainable cocoa practices. However, the scalability and adoption of these practices require ongoing support from governments, the private sector, and non-governmental organisations. By fostering partnerships and investing in research and development, stakeholders can enhance the sustainability of the cocoa sector, ensuring that it contributes positively to global sustainability goals.

The long-term viability of Ghana's cocoa industry is a multifaceted variable that captures the industry's capacity for sustainable cocoa production over an extended period (Gupta, 2020). It involves a comprehensive assessment, considering economic, environmental, and social factors contributing to the industry's overall health and endurance. A combination of indicators will measure this variable, each shedding light on the industry's sustainability aspects. These indicators encompass cocoa production levels, economic contributions, environmental impact, and social factors. Cocoa production levels will be assessed quantitatively, possibly using numerical data derived from agricultural reports and production statistics (Osei, 2020).

Economic contributions may involve evaluating revenue generated by the industry, while environmental impact could consider sustainability practices through data obtained from environmental impact assessments. Social factors reflecting the well-being of smallholder farmers may be assessed using data collected from social welfare studies or surveys.

The measurement approach may involve ordinal Likert-type scales for certain indicators, allowing for a qualitative assessment of the perceived impact or effectiveness of sustainability practices (Sustainable Agriculture Network, 2021). Additionally, numerical data from various sources, including agricultural reports and economic studies, will contribute to a quantitative understanding of the cocoa industry's long-term viability. This comprehensive measurement strategy ensures that the assessment covers diverse dimensions, providing a holistic view of the industry's sustainability and potential future implications.

Mediating Variable: Smallholder Farmers' Living Income

Agricultural economics tell us that smallholder farmers' living income, and thus the income of much of the rural population, food security and economic development of many parts of the world depend on their income from crop and livestock production and other farm activities. In theory, smallholder farmers have the same opportunities to grow their crops and raise their animals profitably as larger commercial farmers. However, in reality, the income of smallholders depends on many factors beyond their control, such as access to markets, financial services, and new agricultural technologies, which constrain their productivity and, thus, their ability to earn a sustainable income. As Barrett et al. explain: 'Smallholder farmers are those involved in relatively small-scale farming activities, typically compared to some sort of larger commercial farming entity.' They are common in many parts of the world, often because of a historical lack of access to land or because political or other factors have limited their ability to scale up to larger sizes.

Researchers measure smallholder farmers' living income in absolute numbers or as a percentage of the poverty line by operationalising total income from agricultural activities over a given period (usually annually). It means measuring cash income from the sale of produce and livestock and the value of consumed or bartered products that enter the household's consumption and livelihood. The World Bank (2016) notes that measuring smallholder income requires methodologies for collecting comprehensive data on the diverse and seasonally variable income sources of small-scale agriculture. Furthermore, metrics relevant to capturing income heterogeneity across smallholder farmers must be disaggregated by crop types, location and access to agricultural services, such as extension services and credit facilities.

Smallholder farmers have often been found to have a ratio level of income measurement because, in addition to having a true zero (no income), the number is useful for comparison between different levels of income. Income data may be obtained from household surveys in which respondents are asked questions about volumes and prices of crops and livestock products sold, input costs, wages and salary, and other income-earning activities. Example questions from a sample survey might include Total income from crop sales, Income from livestock products, and Expenditures on agricultural inputs. The above questions may be used to calculate net income, such as total income from crop sales and expenditures on agricultural inputs.

By the early 2010s, impact studies on smallholder farmer incomes emphasised the potential for income stability and poverty reduction via diversification and innovation. For example, a study by Mishra et al. (2018) found that smallholder farmers tend to have higher and more stable incomes when they diversify income sources – by cultivating multiple agricultural products, keeping livestock, working beyond the farm, or any combination of these activities. Similarly, studies of impact evaluations of small farmer-focused agriculture development programmes demonstrate that agricultural productivity, and thus incomes, may

be enhanced by access to improved farming practices and technologies. These studies offer key insights into the strategies likely to succeed in improving the incomes and livelihoods of small farmers.

Smallholder farmers' living income is the intervening variable in this experiment because it relates to the income earned by an individual or a family who engages in cocoa farming, which is the focal point in the relationship between green financing and the future of the cocoa industry (Osei, 2020). However, smallholder farmers' living income represents a ratio-level variable because it is quantitative and measures the amount of money farmers earn from cocoa cultivation. The variability or range of smallholder farmers' living income is wide as it covers a large range in its income level, which could be low or high in the first place. This variability happens because various factors could affect smallholder farmers' living income, such as cocoa yield, the price of cocoa beans in the market, and the efficiency of farming techniques adopted by an individual cocoa farmer (Nyamekye, 2021). Cocoa yield directly relates to the number of beans produced. Thus, it affects the farmers' living income, while the prices of its beans in the market could affect their income from an external factor. In contrast, the efficiency of farming techniques adopted by a farmer could affect the productivity of a farm if sustainable techniques are adopted.

Data about smallholder farmers' living income can be collected from several sources, such as surveys, financial records, and agricultural reports. Surveys and interviews might collect smallholder farmers' self-reported income. For example, a survey might ask questions such as: 'What is your total income from cocoa farming this year?' or 'Last year, how much income did you earn from cocoa farming? Similar data could be sourced from financial records, such as bank accounts and financial documents that give producers data on the money they have taken in or spent on their farming activities. In addition, economic data about smallholder income might be sourced from agricultural reports, which present income levels at the regional

or farming community level. Specific cocoa smallholder income scores could be determined by aggregating income data from individual smallholder farmers or households, ensuring that income levels in the cocoa industry are properly reflected and understood.

Model Specification

The researcher, based on the conceptual model for this study, specified the regression model for the study examining the various relationships in all four models was specified for this study, which includes the model examining the relationship between green finance and sustainable cocoa production, green finance and living income, living income and sustainable cocoa production, and green income and living income on cocoa production. These models are specified below;

Regression Model

$Y_{it} = ß_0 + \beta_j X_{it} + \mathcal{E}_{it}$

Where Y_{it} = is the dependent Variable

X_{it} = Explanatory Variable

t= 1……..T- periods

β_0 = Represents the constant term

β_1 = Represents the coefficient of explanatory variables

uit = represents the error terms

Model 1

Green Finance (GF) on Living Income (LIV) (Mediator)……..1

$Liv_t = ß_0 + \beta_c GF_{it} + \mathcal{E}_{it}$

Where Liv_t = living income of farmers

$ß_0$ = Represents the constant term

$ß_c$ = Regression effect of green finance on the living income of cocoa farmers

GF_{it} = Green Finance

$\mathcal{E}$it = represents the error terms

Model 2

The effect of green finance on sustainable cocoa production without a mediator

$SCP_t = ß_1 + \beta_a GF_{it} + \mathcal{E}_{it}$

Where SCP_t = Sustainable Cocoa Growth

$ß_1$ = Represents the constant term

$ß_a$ = Total effect of green finance on sustainable cocoa production

GF_{it} = Green Finance

$\mathcal{E}$it = represents the error terms

Model 3

Green Finance (GF) and Living Income (LIV) on Sustainable Cocoa Production (SCP)

$SCP = ß_2 + ß_c \cdot GF + ß_a \cdot LIV + \mathcal{E}_{it}$

Where SCP_t = Sustainable Cocoa Growth

GF_{it} = Green Finance

Liv_t = living income of farmers

$ß_2$ = Represents the constant term

$ß_a$ = regression coefficient of green finance on sustainable cocoa production

$ß_c$ = regression effect of green finance on sustainable cocoa production without a mediator

$\mathcal{E}$it = represents the error terms

Model 4

Living Income (LIV) on Sustainable Cocoa Production (SCP)

$SCP_t = ß_0 + \beta_c Liv_{it} + \mathcal{E}_{it}$

Where SCP_t = Sustainable Cocoa Growth

Liv_t = living income of farmers

$ß_0$ = Represents the constant term

$ß_c$ = Regression effect of living income on sustainable cocoa production

$\mathcal{E}$it = represents the error terms

Study Procedures

Whatever intellectual territory the academic research covers, it must be ethical. Based on the foregoing, the Unicaf Research and Ethics Committee (UREC) submitted and approved research documents before data collection. These documents include a gatekeeper letter, a Doctoral Research Ethics Application Form, an Informed Consent Form (Participant Debriefing Sheet & Certificate of Consent), a Risk Assessment Form, a Structured Questionnaire Template, and a Focus Group Questions Template.

Although no harm would befall the study participants, adhering to the ethical considerations ensured they would not feel or experience the adverse effects of participating. Newcombe (2022) argues that a human participant is anyone whose information a researcher (whether a student or professional) tries to acquire about a subject for a research study through a direct or indirect intervention or interaction. Shi et al. (2023) defined research as an organised and methodical inquiry that leads to unique information/findings and ethics as norms of conduct that tell one what one should do and what should not be done morally in the conduct of any activity, and research is a series of stages. Research ethics are important. Doing the right things in research from the legal and/or moral perspective is implied in the definition of research ethics, and the way we use the term here is to mean a code of conduct in the field that defines what is appropriate and what is inappropriate. It implies that a research endeavour has

been described and might involve methods, procedures or a process. Stommel and Rijk (2021) defined research as a methodically oriented, creative process with the primary purposes to enlarge the body of knowledge and to put that knowledge to use in developing new applications, and this includes extending the knowledge about human nature (including society and culture); and Shi et al. (2023) defined research as an organised and methodical inquiry into a particular topic that leads to unique information/findings or confirmation and extension of the existing knowledge/information through research and scientific techniques. I submit here, echoing Head's (2020) statement, that while new knowledge must be sought and/or the confirmation or extension of existing knowledge in research, it is paramount that such knowledge is not obtained at the expense of the rights and welfare of people in research if they are involved.

These rules or principles systems help researchers do their jobs honestly and not hurt anyone. The investigator must ensure that the project meets all expectations for ethical behaviour in the field. All project parts must be moral, from developing the research questions and/or hypothesis on how the protocol is executed to disseminating the results. It helps to keep research scales in check and balanced. Research ethics are ancillary to modern concepts of good and evil but originated in classical Greek moral philosophy (Brown et al., 2020). Ethical processes are philosophical, but they examine radical changes that can be and have been made to previous patterns of beliefs about decision-making and deeds (Nneoma et al., 2023). One definition of ethics AE gives is 'Moral philosophy, the branch of philosophy that studies right and wrong. It is particularly focused on the 'central dynamics of this question'. Individual, cultural and social norms regulate research projects as they do all human endeavours (Allen & George, 2023). While the focus is on the questions mentioned above, the areas of the association are the dissemination of research findings, the protection of the dignity and self-esteem of research participants, and meeting the dictates of day-to-day work (University of

Minnesota, 2003). To be accepted and trusted by society and its members, research must be conducted ethically, honestly and socially responsibly (University of Minnesota, 2003). A study undertaken that is not ethical, honest, and responsible cannot be considered credible. To be considered moral, a study must meet certain standards at all levels, from planning to peer review. The integrity of the entire research will be questioned if any part of it is poor, unethical or doubtful.

Moreover, the data collected in this study was collected by sending gatekeeper letters to cocoa farmers and members of or affiliated with the cocoa industry; some were posted through online media outlets, and others were disseminated by hand. In this study, cooperative unions and departments and the banks were utilised to authorise and recruit study volunteers formally, and they were made to have access to their acquaintances; however, responses to these requests in some cases were not favorable. Data collection for this study took six weeks. Three days were spent conducting focus group interviews; another two collected and analysed responses to structured questions, and another day facilitated the focus group session. Respondents emailed back some of the structured questionnaires.

In contrast, others were filled out in soft copies, and then the researcher was summoned to their offices to pick them up, believing their email addresses were likely to be monitored. The data collection took place in the Western Region of Ghana. Since the majority of the cocoa cooperatives in Ghana are in the west and the area is one of the country's major cocoa producers, the Western Region was considered the most representative and appropriate place for carrying out the data collection activity. The collaborative space was the chosen venue for the focus group.

Therefore, the questionnaires were circulated among the farmers to ensure the opinions of all or any cadres of workers were represented. The focus groups, however, were limited to the seasoned farmers and senior managers of financial institutions and cocoa sector players. It

is because senior management and seasoned cocoa farmers in Ghana are in the most appropriate position to explain green financing and sustainable cocoa production and to give their opinions since they are knowledgeable about these issues.

Ethical Assurances

The primary investigator paid close attention to ethical considerations as the researcher progressed into the investigational phase. A large amount of technical information was acquired throughout the design phase. Respondent-informed consent, which served as a protective factor for vulnerable populations, was thoughtfully addressed during the recruitment phase (Newcombe, 2022). As proposed within the beneficence principle, 'respect for persons' requires potential participants to have an opportunity to make decisions about their fate to the best of their ability. Information, voluntariness, and understanding are the foundational pillars of the informed consent principle. As with the beneficence principle, the research study design should be positive about benefits and risks (Mbabe et al., 2021). Morally sound procedures for selecting participants are aligned with the research justice principle, and by selecting research participants in morally just ways, the principle of justice is upheld.

All volunteers participating in any given study should be treated similarly and given fair, non-invasive access to any studies they might find beneficial. As part of the data collection phase, we also kept in mind the dignity of all study participants and the principle of anonymity and integrity of the data. The same strict secrecy requirements bound the research data administration phase (Allen, 2023). We must maintain the confidentiality of participants in our research or surveys (Head, 2020). The collected data should contain no identifiers of the study's participants, and the possibility of linking such data to a specific person should be minimised. Confidentiality standards should be maintained to protect the privacy of participants. It includes

the protection of the personal information of the respondents from improper access, theft, or use, as well as from alteration or disclosure.

Preserving participants' privacy is an important part of data privacy, as it ensures that 'fundamental sovereign rights, overall health and autonomy are protected'; as Newcombe (2022) put it, the obligations for data privacy rest upon ancient social norms. One is the general expectation that things about an individual should remain private and not be made public. It is impossible to ask too many researchers not to act unethically, say Brown et al. (2020). 'Doing so helps researchers to achieve whatever their aim in doing research, whether to discover new things, avoid making mistakes (fabrication, exaggeration or otherwise gaming results), and/or adhere to the social compact between researcher and research participants.' There are also specific aims around developing the necessary rules governing such joint endeavours based on trust, respect, justice and accountability, all of which become particularly important when we realise the high degree of collaboration that goes into research and the broad range of players involved as stakeholders. Similarly, Stommel and Rijk (2021) argue that per ethical standards, 'it is important to uphold the confidentiality of participant-related information and the anonymity of study responses. '

It means that someone contemplating involvement in a study should know how that information will be used before agreeing to participate. Ideally, the respondents will be informed of how to follow up on feedback they receive, whether that information is shared during the study or post hoc. The ability to maintain confidentiality by guaranteeing protection for research participants' identities across the entire study and its evaluation is a cornerstone of anonymity. The privacy of research participants is adhered to from the outset and throughout all stages of the study and the researcher's work, whether the collection, storage, analysis or presentation of that data. Research must be carried out in a way that enables others to believe

both in the researcher's methodology and the veracity of the results if such work is deemed honest and credible.

The extent to which a researcher might meet required professional standards is the only variable to consider in integrity-based research. Its five pillars are freedom of inquiry, integrity of record, honesty, respect and care, candour, and open communication. Researchers need to be morally and academically accountable for all measures of the proposal, implementation, and publication process, which align with the World Health Organisation's standards for ethical research (WHO, 2017). Responsibility and candour are the foundations of an unbiased and reliable research proposal, portrayal, data accumulation, analysis, reporting and publication.

Integrity and honesty are other ways this research will be ethical: the results will be stated truthfully, in light of the study's methodology and data gathering, and any previous disclosures of the same or similar information. Research data should not be fictional, and conclusions should not be based on unrelated findings from other studies. The research should not do anything that would seem to be an attempt to deceive. In addition, if the researcher and the research subjects strike a deal, the researcher should keep this word. All of the relevant steps should be taken to avoid bias in the research at all stages, from the project design to data collection and analysis to peer review, to ensure caution and objectivity, according to Nneoma et al. (2023). The researcher is also responsible for the study team not being inadvertently excluded. The researcher should disclose financial interests that could affect the work (Allen & George, 2023). The careful component means that every attempt must be made to avoid careless mistakes. The research results depend on a thorough assessment of the project's operations. In addition, this study obeys the data proportionality principle; that is, research projects should only collect the data that is necessary and appropriate, as suggested by Brown et al. (2020).

As with all data, researchers must treat all information privately and as confidentially as necessary for responsible publication and strict adherence to any procedures for secure storage of sensitive or classified data. Instead of publication for one's interests, the end goal of all research is to serve 'the free flow of research and information'. Therefore, nothing should be published as a complete rehashing of already-published work or as a second publication without meaningfully new information. Even when information is shared only with other researchers, no one other than the study subjects should be able to see personally identifiable information (PII) collected during a study. The publication of research outcomes should be anticipated, and participants' confidentiality should be validated. Research subjects deserve the reaffirmation of their anonymity when a paper is published (Allen, 2023).

Data Collection

This research used survey and focus group methodologies to gather data. A structured questionnaire was used as the survey instrument. To collect primary data, the study utilised focus groups to elicit qualitative information and structured questionnaires to collect quantitative data. For the quantitative study, 390 participants were sought after; however, only 388 participants participated. To ensure that the structured questionnaire provided high-quality data appropriate for decision-making, the instrument was subjected to a rigorous review and enhancement process. First, the questionnaire was reviewed and corrected under the supervision of the supervisor. The instrument in this stage involved a thorough assessment of all concepts, constructs and factors used in the study to ensure that each item precisely measured what it was envisioned to assess. In the review process, any repetitive or redundant questions that sought to address the same concept were streamlined, reducing them to a single, well-structured question to enhance clarity and efficiency. After the supervisor had done the review, the researcher conducted a pilot study, which was done using a small sample of

respondents. This step was essential in testing whether the questionnaire maintained its clarity, relevance, and comprehensiveness among participants. In the pilot study, it was revealed that some cocoa farmers had difficulty understanding certain questions due to language barriers. In order to address this limitation, the researcher had to engage the services of translators to ease participation among non-English-speaking farmers. Individuals with an understanding and fluency in both English and the local dialects were contacted and engaged by the researcher to help translate and interpret the questionnaire. This ensured that all respondents were able to understand and fully respond to the questions accurately. The purpose of this multi-step process was to improve the instrument, thereby improving its reliability and guaranteeing that it efficiently captured the required data for meaningful analysis.

In addition, the study included four different focus groups, each with six participants. For the qualitative research, 24 participants were surveyed. Eight farmers and 16 stakeholders from the cocoa and finance sectors make up the 24 respondents.

As mentioned in the work, researchers have begun using combined-method data-gathering approaches to validate one type of data with another, transform data for comparison, or answer several types of questions.. of Cameron (2011). Dawadi et al. (2021) state that researchers using a concurrent triangulation research design, which involves the parallel execution of quantitative and qualitative approaches, gather and analyse both data types simultaneously and then compare the results. For mixed-methods research, this data collection strategy has many benefits. To begin with, it has the potential to be easy to understand for those taking part.

In the interview section of the study, the researcher collected data professionally and systematically to ensure the credibility and relevance of the data collected. To safeguard the effectiveness of the interview session, the discussion with the focus group was guided by a semi-structured interview protocol, which allowed for flexibility in assessing key themes while

upholding consistency across sessions. This process allowed the researcher to have an in-depth understanding of participants' experiences, perceptions, and challenges associated with green finance and sustainable cocoa production.

The Interviews were conducted in an environment that was convenient and comfortable for participants; this ensured confidentiality and encouraged open dialogue. In some cases, the researcher observed that some interviewees lacked an understanding of the English language. Translators capable of understanding and communicating in both English and local dialects were engaged to facilitate effective communication, predominantly with farmers who were not fluent in English. To have accurate responses, each discussion was audio-recorded with participants' consent and later transcribed for content analysis.

Collecting and assessing embedded qualitative answers can be useful for augmenting and clarifying complex or inconsistent survey replies. Concurrent data collection from mixed designs, however, can make it more difficult to follow up on replies that are particularly striking or ambiguous. (Halcomb, 2019). According to Beiske (2002), there are several advantages to using a structured questionnaire to gather data for this study. Bazeley (2015) states that the instrument can potentially become a highly effective method of collecting quantitative data about people's behaviour, norms, experiences, and past actions if given correctly. Using questionnaires, researchers can get many data at little expense. According to Gallaher and Winkler Prins (2016), questionnaires can be sent to the target audience by email or regular mail, and respondents can choose to fill them out at their leisure. Conversely, a poor response rate is typically encountered when questionnaires are disseminated using electronic mail or the post. There is empirical evidence that mail questionnaires can have response margins as low as 20%. Furthermore, the number of usable surveys may be reduced, and the data quality may suffer if the questionnaires are inaccurate, incomplete, or unreadable or contain missing answers; researchers cannot follow up on ideas or clarify things with questionnaires.

However, this constraint can be circumvented by conducting interviews. Deriving the optimal level of consistent and meaningful data requires careful consideration of every part of the questionnaire, from design to determining the genuine target group. According to the author, who cites Leavy (2022) As evidence, semi-structured interviews might be a better fit for research that calls for much leeway in the questions. In addition, the design of the instrument is another limitation of questionnaires. A fixed-option questionnaire might assume an unstated general knowledge of the studied topic. It could make respondents answer questions they might not know much about, have different opinions on because of personal perception, or be influenced by factors like age, culture, social status, education level, or lack thereof. Interestingly, this research used multi-method data collection tools, including a structured questionnaire in conjunction with focus groups and interviews, to help overcome the aforementioned questionnaire constraints. (McClean, 2017).

Most of the surveys for this study were delivered using online forms that the different cooperatives then handed out. We distributed paper copies of the surveys by hand in areas where electronic versions were not feasible. Respondents were asked to complete the surveys and send them to the researcher to keep their information private.

The frequency, ratio, and percentage of checked responses in 'Yes' or 'No', multiple-choice questions or Likert scales 1 to 5 format in the survey were coded in various tables. In addition to expressing frequencies, focus group questions with yes/no answers were coded in tables. Tables are provided to show the descriptive thoughts and opinions offered in response to the focus group questions. Ratios, percentages, and the mean comprise the statistical tools for quantitative data used in this study. The data from the structured questionnaire were analysed using various statistical methods, such as factor analysis, Cronbach's alpha, and correlation coefficient. The results are displayed visually in tables, charts, and graphs. Applying statistical

analysis made it easier to spot patterns in the data. Content, discourse, and narrative analysis, on the other hand, were used to examine qualitative data.

To gather data for the green financing study, about 390 structured questionnaires were sent to cocoa farmers and industry stakeholders, including 38 questions for each respondent. To collect primary qualitative data, a focus group session was organised with about 24 participants, comprising eight farmers and 16 stakeholders (such as bankers and senior managers) from the cocoa business. The session aimed to generate ideas for answering the study questions. A total of 414 people were included in the study, with 390 filling out the structured questionnaire and 24 participating in the focus group. The research topics and hypotheses of the study were addressed by employing a structured questionnaire composed of an ordered set of questions.

The research participants were selected from the cooperatives in Ghana's Western Region and actors in the cocoa industry where the study took place. A stratified random selection method was used to assist with the structured questionnaire tool, and a purposive sampling method was used to supplement the focus group instruments. The Ghanaian cocoa sector was the exclusive source for all participants in the focus groups and structured questionnaires. Data were collected from all levels and cadres of the workforce to ensure that the opinions of all the farmers and players in Ghana's cocoa business were represented.

In this study, the reason underlying the triangulation of qualitative and quantitative data collection methods was supported by the need to attain an all-inclusive and well-rounded understanding of the research problem. Using both methods helped the study to leverage the strengths of each method to improve the credibility, validity, and depth of the findings. In collecting data using qualitative procedures from group discussions and interviews, the study provided a rich understanding and insight into the experiences, issues, and what they perceived as cocoa farmers and stakeholders within the green finance environment. This provided a

deeper study of the fundamental issues that affect sustainable cocoa production as well as farmers' access to green finance. On the other hand, the quantitative data, collected using structured questionnaires, allowed the researcher to identify and record measurable patterns, relationships, and generalisable trends across a broader population. The process of triangulating these methods ensured that multifaceted issues were examined from several viewpoints, thus reducing the potential biases associated with a single method while allowing for the validation and cross-verification of findings. As captured in the literature, triangulation also serves to facilitate the transformation of qualitative data into forms that are suitable for comparing with quantitative results, and this presents the opportunity to clarify inconsistencies, reinforcing converging results. Finally, the integration method supports the robustness and reliability of the study, providing supporting evidence-based conclusions and recommendations that are relevant to policy and practice in green finance and sustainable cocoa production in Ghana.

Data Analysis

Data analysis encompasses a wide range of methods and approaches. Data analysis, thus, comprises methods for utilising data to bolster research project activities, objectives, and strategies. According to Bailey (2018)Data analysis entails the following steps: defining the problem, developing research questions, gathering relevant data, analysing the data, drawing conclusions, reporting and sharing the results, and finally, evaluating the results.

Bazeley (2013) cites Lester et al. (2020a) in their definition of data analysis as a researcher's procedure to make sense of a large amount of acquired data. In addition, the author reiterated the recommendation of Lester et al. (2020) that data analysis should be carried out concurrently with or immediately after data collection from the field, regardless of whether the researcher is still in the field or has already left. The aim was to describe, label, and transmit as part of the field data analysis process for qualitative data. Both a top-down and a bottom-up

strategy are possible when doing the analysis. Based on the work of Castleberry and Nolen (2018), the author proposes the following three steps for qualitative data analysis: organising, summarising, and categorising the data.

Data analysis converts raw data into useful information and uncovers hidden relationships between variables. (Onwuegbuzie & Combs, 2011). Data analysis is describing, displaying, compressing, summarising, and assessing data using statistical and logical methods. Drawing on the work of Lester et al. (2020a), the authors pointed out that various analytic techniques allow us to draw scientific conclusions from data and distinguish between statistical changes (the "noise") and the "signal," or essential phenomena, contained in that data. Descriptive statistics, percentages, means, and standard deviations all play a role in this study's quantitative data analysis. Tables, charts, and graphs display the results of the statistical analysis procedures used to examine the Likert scale data: factor analysis structural equation modelling. The study's data and information show patterns with the help of this statistical analysis. This study's quantitative data analysis tests the hypotheses and answers the research questions posed by the data.

Quantitative Data Analysis

This study uses the Statistical Package for the Social Sciences (SPPS and SPSS Amos) to analyse quantitative data. Researchers worldwide rely on it to help them analyse complicated statistical data. (WHO, 2019). With their unusually comprehensive user manual and simple, English-like syntax, SPSS and SPSS Amos are highly sought-after tools for social science analysis worldwide. Researchers agree that SPSS is the gold standard for comprehensive statistical analysis (Mihas, 2019). The SPSS programme may be used to manipulate, analyse, and display data, according to Data Analysis and Findings - Research Guide - Subject Guides at the University of Pretoria (n.d..). In most cases, the behavioural and social sciences use the

application. The main program, "SPSS Amos", has many add-on modules that make it capable of much more than data entry, statistics, and reporting. There are many different versions of SPSS.

The commercial software package SPSS is designed for data management and statistical analysis (Mixed Methods: Integrating Quantitative and Qualitative Data Collection and Analysis While Studying Patient-Centered Medical Home Models, n.d.)The first version of the program was created in 1968 by the Norman Nie, Dale Bent, and Hadlai Hull team. (Dawadi et al., 2021). SPSS has contributed to a sea change in how social science researchers do their work. Instead of relying on mathematicians who are experts at operating user-unfriendly programs with mainframe computers, researchers can now independently conduct complex statistical analyses on big datasets with the help of this comprehensive and user-friendly software. (Cameron, 2011). Although some elements of SPSS require command syntax to access, most of its functions may be managed through a point-and-click interface. Academic and applied research institutions often use SPSS, a user-friendly statistical application offering commonly utilised processes. Statistics Base is also an integral part of IBM's SPSS Statistics.

Furthermore, power analysis and structural equation modelling are not part of SPSS but rather the SPSS Amos package. (Dey, n.d.). As mentioned before, SPSS does have a few restrictions. However, according to Mixed Methods: Integrating Quantitative and Qualitative Data Collection and Analysis While Studying Patient-Centered Medical Home Models (n.d.)SPSS's capabilities are remarkable. The application enables researchers to acquire statistics from basic descriptive figures to complex multivariate matrix studies. Scatterplots, histograms, and other representations of data are available. Files can also be reorganised, divided, and combined. In SPSS, you can change existing variables and create new ones. In fact, with SPSS, a researcher has practically unlimited options for what to do with a dataset.

Regarding complex data analysis, researchers can rely on SPSS's Amos program. (Lokanan, 2019)The Statistics programme offers many essential statistical functions, including cross-tabulation, bivariate statistics, and frequencies. Second, researchers can use advanced statistical methods to construct and validate prediction models with the help of SPSS's Modeller programme.. (Molina-Azorin, 2016). Third, SPSS's Text Analytics survey program allows survey creators to glean valuable insights from questionnaires' open-ended responses. Finally, yet importantly, SPSS's Visualization Designer makes it easy for researchers to create various graphics, like density charts and radial boxplots, from their data. Researchers can benefit from SPSS's data management tools when they do case selection, generate derived data, or reshape files. Researchers can use its data documentation function to store a metadata dictionary. (Dawadi et al., 2021). This metadata dictionary provides a centralised location for all data-related information, including its meaning, source, format, relationships, and usage. (Yu, 2008).

This study will analyse the data using Structural equation modelling (SEM). There are many convincing reasons why Structural Equation Modelling (SEM) has become an indispensable analytical tool in the social sciences and beyond. To begin with, SEM enables scientists to examine intricate theoretical models that incorporate several interdependent factors. By allowing the estimate of both latent and observable variables simultaneously, SEM offers a more thorough comprehension of the data's underlying structure than conventional regression analysis. (Baafi et al., 2021). This expertise becomes crucial when examining complicated theoretical frameworks with various components and dimensions or exploring events with elaborate causal paths. SEM provides a solid framework when evaluating the validity of measurements and the fit of models.

Researchers may verify that measurements are accurate and that their theoretical constructions are suitable by using SEM, which incorporates measurement models to evaluate

the validity and reliability of observable indicators. Researchers can assess the congruence between their proposed models and the actual data using the fit indices and goodness-of-fit tests provided by SEM (Maruyama, 1997). Researchers may be confident that their conclusions are accurate and resilient because of this thorough model evaluation method, which increases the study's credibility and validity. Researchers aiming to test complicated hypotheses and expand scientific knowledge might benefit significantly from SEM because of its methodological value in analysing complex theoretical models, rigorously verifying measurement validity and model fit.

The following research questions were analysed using quantitative analysis.

Research Question I (RQI): How effective are the green finance policies and incentives that the government of Ghana enacted between 2011 and 2020?

Data Processing and Analysis: Quantitative data from surveys and financial records were analysed using descriptive statistics. It involved categorising and summarising the types of green finance policies and incentives enacted during the specified period. The statistical analysis was carried out using software like SPSS, which is well-suited for quantitative data analysis.

Research Question II (RQII): What challenges do cocoa growers in Ghana encounter when trying to get environmentally friendly financing?

Data Processing and Analysis: Quantitative data from surveys and financial records were analysed using descriptive statistics. It involved categorising and summarising the types of challenges that cocoa growers in Ghana encounter when trying to get environmentally friendly financing. The statistical analysis was carried out using software like SPSS, which is well-suited for quantitative data analysis.

Research Question III (RQIII): Is there a link between eco-friendly funding and sustainable cocoa farming practices?

Data Processing and Analysis: Quantitative data on eco-friendly funding and cocoa farming practices were subjected to inferential statistical analysis using correlation or regression analysis. The goal was to determine if a statistically significant relationship exists between the two variables. SPSS was used for the quantitative analysis.

Research Question IV (RQIV): What role do smallholder farmers' earnings play in the association between environmentally friendly funding and sustainable cocoa production in Ghana?

Data Processing and Analysis: This question explores the moderating role of smallholder farmers' earnings. Moderation analysis, using regression models, was conducted to examine the interaction effects. SPSS was again the software of choice for quantitative analysis.

a) Qualitative Data Analysis

This study's qualitative data analysis used content analysis to conclude collected behavioural data and discourse analysis to sift through written texts and recorded conversations from focus groups. Additionally, data collected from transcripts of in-person interviews were analysed using narrative analysis. The qualitative data were analysed using the standard three-step process: data organisation, summary, and text and meaning narrative classification. (Lester et al., 2020b). The overarching goal of the research was to use qualitative data analysis to uncover themes, patterns, and correlations. Thomas (2003) States that statistical processes may be a part of qualitative data analysis and that data analysis frequently turns into a continuous recapitulative process with data being gathered and evaluated almost simultaneously. Although it may seem counterintuitive, a researcher's primary goal during data collection is to look for trends. The type of data (audio, video, field notes, etc.) and the qualitative method (content analysis, field study, etc.) used to compile the data impact this type of analysis.

As pointed out by Smith and Firth (2011)The quality of the analysis is heavily dependent on the researcher. Since the researcher is responsible for developing the questions,

they can enthusiastically influence the results according to their personal beliefs. This is the strongest argument against qualitative data analysis. Establishing or disproving the results of a qualitative study is very difficult because the researcher is so dependent on the study's methodology.. (Ritchie & Spencer, 2002)Triangulation, which helps to check and confirm data, was used in this study to solve the aforementioned objections to qualitative data analysis.

Dey (2023) States that one of the difficulties of using narrative analysis for qualitative data analysis in this study is managing the story with how respondents are portrayed and spoken about while presenting the data. The researcher's presence (or lack thereof) in the data, whether onstage or offstage, is another source of difficulties. Making decisions on how to administer, display, and establish the trustworthiness of data is difficult, even though gathering narratives is generally straightforward. (Noble & Smith, 2014)Noble and Smith (2014) state that one problem with narrative inquiry is that stories may be difficult to understand, especially when drawing connections between what interviewees say and what data presenters offer. Second, it is necessary to clarify whose tale it is and how to understand and reinterpret it. (Noble & Smith, 2014). Protecting respondents, even from them, is essential for story analysis investigators. In addition, reaching a consensus on the relevance of the narrative content, its interpretation, and the repeated report is usually challenging. Lastly, resolving data interpretation and presentation disputes can be an ongoing challenge.

Perspectives, experiences, and challenges related to sustainable cocoa production, green financing, and living income from farmers and key stakeholders. The data collection process relates to the In-depth focus group discussions conducted in cocoa farming communities and with experts. Thematic coding identified recurring themes and patterns in qualitative responses. Qualitative analysis software, namely NVivo, was used for coding and analysis.

Several strong arguments support the use of NVivo in qualitative data analysis. To begin with, NVivo offers a methodical way to organise data, which helps researchers efficiently store and classify various types of data, including papers, field notes, interview transcripts, and more.. (Amaratunga et al., 2002)Researchers may use its user-friendly interface to sort data by themes, codes, or other pertinent categories for more organised and methodical analysis. This organisational framework allows the researcher to go deeper into the data and uncover more robust insights by better analysing patterns, correlations, and themes.

NVivo has excellent features for analysing and coding data. Researchers may efficiently code text sections or other data sources using NVivo's coding tool according to relevant topics, concepts, or patterns. This method simplifies analysis and lets researchers spot patterns and themes in the data. (Antwi & Hamza, 2015). With NVivo's powerful search and query features, researchers can easily find coded data and compare it with other sources, allowing for a thorough examination of the dataset. Using these techniques, researchers can find subtle and profound insights that would be hard to find with manual analysis.

Lastly, when analysing qualitative data, NVivo encourages teamwork and openness. Its collaborative characteristics allow several scholars to work on the same topic simultaneously, promoting collaboration and information exchange. (Flick, 2007). The audit trail tool in NVivo also monitors project modifications so everyone involved in the analysis can see what they are responsible for. This trait is invaluable in scientific contexts where repeatability and openness to new ideas are paramount. Qualitative researchers cannot analyse thorough and meaningful data without NVivo's extensive feature set.

The following research questions were analysed using qualitative analysis.

Research Question II (RQII): What challenges do cocoa growers in Ghana encounter when trying to get environmentally friendly financing?

Data Processing and Analysis: Qualitative data from interviews and focus group discussions were coded thematically using NVivo. This approach allowed for the identification and categorisation of challenges cocoa growers face. Thematic analysis helped to explore patterns within qualitative data, providing a rich understanding of the challenges. NVivo was used for in-depth qualitative analysis.

Chapter Summary

The research methods employed in the study aimed to explore the intricate relationship between green finance and sustainable cocoa production in Ghana, specifically focusing on the significance of farmers' disposable income. A mixed methods research strategy was chosen to leverage qualitative and quantitative approaches. Interviews and questionnaires were utilised as data-gathering tools, selected based on their suitability for the study's objectives. Research methods, as defined by Fisher et al. (2018), encompass the strategies and instruments employed by a researcher throughout an investigation. The comprehensive plans and procedures, collectively known as the research approach, guide the study from hypothesis formulation to data collection, analysis, and interpretation. This study adopted a mixed methods design, integrating qualitative and quantitative data to examine the research questions thoroughly. Quantitative data, rooted in numerical values and statistics, formed the backbone of the research. The study utilised descriptive statistics, such as bar graphs and pie charts, to communicate information effectively. The quantitative approach allowed for swift analysis of broad trends but may have limitations in capturing nuanced insights. An in-depth understanding of quantitative data requires proficiency in mathematics and statistics (Rahman, 2020). Inferential statistics were employed when broader explanations or proofs were necessary. Qualitative data, characterised by verbally communicated information, including statements, judgments, emotions, and actions, was collected through interviews and focus groups. As suggested by Amaratunga et al. (2022), thematic analysis was employed to identify themes and

patterns related to challenges cocoa growers face in obtaining environmentally friendly financing and their perspectives on sustainable cocoa farming. The study's mixed-methods approach aimed to overcome the limitations of using only qualitative or quantitative methodologies.

Integrating both data types involved a multi-stage research strategy, with qualitative data informing the study of quantitative data. However, mixed methods research is not without challenges. Time-consuming data collection, potential difficulties in merging qualitative and quantitative information, and the need to carefully consider data integration were acknowledged (Alim, 2017; Hsieh & Shannon, 2019). Influenced by the study's objectives and design, the research approach reflects the researcher's philosophical views. Mixed methods research was chosen to ensure a more profound understanding of the complex phenomenon under study. It allows researchers to delve deeply into complex phenomena, gaining a richer grasp of the topic. The study's mixed methods design emphasises the importance of integrating disparate data sources at various stages of the investigation, facilitating a comprehensive and complementary analysis of the research questions.

The research design serves as a data collection and analysis plan, emphasising efficiency without compromising relevance to the study's objectives. This study adopted a mixed-methods research strategy, integrating qualitative and quantitative approaches to explore the relationship between green finance and sustainable cocoa production in Ghana. The convergent parallel design, a popular mixed methods strategy, involves collecting independent datasets simultaneously, employing qualitative and quantitative analytical approaches. The explanatory sequential design incorporates two stages: quantitative data analysis and qualitative methods to provide context for incongruous findings. The exploratory sequential design starts with qualitative data collection and analysis, informing the creation of quantitative

measures. The study employed a sequential exploratory design, simultaneously gathering and merging qualitative and quantitative data for in-depth analysis.

The research targeted banks, financial institutions, cooperative organisations, and cocoa farmers in Ghana's Western Region, focusing on those with in-depth knowledge of cocoa financing. Cocoa farmers play a pivotal role in cocoa production, directly affecting sustainability. Examining this group provided immediate insights into challenges and possibilities related to sustainable cocoa cultivation. Given their significant role in the cocoa supply chain, a robust understanding of farmers' livelihoods was crucial. The study employed purposive sampling for qualitative data, ensuring the intentional selection of participants with specialised expertise in cocoa farming, sustainable agriculture, and financial aspects. Focus groups aimed for diverse perspectives. The study adopted a stratified random sampling approach for quantitative data to ensure representation across diverse cocoa farming contexts. Stratification considered geographical locations, farm sizes, and agricultural methods. This method enhanced the generalizability of results by capturing the inherent variety within the cocoa farming population. A power analysis determined the quantitative sample size, resulting in 390 participants. Recruitment involved various strategies. Qualitative focus group participants, including cocoa growers, key informants, community representatives, financial experts, and sustainability advocates, were selected intentionally for their knowledge and perspectives. For quantitative data, the sampling frame encompassed the entire population of cocoa producers, with stratified random sampling ensuring fairness. Participants were approached through local channels, emphasising clear communication about the study's goals, benefits, and voluntary nature. The study's robust sampling strategy combined purposive and probability methods, addressing the complexity of understanding green finance's impact on sustainable cocoa production in Ghana. By intentionally selecting participants with diverse experiences, the research aims to provide a comprehensive and nuanced analysis of the

relationship between green financing, farmers' livelihoods, and sustainable cocoa production in the Western Region.

The survey instrument, designed due to the absence of pre-existing tools, captures participants' opinions through a Likert scale. The closed-ended format ensured quantitative properties, facilitating statistical analysis. The survey encompasses a wide range of stakeholders for a comprehensive perspective on the interconnectedness of green finance, sustainable cocoa production, and farmers' livelihoods in Ghana. Questionnaires, recognised tools for data collection, come in closed-ended, open-ended, or hybrid formats. The study employed a structured online survey, leveraging the advantages of web surveys for broad data collection. Closed-ended questions enhance quantitative analysis, while open-ended questions capture qualitative insights. The online survey's flexibility, allowing engagement through various devices, aligns with the research's simplicity in implementation. Interviews serve as a qualitative data collection method, offering a systematic exchange of ideas. Open-ended questions in interviews facilitate obtaining personalised information from participants. Content analysis interprets interview data, ensuring consistency and reliability over time. Content analysis identifies goals, themes, and communication patterns within individual, group, or organisational contexts.

Validity considerations involve content validity, ensuring accurate measurement through professional evaluation and feedback incorporation. Internal validity focuses on alignment with reality, and the study employs methods like triangulation, member checks, and peer examination to enhance it. Triangulation, involving multiple data collection methods, validates research outcomes by ensuring consistency across diverse sources. Reliability concerns the consistency and dependability of outcomes. Quantitative data reliability is assessed using Cronbach's Alpha for the survey tool. Triangulation in qualitative methods ensures dependability, with diverse data sources and methodologies enhancing reliability. The

study recognises the challenges of achieving consistency in qualitative research and prioritises the dependability and consistency of findings.

The independent variable in the study is green financing within the context of Ghana's cocoa industry. Green financing represents a strategic financial approach that champions environmentally sustainable initiatives, aiming to align economic activities with principles of environmental stewardship as this multifaceted mechanism employs various financial instruments to foster sustainable cocoa production, departing from traditional models. It includes targeted funding for eco-friendly agricultural practices like agroforestry, extending beyond conventional financial structures (Bryne, 2016). Green financing manifests through grants, loans, or subsidies to incentivise sustainable practices among cocoa farmers, fostering a culture of environmental responsibility. The level of measurement for green financing is nominal, emphasising unique financial mechanisms without specific numerical values. The variability in green financing arises from diverse funding sources and types, creating a spectrum from low to high variability. Data on green financing can be collected from financial records, government reports, and international organisations' databases, facilitating a comprehensive assessment.

The dependent variable is sustainable cocoa production, encompassing economic, environmental, and social dimensions (Ghana Statistical Service, 2021). It evaluates the industry's ability to produce cocoa over time sustainably, demanding a careful balance between economic prosperity, environmental stewardship, and social responsibility. The measurement is conducted at the ratio level, allowing for sophisticated quantitative assessments. Variability in long-term viability spans economic, ecological and social dimensions, reflecting factors like revenue fluctuations, sustainability practices, and the well-being of smallholder farmers. Data sources include agricultural reports, financial data, environmental impact assessments, and social welfare studies, providing a holistic evaluation. Numerical scores derived from

aggregated data enable a comprehensive interpretation of long-term viability, aiding in trend analysis and intervention strategies. The review of previously established use involves examining research on the sustainability and health of Ghana's cocoa industry.

The mediating variable is smallholder farmers' living income, a financial barometer reflecting their economic well-being. It plays a pivotal role in the relationship between green financing and the long-term viability of the cocoa industry. Green financing intersects with farmers' living income, influencing the adoption of sustainable practices (Osei, 2020). Measured at the ratio level, variability in income arises from factors like cocoa yield and market prices. Data sources include surveys, financial records, and agricultural reports, enabling a nuanced understanding. The analysis involves assessing income distribution, correlating sustainable practices and income, and identifying mediating factors through regression analyses and correlation studies.

The study adhered to rigorous ethical standards and procedures, emphasising participant welfare, rights, and privacy. The study obtained official approval from the University Research Ethics Committee (UREC) before data collection, reflecting a commitment to ethical research practices. Moral considerations are integral to the study, starting with participant recruitment. The researchers employed a purposive sampling method to select smallholder cocoa farmers in Ghana, ensuring participants had relevant experience. Informed consent procedures were diligently implemented, providing detailed information about the study's objectives, methods, and potential implications. Participants were assured of voluntary participation and the right to withdraw without consequences.

Confidentiality measures were prioritised to protect participants. Each participant received a unique coded identifier, replacing personal details throughout the study. This meticulous approach aimed to shield identities, minimise risks, and foster trust between researchers and participants. The commitment to anonymity contributed to the research's

integrity, allowing for open participation while mitigating potential adverse effects. The study, focusing on the impact of green finance on sustainable cocoa production, acknowledged potential risks to participants. Ethical issues associated with smallholder farmers' livelihoods were actively considered, and measures were taken to minimise risks and ensure participant well-being.

Data collection instruments included structured surveys, in-depth interviews, and focus group discussions, enhancing the study's depth and breadth. Surveys were administered in person to facilitate real-time clarifications, personalised interactions, and trust building. Interviews with key stakeholders and focus group discussions in communal spaces encouraged collaborative insights and provided a nuanced understanding of participants' perspectives. The data collection process extended over several months, aligning with the seasonal variations in cocoa cultivation. Multiple visits to selected locations coincided with distinct stages of the production cycle, capturing changes over time and reflecting the dynamic nature of the cocoa industry. A meticulous pilot study was conducted to validate the data collection process. This preparatory phase tested and refined instruments, ensuring clarity, relevance, and appropriateness. The iterative process enhanced the quality and reliability of subsequent data collection, contributing to the overall validity of the study findings.

The study's ethical assurance extends to the analysis and reporting phases, prioritising transparency, objectivity, and accuracy. The research design incorporates a mixed-methods approach, respecting cultural contexts and participants' perspectives. Formal ethical approval from the Institutional Review Board (IRB) or equivalent is sought, adding a layer of protection for participants. Informed consent procedures are comprehensive and ongoing, with clear documentation of participants' rights and confidentiality measures. The role of the researcher is central, emphasising transparency, objectivity, and acknowledgement of potential biases. Regular reflexivity sessions and a diverse research team aim to prevent personal biases from

influencing analysis and findings. Efforts to avoid influencing analysis include structured methodologies, diverse team perspectives, and reflexivity sessions. The commitment to addressing biases underscores the research team's dedication to producing credible and impartial findings. The study aimed to uphold the highest standards of research integrity and contribute valuable insights to understanding green finance and sustainable cocoa production in Ghana.

The research employed a thorough data collection and analysis approach, focusing on various facets of Ghana's cocoa industry sustainability, particularly the impact of green financing on cocoa production and smallholder farmers' living income. Financial records related to funding green cocoa production statistics and smallholder farmers' living income were obtained through surveys administered to farmers and stakeholders. The collected data underwent statistical analysis using SPSS software, where numeric codes were assigned to different financial mechanisms and income levels. In addition to quantitative data, the study gathered perspectives, experiences, and challenges related to sustainable cocoa production and green financing through in-depth interviews and focus group discussions. Qualitative data were subjected to thematic coding using NVivo, identifying recurring themes and response patterns. Integrating quantitative and qualitative data, known as triangulation, involved comparing and cross-verifying findings, ensuring a comprehensive understanding of the complex relationships between green financing, cocoa production, and farmers' living income. This comprehensive approach enhances the credibility and reliability of the study.

The collected data aimed to provide a holistic view of the sustainability landscape in Ghana's cocoa industry, addressing economic, environmental, and social dimensions. Information on financial mechanisms, production practices, and income levels proved crucial for assessing the impact of green finance on sustainable cocoa production. Each research question was strategically associated with specific analysis methods. For example, Research

Question I, focusing on quantitative data from government reports and financial records, underwent descriptive statistical analysis using SPSS. In contrast, Research Question II, which centres on qualitative data, utilised thematic analysis with NVivo. Instrumentation materials, including structured questionnaires, semi-structured interview guides, and discussion protocols, are meticulously designed for surveys, interviews, and focus group discussions to ensure consistency in data collection methods. The primary construct of the study is sustainable cocoa production, a multifaceted variable considering economic, environmental, and social factors. Indicators such as cocoa production levels, financial contributions, environmental impact, and social factors were quantitatively measured to provide a comprehensive assessment.

Green financing, the independent variable supporting environmentally friendly practices, was measured at the nominal level. It involved categorising financial support into distinct types, allowing nuanced analysis and facilitating quantitative assessments. Smallholder farmers' living income, the mediating variable, was measured at the ratio level, considering factors like cocoa yield, market prices, and farming practices. Various influences on income were regarded to explore its mediating role between green financing and the long-term viability of the cocoa industry. The study proposes hypotheses about the correlation between green finance, smallholder farmers' living income, and sustainable cocoa production. Quantitative strategies were used to test these hypotheses, including correlation and moderation analysis. Integrating quantitative and qualitative findings through triangulation enhanced the overall robustness of the study. Quantitative data provides numerical insights into correlations, while qualitative data offers narrative depth, ensuring a comprehensive understanding of the dynamics influencing sustainable cocoa production in Ghana.

CHAPTER 4: FINDINGS

The primary purpose of this study is to gain more insight into the connectivity between green finance, sustainable cocoa production, and the living income of smallholder farmers in Ghana. This objective was reached by a comprehensive analysis of previous studies on smallholder farmers' revenue, annual cocoa yield, rapid climate change, and green financing; understanding the interplay among green financing, sustainable cocoa production, and farmer income was the driving force for this study. The overarching objective of the study was to assess the effect of green finance on the financial health of cocoa plantations and the lives of its producers. It was hypothesised that environmentally friendly funding would improve efforts to cultivate cocoa sustainably. It helps to increase yields, quality, and environmental effects, and the availability of green finance may shore up sustainable chocolate production practices. Farmers' living income is inversely related to green funding, encouraging environmentally responsible chocolate production.

The research takes a mixed-method approach, combining qualitative and quantitative methods; in-depth interviews and focus groups are used to obtain qualitative data with the quantitative analysis in this research. The views of farmers on green finance, sustainable cocoa production, and their financial income are revealed in detail through these approaches. In-depth interviews and focus groups were conducted to gather data from farmers about their thoughts on the issues mentioned above and to use qualitative data analysis to identify patterns, themes, and connections (Bryman & Bell, 2015). These methods are conversational, so farmers are open and honest about their views and perspectives. Multiple checks and balances were included in the data collection and analysis phases to establish the honesty and accuracy of the results and help verify the reliability and validity of the focus groups and interviews, so a pilot study was undertaken. The focus group and interviewees were selected using a purposeful sample method, with members picked depending on their knowledge of the topic.

The chapter presents a brief overview of the purpose of the research study, and it provides a summary of the objectives and significance of the study. The chapter states the trustworthiness of the data and its validity and reliability, and it performs checks and balances to establish the honesty and accuracy of the results. It helps to verify the validity and reliability of the data collected from the focus groups and interviews. A pilot study was undertaken, and a preliminary test was conducted through structural equation modelling to ensure the validity of the results. A mixed-method approach that includes structural equation modelling, focus group talks, pilot research and a pre-test will be conducted to boost the validity and reliability of the data. This chapter also presents the results of the data analysed from the focus group and interview administered on the field, and the chapter presents the results comprising the background information of interviewees and respondents and tests the quantitative conceptual framework of the study using structural equation modelling (SEM) to answer the research questions. The thematic analysis was implemented to present the solutions to the research questions individually, and findings from the thematic analysis were discussed, and the chapter was summarised.

Trustworthiness of Data

Kavanagh et al. (2016) define data dependability as the extent to which the data may be depended on for other uses in the future. It is a case study that analyses the link between environmentally sustainable banking practices and ethical cocoa production in Ghana. The primary purpose and goal were to address the poverty issue of farmers linked to their living income and boost cocoa production in Ghana. As for the data for this investigation, the researcher relied on primary sources of information only (Allen, 2017). Secondary data refers to information collected from sources other than the subject under study by the researcher. In contrast, primary data refers to information directly obtained from the identity under study.

Regarding data collection, this investigation used interviews, in-person focus groups, and survey methods (Ajayi, 2017).

Other emphasis features include a justification for using a highly rigorous qualitative research approach to the study (NIH Office of Behavioural and Social Sciences, 2018). Memorial University of Newfoundland is a university with high-level doctoral programmes. Credibility, transferability, dependability, and conformability were employed to ensure the collection of reliable data in the study. However, Cronbach's alpha, an internal consistency reliability test, was used to determine the reliability of the questionnaire as centred around the quantitative research, as a way of axing the quantitative exploration's validity (Hedges, 2015a). In addition, accurate documentation was maintained as a key criterion for the overall credibility of the data. A validity test was conducted to ensure that the quantitative part of the study was more credible. The process involved ensuring that the questions posed in the survey effectively captured the said variables. The evaluation was done by professionals combined with experts in the analysis of sustainable agriculture and green finance to minimise the number of mistakes. The validity or accuracy of the measuring instrument was confirmed through face validity as well as construct validity, or how well the instrument measures the concept (Hedges, 2015a).

Credibility

A report's credibility is determined by how well the conclusions drawn from the evidence match the stated reality. However, trustworthiness plays a crucial role in establishing trust in the veracity and legitimacy of the results derived from the respondents. Several aspects of the study's methodology and reporting affect the reliability of the results. For example, according to Ogunbanjo et al. (2014), several essential research practices should be followed. These include following established methods, fully immersing oneself in the phenomenon

under study, involving participants in verifying transcriptions and emerging themes, conducting peer reviews of the research process, and utilising triangulation.

The use of respondents, data kinds (qualitative or quantitative), and data collection techniques (interviews, questionnaires) are known as triangulation, and it is a technique used to confirm evidence (Shenton, 2004). Triangulation addresses a research issue using several datasets, techniques, theories, and/or investigators. This method reduces the impact of random variables on the results and increases their reliability (Bhandari, 2022). This study used methodological triangulation by combining several approaches to the same research question. Using many methods rather than relying on a single research strategy helps reduce the likelihood of bias and inaccuracy.

Transferability

Transferability refers to how effectively the results of one set of work may be applied to another somewhat similar situation. Research can be transferred if it describes the context in which the study was conducted, the subjects involved, and the results achieved. Transferability entails the ability to use findings from a survey in another slightly different context. Describing the context, participants, and results in detail is crucial since transferability's necessity is known as a thick description.

Dependability

Reliability is the probability of getting similar results if the study is repeated. It is also important to note that a certain level of variation should be anticipated in any qualitative research since the focus is placed on participants' experiences instead of typical experiences. Enhancing the credibility of research entails elaborating guidelines that other researchers can

easily implement based on an audit trail. It is also vital that each step can be accounted for and documented (Forero et al., 2018).

Conformability

The capacity of the researcher to maintain objectivity during data collection and presentation is relevant to conformability. Qualitative researchers must retain their reflexivity, even though triangulation can help. Being self-aware as a researcher is what we mean when discussing reflexivity. According to Jootun, McGhee, and Maryland (2009), the traits of the person conducting the interview or making the observation might impact the reliability of the data obtained from these methods. That is why the researcher is self-aware; he knows that his mental and emotional reactions could colour his results.

Table 4.1- Criterion for conformability of data

Criterion	Original Strategy	Strategies employed for this study
Credibility	Prolonged engagement	Interviewers spent an average of 3-4 on the field to engage with the respondents.
	Peer debriefing	We had regular debriefing sessions with key members of the Ghana Cocoa Board (COCOBOD).
	Triangulation	- We ensured the investigators had the required knowledge and skills. - We requested field notes from the interviewers for analysis.
Dependability	Audit trail	- We created a detailed track record of the data collection process. - We ensured the accuracy of the coding coders' reliability of the research team.
Conformability	Reflexivity	We ensured weekly meetings for the investigators to assess the field report and remind them of the need to be unbiased.
	Triangulation	Methodological triangulation was applied.
Transferability	Purposive sampling	We combined three purposive sampling methods.
	Thick description	We ensured a detailed description of the study setting, the selection of respondents and the findings.

Reliability and Validity of Data

Validity

Internal validity and external validity are the two general validity types. The internal validity of the assessment tool relates to its dependability and precision. On the other hand, external validity involves how generalisable the findings are to the rest of the population of concern. Both considerations are vital when determining whether or not a research endeavour is appropriate, necessary, and valuable. The term "validity" describes how successfully an evaluation tool measures the variables for which it was intended (Cresswell, 2014). This metric also shows how well the results from the study's population generalise to other comparable samples. We validated the instrument by doing a pilot survey and ensured it accurately measured the target components.

The instrument's effectiveness in terms of question clarity and directness of responses was evaluated in a pilot survey with 10 participants to determine its acceptability for the research. Before its distribution for the primary inquiry, the questionnaire was modified based on feedback from the initial survey participants. For the same reason, accuracy in research requires that the research instrument match the research problem's designs and aims to a tee. Triangulation was used to help ensure the data analysis was credible. Many researchers participated in the first type of triangulation, and many resources participated in the second type. In addition, responder verification was conducted, and records of all the materials and processes used in the study were kept until later. Investigators also employed reflexivity to be aware of how they might influence the study’s results.

Reliability

In research, reliability refers to how consistently the measurement tools are employed. Both the validity and reliability of a measurement are necessary for its use. A measurement must be valid and reliable to be trusted to represent a research subject. Research conducted with care, honesty, and precision is reliable (Robson, 2002). A research instrument is dependable if it can reliably produce the same results when the same methods are repeatedly used. There must be confidence that the findings will hold up over time and represent the entire population (Creswell, 2009). According to Noble and Smith (2015), there are three types of reliability in quantitative studies: test-retest reliability, temporal stability reliability, and internal consistency reliability. The first kind is test-retest reliability, which indicates the extent of agreement with the employed estimate.

The second kind of reliability, temporal stability reliability, depicts the stability of an estimate over time. Lastly, internal consistency reliability describes similar estimates within a specific time frame. Using the test-retest procedure at two separate periods, Andrew et al. (2019) found that respondents' level of consistency in answering questionnaire questions may be assessed. Interviewer reliability concerns conducting interviews and some elements, including constructing queries and ways of approaching the interviewees (Cohen et al., 2007). The concept of auditability entails that a system is fully documented and provides a comprehensive report on the data collection and analysis done. Another strategy used was peer review, whereby other researchers commented on the study’s procedure, findings, and analysis. In the survey by Robert et al. (2011), they pointed out that mixed methods increase research adaptability, credibility, and thoroughness.

To ensure the accuracy and reliability of the results, we reached out to key informants to verify that the survey accurately reflected the study's setting, limitations, and demographic information, in addition to outlining our research aims. Consequently, the researcher was able

to select individuals with substantial expertise and sway in cocoa funding, as well as key positions in nations that produce cocoa. Two components have been identified thus far using statistical study definitions of reliability and validity. To begin, the repeatability of outcomes is a key component of dependability. Secondly, validity refers to how well the assessment techniques capture the target variable and how accurate they are. Interview reliability issues pertain to the interview procedure, including question construction and rapport building with interviewees (Cohen et al., 2007). "Auditability" describes a well-documented system and thoroughly reports on its data collection and analysis processes. Another approach was peer review, which asked other academics to comment on the study's methodology, findings, and overall quality.

Reviewers have questioned the reliability of the qualitative sample in representing the occurrences seen in the quantitative sample. The lengthy time needed to complete the task, the difficulty of preparing for the qualitative phase, the need to find quantitative results for additional analysis, and the importance of identifying participants who can provide explanations are all additional challenges to consider. An efficient sampling method was used to ensure that the pool of cocoa growers to be studied was well-selected and random. In the next step, the farmers from the sampling frame derived from the agricultural census record were stratified by geographical areas, farm size and agrarian practices applying the stratified random sampling method. In addition, to ensure that each farmer had a fair chance, a random selection was made within each group.

Several measures were taken to help increase the reliability of the quantitative results. Relative to the survey instrument, Cronbach’s Alpha is applied to measure the reliability of quantitative findings. These are some reasons why the employment of triangulation, which is the use of results from several sources, may help boost the reliability of qualitative approaches. The amount of green financing and sustainable manufacturing of chocolates was determined

by conducting interviews and focus group discussions. Thus, following the principles of thematic coding, the analysis of the qualitative data involved using NVivo software to identify recurring themes and patterns in the responses. Data triangulation is used to soundly analyse the research problems and establish the flow of green finance and the correlation between cocoa production, farmers' living income, and green finance. This method involves using quantitative and qualitative data, which are compared and checked against each other. This all-embracing method also increases the reliability and credibility of the study.

Data triangulation, made possible by the mixed-methods approach, increased the study's validity and reliability (Creswell & Clark, 2018). A structured questionnaire and a focus group session were the two primary tools utilised in the study. The instruments' applicability greatly affected the project's reliability and validity. Combining qualitative and quantitative approaches allows us to fully understand and become competent in the complex topic (Creswell & Clark, 2018). Researchers can improve their adaptability, credibility, and thoroughness by using a mixed-methods strategy, according to Robert et al. (2011). We contacted key informants to make sure the survey accurately reflected the study's setting, limitations, and demographic data and to make sure our research goals were clear so that the results would be accurate and reliable. Consequently, the researcher was able to select persons with substantial expertise in cocoa finance and significant influence in cocoa-producing regions. Two components have been identified thus far using statistical study definitions of reliability and validity. The ability to replicate the result is the first aspect of dependability. Second, the issue of the dependability and credibility of the assessment tools in gauging the dependent variable cannot be overemphasised. Intersecting with credibility, reliability and validity are typically assessed and focused on in qualitative projects as factors that enhance the credibility of a research report and ensure the high quality of the studies (Dawadi et al., 2021). Triangulation is a method of increasing the richness of research using several methods. One possible way of

doing this is to incorporate a mixed methods research design, as was employed in this research. Thus, the primary concept of triangulation as a method is the improvement of the reliability and stability of the study or the assessment of the obtained results.

Table 4.2-Reliability of Statistics of Data Representing Green Finance

Reliability Statistics

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.865	.666	11

The reliability analysis of the data concerning Green Finance yielded a Cronbach's Alpha of 0. 865, suggesting relatively high internal reliability in the context of the 11 items. However, if we calculate Cronbach's Alpha based on standardised items, it reduces to 0.666, which is lower than the acceptable level of 0.865. Such a discrepancy implies that, although the actual scores for the items are very close, the standard scores are somewhat off. It might mean that while the items as a whole can be considered reasonably accurate, their scaling or measurement properties might have differed. Therefore, it is suggested that further research be conducted to delve deeper into the components of the individual items and the roles they play in measuring the construct.

Table 4.3-Reliability of Statistics of Data Representing Farmers' Living Income

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.717	.737	5

Source: Author's Compilation (2024)

The reliability of the measures used in the investigation of farmers' living income involved the use of Cronbach's Alpha, which was 0.717, which marginally rises to 0.737 when based on standardised items across five items. It shows a reasonable coefficient for internal

consistency for the items used to assess farmers' living income. Any Cronbach's Alpha coefficient of more than 0.7 is usually deemed reasonable, which indicates that the items are positively affiliated and can consistently assess the same construct; therefore, the data can be regarded as dependable for further analysis.

Table 4.4- Reliability of Statistics of Data Representing Sustainable Cocoa Production

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.739	.740	10

Source: Author's Compilation (2024)

The reliability statistics of the data collected regarding sustainable cocoa production indicate a Cronbach's Alpha of 0.739, slightly lower at 0.740 when based on standardised items across 10 items. It means that the items used were internally consistent with sustainable cocoa production. A Cronbach's Alpha above 0.7 tends to indicate the items have relatively high correlations. Hence, the items are valid measures of the same construct, making the data credible for further analysis.

Reliability analysis has certain methodological advantages of using individual variables instead of composite variables. According to Field (2018), individual item analysis is informed by identifying problematic items that affect the overall reliability of an instrument. It remains an integral part of the measurement refinement process. It will identify those items that are not performing well and perhaps dropped to enhance consistency at the scale level.

In constructing composite variables, items are summed or averaged. Sometimes, this may artificially inflate the estimate of reliability and thus spuriously suggest that the scale is internally consistent (Tavakol & Dennick, 2011). It may mask possible discrepancies between the items and the intended construct. Reliability statistics run on separate variables ensure that

each item's reliability is evaluated without aggregation biases that may misrepresent the reliability.

Common Method Bias

The typical method bias is viewed as a situation where information gathered through various researchers differs due to disparate measuring methods used in multiple types of research (Cresswell & Cresswell, 2018). As mentioned above, bias can distort the relations between variables and, in the process, make the reader doubt the authenticity of the study being conducted. Several approaches may be used to deal with common method bias; they include the latent method, reverse coding, the correlation marker technique, and Harman's single factor test.

Harman's single-factor test, sometimes called the one-factor test (Fuller et al., 2016; Podsakoff et al., 2003), is the most popular way to detect common technique bias. To help find common technique bias, this test uses exploratory or confirmatory component analysis. According to Fuller et al. (2016), standard method bias is indicated by the findings of Harman's exploratory factor analysis test, which states that if all measured items in the unrotated solution led to one factor accounting for more than 50% of the variation, then there is likely to be bias. Podsakoff et al.. (2003) compare this procedure to confirmatory factor analysis, which looks for evidence that a single factor explains most of the variation in the items measured. According to Korsgaard and Roberson (1995), common method bias occurs when the data is equally well-fit by the hypothesised model and the essential, one-factor measurement model.

Besides, the correlation marker strategy uses a marker variable in the survey. Cognizant of the need to maintain an unbiased instrument, this marker variable is independent of the other variables (Lindell & Whitney, 2001). Subsequently, we determine the lowest correlation value between the marker variable and any variables analysed to detect common method bias

(Richardson et al., 2009). Likewise, another variable that is defined as being unrelated is employed in a confirmatory factor analysis using the marker variable method. If the fit indices of two nested models are compared, a method of comparing common bias may be made. One of them integrates the indications of the research variable into the marker variable (Richardson et al., 2009). Thus, by adopting this strategy, it would be possible to overcome the potential bias that could stem from measuring different variables at the individual level (Williams et al., 2010). Similarly, in the regression-based marker approach that Siemsen et al. (2010) suggested, they stated that one should include the marker variable when applying a regression equation.

As a distinct approach to handling the issue of typical method bias, the unmeasured latent method construct (or the unmeasured latent method factor) can be used. In the unmeasured latent method construct approach, a latent variable is computed only with the help of observed items of primary research constructs. This variable is examined in research by Chin et al. (2012), Podsakoff et al. (2012), and Richardson et al. (2009); it only means method variance. Podoskoff et al.. (2012) suggested that if the source of standard method bias is identified and investigated during the survey assessment, the directly measured latent method factor approach can decrease the bias. Therefore, the technique variable operationalised with measures and items of the primary constructs in the conceptual model is used to control bias (Podsakoff et al., 2012). When the study could be affected by the anticipated bias, it is suggested that the directly measured latent technique component be used. If there is a need to compare the accuracy of survey responses, reverse coding should be used, and it often is. That is precisely what the concept entails: incorporating a ‘negative’ view on a ‘positive’ thing. This way, it can confirm if the responses are coherent when done effectively. The number of reverse-coded items and the reasons behind their reverse coding also vary from one instrument and factor to another.

Table 4.5- Showing Herman's Single Factor

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.076	11.831	11.831	3.076	11.831	11.831
2	2.602	10.008	21.838			
3	1.934	7.440	29.278			
4	1.493	5.743	35.021			
5	1.418	5.455	40.476			
6	1.278	4.915	45.392			
7	1.173	4.512	49.903			
8	1.071	4.120	54.023			
9	.959	3.690	57.714			
10	.928	3.570	61.283			
11	.883	3.395	64.678			
12	.814	3.129	67.807			
13	.790	3.040	70.847			
14	.771	2.967	73.815			
15	.737	2.836	76.650			
16	.712	2.739	79.389			
17	.667	2.567	81.956			
18	.635	2.442	84.398			
19	.623	2.394	86.792			
20	.576	2.214	89.006			
21	.533	2.050	91.056			
22	.514	1.977	93.033			
23	.483	1.856	94.889			
24	.475	1.828	96.717			
25	.439	1.689	98.405			
26	.415	1.595	100.000			

Extraction Method: Principal Component Analysis.

Source: Author's Compilation (2024)

The investigation produced 26 factors, explaining all 100% variation. The first component contributes 11%. It is followed by the element from MSB, which contributes 831% of the variation, while the other components contribute fewer proportions of the variance. If the value of the first element exceeds the threshold of 50%, then it can be said that the data

contains Common Method Bias (CMB). The above table shows that CMB is missing because the first item accounted for only 12% of the variance.

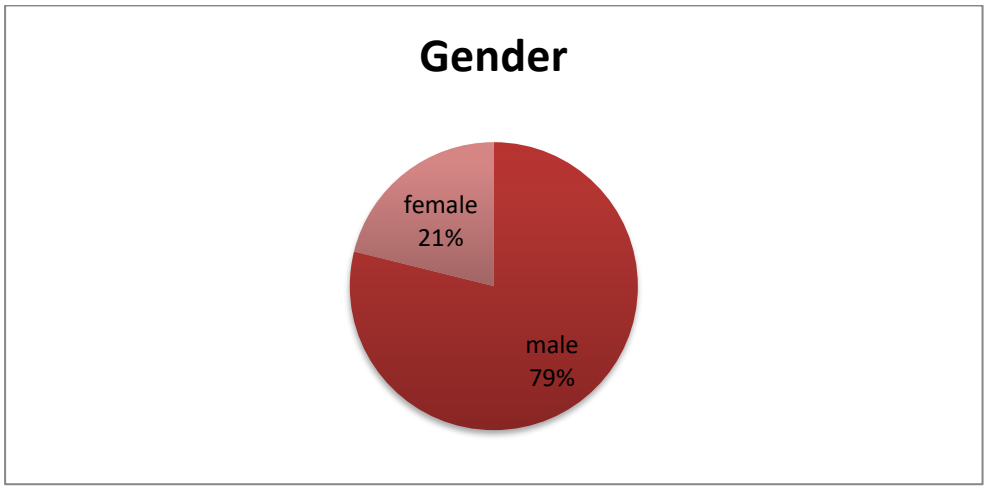
Respondents' Background Information (Demographics)

This section presents the demographic profile of the participants, including their gender, age, educational background, years of experience, farm size, marital status, and other relevant information.

Gender of Respondents

Figure 4.1 below depicts the extent to which 388 respondents from the cocoa sector, both males and females, are involved in cocoa farming in Ghana.

Figure 4.1- Gender Distribution



Source: Author's Compilation (2024)

First, concerning sex, it was evident from the statistics that males were more active and involved in cocoa farming than females, as they comprised 79% of the workforce. An equal proportion, or 21%, was among females. When considering the picture, one can assume that men and women farm cocoa in different African countries. Of the 388 persons who took part in the poll, 306 were male, representing 79% of the total participants, while 82 were female,

representing 21% of the participants. The only possible reason male farmers dominate cocoa farming is physical capacity; the male farmers are more daring and vigorous and, therefore, capable of meeting the agricultural demands in Ghana's cocoa fields.

Similarly, it can be extended to other typical activities in industries like fishing, logging, mining, and almost any manual work. Culture defines right and wrong in Ghanaian societies such that farming, including cocoa growing, is socially constructed as a male-dominated activity. Cocoa cultivation is manual; therefore, most of it is done by the men as the breadwinners of the families. Another way male advantage is supported, thus locking out women, is through opportunities that can be utilised in farming but allocated to resources such as land, capital, and inputs. Cocoa production is a labour-raising industry and involves most of the manual work. Thus, it might not be challenging for men to take higher ground in this sector than women. On the other hand, women might be more inclined to employment opportunities that do not involve much physical effort, such as post-harvesting and marketing. The scarcity of numerous attempts and the slight effectiveness of the measures that responded to the question of women's support could extend the patriarchal tendencies within the cocoa sector.

The lack of educational opportunities for women could also be a factor. Connections between education and awareness, education and access to better agricultural practices and resources, and awareness and continued involvement in agriculture must be understood in detail to design interventions that promote farmers' gender equality. Improving women's participation in cocoa production is a potentially powerful strategy to reduce poverty in the cocoa belt and enhance the sustainability of cocoa. Addressing some of the fundamental challenges described here could strengthen women's participation in cocoa farming for both men and women and improve the economic benefits associated with cocoa production.

Age Group of Respondents

The table below shows the age distribution of cocoa farmers and stakeholders in the cocoa sector of Ghana.

Table 4.6-Age Distribution of Respondents

Age Distribution

Age Range	Frequency	Percentage
20-30	53	13.7
31-40	129	33.2
41-50	81	20.9
51-60	47	12.1
above 60	78	20.1
Total	388	100.0

Source: Author's Compilation (2024)

The statement is supported by the accompanying bar and pie chart, based on a study conducted among cocoa farmers and stakeholders in Ghana. The graph shows that active relevant responders in the age bracket 31 - 40 years account for 33% of 129 farmers. It might be because most people in this range are at the peak of their productive lives. They have the energy required for practical farming and, more importantly, the requisite experience to handle cocoa farming. The representation is too high because they are often the target of any Green financial strategy and organic farming or farming sustainability. Respondents aged 41 to 50 and 56 and above make up 21% each of the respondents. Farmers in the 41-50 age cohort are likely to be more experienced (a difference of roughly a decade, depending on when the survey occurred) and have more financial resources. Farmers over the age of 56 are typically very experienced, with multiple decades in the farming industry. Often, the know-how of elderly farmers can be especially valuable, especially if they are still working as farmers. They may also be less willing to modify their tried-and-tested conventional agriculture practices or resist adopting new sustainable practices. Those five years were the smallest age cohort, as only 12% of participants were aged between 51 and 55. Many will either have retired early or have been

lucky enough to leave physically demanding work behind. Awareness of the demographic makeup of the different age cohorts and which generation has specific characteristics will enhance the possibility of launching more successful green financing and cocoa production programmes.

Observing the pyramid age distribution, we can suggest green financing, focusing on investments in young and middle-aged abilities to support skills and capabilities for a successful contribution. It will help cocoa producers to switch to sustainable basics. One of the most prominent groups- 52% of farmers- is between the ages of 31 and 40. They should be the key target. We should expect the least activity from older people, mostly above 50. More attention should be given, primarily to support working with elderly farmers, to support their better understanding of sustainability results, and to offer better-tailored incentives.

Training curricula and funding support should be aligned to different age groups and their needs. Younger farmers might be more open to novel funding and farming practices. In comparison, older farmers could benefit from higher incentives thanks to their years of experience, which makes them more willing to actively explore new methods. It is important to keep all producing farmers motivated and engaged in cocoa production, especially the experienced ones. Before retirement, they might want to pass on their knowledge to engage younger generations. This way, all may gain from sharing knowledge and ensuring sustainable agriculture.

Inequality in income among farmers can also act as a moderating influence as to how much fund flow is available and which projects are financed, eventually affecting technology and the best way of adoption. Income disparity exists, and it needs to be bridged and overcome to make green financing maximally available to all, spanning all generations. Ghana must design and implement educational programmes and financial inducements to ensure that a broad cross-section of stakeholders better understands its green finance and sustainable cocoa

growth. Therefore, the most successful way forward is to continually monitor and learn from the evolving behaviour of the farmers and continuously adapt the tactics or approach to ensure its sustainability and assess farmers' and cocoa growers' demographic and economic situation to develop appropriate and effective policies and strategies.

The outcome of the age distribution shows that the largest proportion of the sampled farmers are middle-aged farmers, which is 33.2%. This figure shows us that middle-aged farmers are the group with the most potential, and the green finance policy in Ghana needs to lay a hand on them directly. On the other hand, the combined proportion of young farmers and old farmers is 33.8%. It suggests that the green finance initiative in Ghana creates an inclusive policy to cope with the different needs of young and old farmers so that the initiative can give them another unique strength and leverage their strengths. For instance, tailoring a green production practice and a green-friendly financial product to young and old farmers can better promote cocoa production's sustainability in Ghana.

Educational Background of Respondents

The table below displays the distribution of respondents according to their highest degree of educational achievement.

Table 4.7-Educational Background of Respondents

Educational Level:		
Education Level	Frequency	Percentage
No formal education	91	23.5
Primary education	124	32.0
Secondary education	75	19.3
Vocational/Technical Education	34	8.8
Tertiary education	52	13.4
Postgraduate degree	12	3.1
Total	388	100.0

Source: Author's Compilation (2024)

As shown in the table above, of the 388 respondents, 124 (32.0%) have been able to complete their primary education. These figures suggest that most respondents (32.0%) have completed their primary education, which is their highest qualification. The second group of respondents, which totals 75 respondents (19.3%), have completed their secondary education. It demonstrates an extremely sharp decline in the number of educated people who fail to advance beyond their primary education. According to the pie chart, the geographical distribution of 388 respondents was 65 (16.8%) from urban areas, as shown in the chart below.

Furthermore, another smaller but significant portion of the population has attained higher education, which refers to the 52 persons, constituting 13.4% of the sample, who hold a tertiary education: 3% of the population had a postgraduate qualification. The study found that an interesting number of the respondents held PhDs. It indicates that individuals with expertise in sustainable agriculture and green finance participated in this study. The growth of PhDs in the agricultural sector is good as they equip these experts to tackle pressing issues related to cocoa production in Ghana. It also signifies a fair balance between respondents who graduated with an undergraduate degree and those with other academic qualifications. Thirdly, 34 respondents (8.8%) have vocational or technical education, which signifies this subset of the population has opted for specialised, career-oriented training.

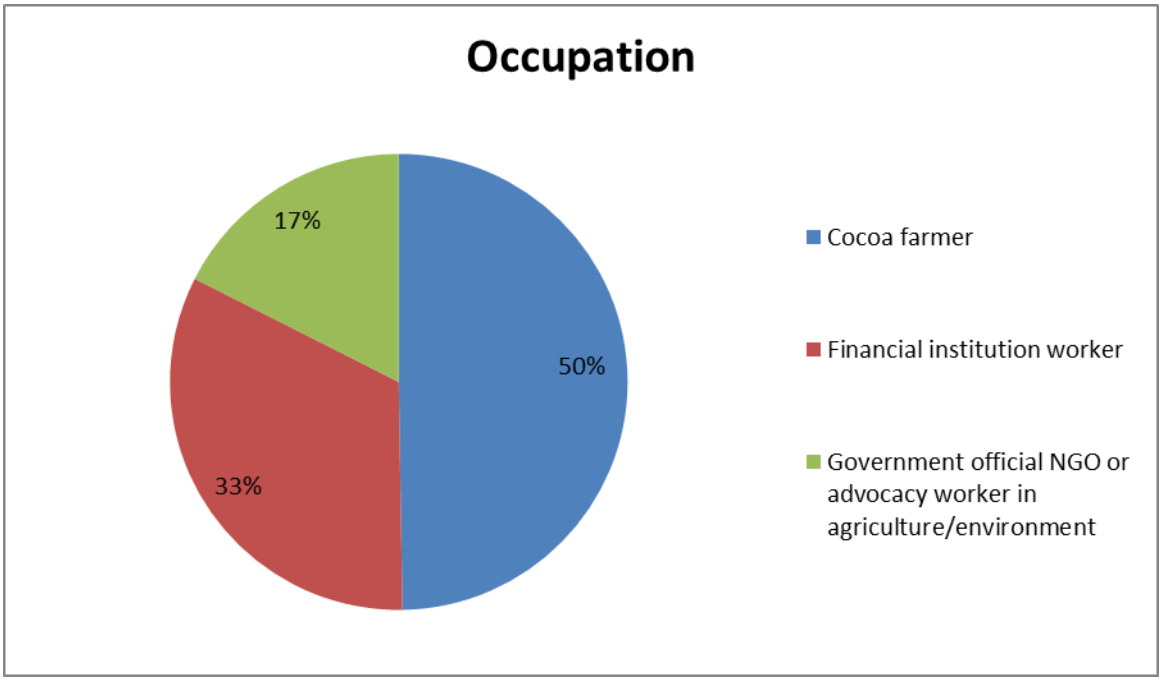
Lastly, the data show that 91 respondents (23.5%) did not have formal education. This segment represents an important sector for developing education since these people may not be able to access some basic educational opportunities. A distribution of educational status depicts the respondents' education levels.

Most people in the cocoa business have primary and secondary education, while higher education and vocational training are less common but still important.

Occupation of Respondents

Figure 4.2 depicts the occupation of the respondents, indicating that 50% are company owners in the agriculture sector. This suggests that the respondents possess sufficient management expertise. The remaining half was divided among employees in Ghana's private and public sectors.

Figure 2.2-Occupation of the Respondents



Source: Author's Compilation (2024)

The table indicates how a sample of 388 people surveyed were distributed into specific jobs based on their responses to a questionnaire. Overall, the graph shows that 49.7% of citizens (193 people) work as cocoa farmers; a high proportion indicates the importance of primary production, showing that those directly involved in cocoa production are represented decisively in our research. These findings suggest that the production of cocoa farmers will be the most

predominant group studied in this survey, and considering this shortage, questions on how these farmers work are very important.

In addition, 32.7% (127) of the respondents are workers from financial institutions, showing the importance of financial professionals who work to implement development-minded agricultural and green finance initiatives. In comparison, 17.5% (68) of the respondents are government agricultural officials, NGOs or advocacy workers working on agriculture and the environment, exhibiting how policymakers and advocates influence agricultural and environmental policies analysing a sector as multifaceted as the cocoa industry requires diverse interviewees representing various roles and stakeholders, including cocoa farmers and financial and policymaking representatives. Through these interviewees, we gain a deeper understanding of the cocoa sector and the challenges faced by its key players while still recognising how farmers embody the central role and form the backbone of the cocoa industry.

Years of Experience of Respondents

Table 8 below shows the responses of cocoa farmers and stakeholders in the Ghanaian cocoa sector, as well as their years of experience.

Table 4.8-Years of Experience

Years of Experience	Frequency	Percentage
Less than 1 year	53	13.7
1-5 years	103	26.5
6-10 years	138	35.6
11-20 years	56	14.4
Over 20 years	38	9.8
Total	388	100.0

Source: Author's Compilation (2024)

Table 4.8 reveals that participants have extensive experience in cocoa farming practices. 36% of the respondents possessed 11-15 years of experience, while 27% responded to have experience of 6-10 years. Nonetheless, 13% of the village respondents have more than twenty-one years of experience in cocoa farming practice, as against 14% who have less than six years' experience. The massive experience of participants in cocoa farming will be used to verify this study's outcome.

The table illustrates that many respondents had more than 10 years of experience. Working experience. The higher level of respondents' experiences indicates a positive correlation between experienced farmers' knowledge of the importance of sustainable behaviours and the effectiveness of green funding they have for green activities. A wealth of experiences is vital for farmers to improve their access to green finance. Experienced farmers have built business relationships with intermediaries and customers, establishing their reputation with successful agricultural performance over their farming experience. Established, experienced farmers usually have more expertise and understanding and meet the requirements of applying for and potentially receiving green funding. Experience is necessary to successfully deal with potential risks associated with farming, such as their ability to anticipate problems, which might enhance the efficiency of implementing green finance projects.

Farm Size of Respondents

The table displays the distribution of respondents according to the size of their farms, measured in hectares.

Table 4.9- Farm Size

Farm Size (hectares)	Frequency	Percentage
Did not answer	43	11.08%
3 hectares and below	299	77.06%
Above 3 hectares	46	11.86%
Total	388	100%

Source: Author's Compilation (2024)

Of the 388 replies, 43 (11.08%) refused to reveal the size of their farms in response to the question, 'What is the size of your farm?' These findings suggest that most participants were willing to share information about their farm size, while a minority preferred to hide their farm size. Given the smaller proportion of people who refused, this enables further analysis of the farm size of those who replied. Although many respondents answered this question, the fact that the question was not perfectly answered - sometimes because the interviewer forgot to ask it and other times because the farmers could not remember- raises concerns for the future of cocoa farming in Ghana. Those said to be in a good financial position to have a large farm could not clearly remember their farm size. It creates challenges for potential green money providers who are interested in those with larger farms where sustainable agriculture techniques could be employed.

To sustain the cocoa sector in Ghana, we should review and pay more attention to farm record-keeping and raising awareness in the farming sector so that any information needed, even by a stranger, can always be provided. Without information, it will be difficult to address

the issues confronting the current cocoa space, and it would be hard to make recommendations on how to move the sector towards sustainability.

From the responses, over 299 people, or 77.06% of the total sample, said they owned farms of three hectares or less. This indicates that small-scale farmers comprise the majority of the population interviewed. Such small farm sizes illustrate that assistance and resources must focus on smallholder farmers who comprise most of the farming population in the local area or agricultural sector. Small-sized farms might be a bit like normal-sized farms, which implies that they should be supported through specific interventions.

On the other hand, only 46 people said they owned farms over 3 hectares, and large-scale farming is rare indeed. Because there is such a limited sample of large farms, most people do not think they do large-scale farming. This can be visualised clearly by looking at the size distribution. A few of the larger farms exist, but smaller farms far outnumber them. This data can be extremely critical to governments and organisations that want to provide community support to farmers in the cocoa industry. In allocating resources, smallholders must not be completely ignored, and largeholders should not be left out altogether. A properly scaled programme covering small and large farms can make interventions work the best they can. In short, the statistics reveal that the food landscape is dominated by small farms, which has implications for agricultural policy and the distribution of resources. Understanding the primary place of smallholder farmers helps policymakers and other actors create interventions that better reflect the needs and conditions of the farming community to achieve equitable and sustainable development.

Number of Employees

The table displays the categorisation of participants according to the number of staff members.

Table 4.10-Number of Employees

Number of Employees	Frequency	Percentage
Did not answer	58	15.00%
Below 20	75	19.38%
21-30	151	39.02%
31-50	103	26.60%
Total	387	100%

Source: Author's Compilation (2024)

Of the 387 survey replies, 58 people chose not to answer the question about the number of workers. Based on these results, it is clear that although some respondents did not want to provide information about their employees, the majority were still willing to do so, allowing a comprehensive analysis of employment within the respondents.

Of those who answered, 75 people (19.38%) mentioned that they have less than 20 workers. It means that plenty of the people they surveyed are in small businesses, which could be family-owned or small firms. The tent of small businesses magnifies the need to help these companies because it could mean a big chunk of labourers in this study.

Most of them, 151 or 39.02%, operated with a workforce between 21 and 30. The second, which comprised 103 participants or 26.60%, was operating with a workforce of between 31 and 50 personnel. All of these figures demonstrate that most of the participants are operating with midsize activities. Many midsize organisations may indicate that growth and

enhancement within the sector are possible because large companies have more resources and opportunities for expansion than small operations.

Marital Status of Respondents

Table 4.11 below shows the marital status of the study respondents. It displays the distribution of respondents according to their marital status out of 388 persons.

Table 4.11- Marital Status of Respondents

	Frequency	Percentage
Single	47	12.1
Married	104	26.8
Divorced	54	13.9
Widowed	89	22.9
Separated	51	13.1
Cohabiting	43	11.1
Total	388	100.0

Source: Author's Compilation (2024)

People who have been married dominate the respondents, with 104 accounting for over one-quarter of the total population. A significant amount of data indicates that most respondents are married, suggesting that stable family structures, such as marriage, influence sustainable farming practices. Married individuals often feel a stronger sense of responsibility for their families, which may motivate them to invest in farming methods that protect the land and ensure a better future for their children. This association between family commitment and long-term farming strategies can foster more sustainable agricultural practices. Also, with 89 responses, or 22.9%, the dominant data reveals that widows comprise the most populous segment. I believe this wide distribution of responses helps us understand the situation of

widows. Many widowed farmers may point to their unique challenges, such as greater financial strain and possible social isolation. These difficulties could affect their ability to access green financing and adopt sustainable farming practices.

Divorce and separation account for 54 people (13.9%) and 51 people (13.1%), respectively, which describes the percentage of the married population whose marriage has ended by divorce or separation. This percentage is high, indicating economic instability or shifting dynamics in family support that may affect their farming practices and financial decisions. Finally, 47 respondents, or 12.1% of the total, are single, while 43 respondents, or 11.1%, cohabit. Single respondents have never been married; while cohabiting respondents live with a partner but have not yet registered a legal marriage. Both groupings are much smaller than the married and widowed division, illustrating the population's many relationships and relationship statuses. Overall, the data provides a clear picture of the marital status distribution among respondents. Respondents who are married comprise the largest group. Nearly half of the population has experienced divorce or separation, with a significant proportion becoming widowed.

Formal Training

Table 4.12 shows the total responses of the study participants, indicating whether they have had formal education or not.

Table 4.12-Responses on Formal Training

	Frequency	Percentage
Yes	102	26.3
No	286	73.7
Total	388	100.0

Source: Author's Compilation (2024)

The table reveals that 74% of the respondents, or 286 farmers, have not received any official training, whereas 26% of the 102 have acquired formal training. Most Ghanaians have not received formal training on green financing and its impact on sustainable cocoa output. Many farmers have been deprived of green finance due to their inability to understand the concepts of green finance, such as what green finance is, the documents and forms they need to acquire, the application process, interest, and the payback period.

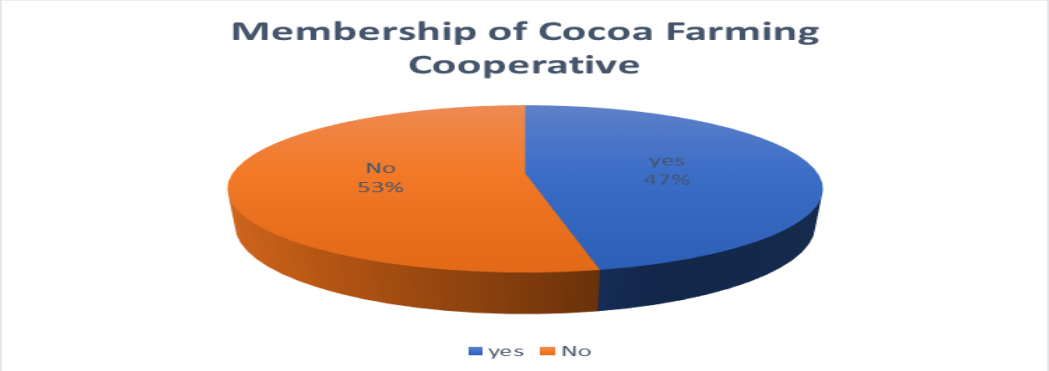
Professional training equips farmers with the knowledge and skills to manage their finances responsibly, create a budget, and optimise resource utilisation. The availability of money does not guarantee its effective utilisation. Not relying on credit that carries interest may be the most important result. The primary reason cocoa farmers have not embraced sustainable cocoa farming practices, such as organic production, agroforestry, pest control, soil maintenance, and the production of fine chocolate, is likely due to a lack of formal training.

Due to their self-taught approach, farmers may lack the knowledge to make their farms resilient to climatic changes and manage pests and diseases. Therefore, formal training equips them with the knowledge to become experts in adaption methods that foster resilience to climatic changes, crop diversification, and pest and disease management.

Membership in Cocoa Farming Cooperative

The figure below shows the responses of participants in the study who were members of a cocoa cooperative association.

Figure 4.3-Membership in the Cocoa Cooperative



Source: Author's Compilation (2024)

Similarly, almost half of the respondents agreed that they are members of a cocoa farming cooperative; that is, 47% (181 farmers) representing nearly half of the respondents, whereas the remaining 53% (207 farmers) answered that they are not members of any cooperative in the cocoa farming sector. Additionally, their cooperative membership guarantees their creditworthiness, enabling them to access green finance easily. Being a part of the cooperative allows us to implement sustainable practices such as shade-grown cocoa systems and biodiversity corridors, which would have been impossible for us as individual farmers. It also aids in obtaining sustainability certifications, which can be costly for smallholders.

Quantitative Data Analysis

Regression Analysis

The relationship between a single dependent variable (or criterion) and one or more independent variables (or predictors) can be studied using statistical regression analysis. Independent variables are inputs, drivers, or elements that impact a dependent variable, sometimes called instruments used to accomplish a given outcome. Most significantly, regression analysis may be used to create predictions, show that independent factors have a meaningful relationship with the dependent variable, and highlight how strong the influence of each independent variable is on the dependent variable (Sarstedt & Mooi, 2014).

According to Ali and Younas (2021), regression analysis has four main uses: control, estimation, prediction, and description. By describing the relationship between the independent and dependent variables, regression analysis explains the relationship. The dependent variable's

value is estimated using regression analysis by utilising the values discovered by observing the independent variables. The relationship between the independent and dependent variables allows regression analysis to forecast the outcome and changes in the dependent variable. Finally, control uses regression analysis to examine the relationship between a single independent and dependent variable, limiting the effect of any independent variables. Regression analysis is crucial for explanation and prediction, according to Pedhazur (1997). All three articles mentioned above agree that regression analysis is used for describing and predicting, and they all give the benefits, uses, and aims of regression analysis.

Regression analysis is one method for fitting a "best" line to a dataset of observations. A "best" line effectively minimises the sum of all squared discrepancies between the line and the data. Popular regression models include:

An equation can be written as:

$$Y = \alpha + \beta 1x1 + e.$$

In the model given, Y stands for the dependent variable, and α is the constant, sometimes referred to as the intercept of the regression model. It reflects the value of Y if all the independent variables are set to zero. A coefficient of the independent variable x, denoted as β1x1 (pronounced as beta), is the gradient, also known as the slope. A positive coefficient is indicated by a regression line that slopes upwards, while a negative coefficient is shown by a line that slopes downwards. E, the last variable in a regression model, can mean either the model's error or residual; the terms are used interchangeably in research and SPSS. When comparing the anticipated and actual regression lines, the error may be defined as the distance between each observation and the best-fitting line.

Logistic, multiple, and linear regression are the three most common kinds. Multiple regression, an extension of linear regression, examines the correlation between the dependent

variable and many independent variables simultaneously. Regression in logistics determines the likelihood of a yes/no event. The dependent variable must have a normal or Gaussian distribution, and there must be a linear association between the independent and dependent variables for linear regression to work. Although logistic regression does not always presuppose a linear association between the dependent and independent variables, it does need a linear regression. Lastly, logistic regression assumes a binomial distribution of dependent data, which differs from linear regression. Similarly, logistic and multiple regression presume a normal or Gaussian distribution for the dependent data and a linear association between the dependent and independent variables. A highly correlated set of variables will likely impact the relationship between the independent factors and the dependent variable. The curves in logistic regression are commonly S-shaped, while the linear and multiple regression lines are usually straight (Ali & Younas, 2021).

While using regression analysis, many factors must be considered, including collinearity, dependent variable scale type, sample size, and other variables. An adequate sample size is necessary for regression analysis, and one may be found. This minimally sufficient sample size is the minimum number of samples needed to boost the probability of a statistically meaningful outcome. A power analysis is one of the two methods to get the right sample size; a power of 0.8 is considered adequate. Alternatively, you might use the rule of thumb. The general rule of thumb for testing the significance of individual parameters, according to Green (1991), is a sample size of 104 + k, where k is the number of independent variables. The second reason for doing a regression analysis is to guarantee that the variables do not remain constant but exhibit variation. It is necessary for the dependent variable in a regression analysis to be of the interval or ratio scale.

The researcher, as part of standard practice for the conduction of regression analysis, tested relevant or prerequisite assumptions to the conduct of regression analysis. The first test

was the Durbin-Watson test, which tests the independence of errors. According to the tests, the criterion is met when the results of the Durbin-Watson test fall between 1.5 and 2.4, as prescribed by Field (2013). From the test, it was observed that the Durbin-Watson test statistics were 1.589 and 1.590. This implies that all values fall within the acceptable range. Hence, the test for independence of errors was met. The test for multicollinearity was done next using Variance Inflation Factor (VIF) as prescribed by Hair et al. (2010), who stated that for the data not to have issues of multicollinearity, all test values should be <5. In this study, the VIF results were 1.00 for both variables tested. The results suggest that the criterion was met as both VIF were <5. The last test was for the homoscedasticity using the Breusch Pagan test as recommended by Gujarati and Porter (2009). According to the authors, for a criterion of homoscedasticity to be met, the residuals must be evenly and randomly spread across all predicted values. Hence, the P-value of Chi-square statistics should be insignificant for the criterion of homoscedasticity to be met. In the study, the results from the test were $\chi^2(1) = 2.17$, $p = .164$. From the results, it is observed that the p-value is insignificant, indicating that the condition of homoscedasticity is met.

Table 4.13-Descriptive Statistics

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Green Finance	388	35.6340	5.18396	-.499	.124	.258	.247
Farmers' Living Income	388	17.3273	3.38236	-.544	.124	1.277	.247
Sustainable Cocoa Farming	388	33.9794	5.47577	-.632	.124	.605	.247

Source: SPSS Output (23), Author's Computation (2024)

The results in Table 13 show that starting with Green Finance, the mean value is 35.6340, indicating the average score across the 388 observations. The Albert Team (2022) supported this assertion further by stating that a high standard deviation indicates that the data points are broadly scattered from the mean. Still, a low standard deviation means the data points are nearer to the mean. However, there remains the issue of the point where the standard deviation can be recognised as low and where it can be termed high. Belsky (2022) suggested that a standard deviation below 1 falls within the category of a low standard deviation. At any point between 1 and 2, the standard deviation is moderate, neither low nor high, but the standard deviation is high from point 2 and above. The standard deviation is 5.18396, suggesting that most Green Finance scores are within approximately 5.18 units of the mean.

Additionally, Frost (2021) stated that standard deviation can be used to assess the reliability of a study's results. He added that a low standard deviation implies that the finding results are more reliable. In contrast, a high standard deviation suggests that the results of green finance are less dependable. Based on the standard deviation of green finance, it can be implied to be moderately reliable.

The coefficient of the kurtosis (0.258) explains that the majority of the values are lower than the mean. Hence, the data does not meet the Gaussian distribution assumption. According to Najim, Ikonen, and Daoud (2004), the criterion for meeting the Gaussian distribution assumption is that kurtosis equals zero. The coefficient of kurtosis, though, is within the range of zero to one. In addition, a kurtosis of 3 indicates a symmetrical distribution. Hence, the distribution for the kurtosis of 0.258 is not symmetrical. Conversely, Para (2020) stated that when values are greater than 1, the distribution is referred to as leptokurtic; when values are less than -1, the distribution is called platykurtic; and when values fall between -1 and 1, they are called mesokurtic. It can be denoted that the above distribution falls between -1 and 1;

therefore, it is a mesokurtic distribution. Also, the coefficient of Skewness, -0.499, indicates that the data is negatively skewed and is not symmetrically distributed.

Menon (2023) stressed that data could deviate from the norm, that is, the normal distribution, which is symmetrical and tilts towards the right or the left direction: when it is right-skewed, it is positive skewness, and when it is left-skewed, it is negative skewness. In positive skewness, the tail is longer to the right, and the statistical results are concentrated on the left-hand side; conversely, in negative skewness, the tail is longer to the left, and the values are focused on the right. The skewness of -0.499 is negative as its statistical values are concentrated on the right.

The descriptive statistics in Table 4.13 indicate that farmers' living income has a mean value of 17.3273 and a standard deviation of 3.38236, showing that the farmers' living incomes are generally within 3.38 units of the mean. The standard deviation falls within the category of a high standard deviation because the result is above 2 and approximately 3. In addition, based on the decision criteria of Frost (2021), the results on farmers' living income can be said to be less reliable; this does not necessarily mean the results are not trustworthy. It simply indicates that the reliability level is below average. Moreover, the kurtosis value 1.277 shows that most values are higher than the mean and do not meet the Gaussian distribution. In addition, the distribution with a kurtosis of 1.277, below 3, is not symmetrical. However, it can be described as leptokurtic because the value falls between -1 and 1. The coefficient of the Skewness value of -0.5447 implies that the data is negatively skewed and, thus, does not meet the symmetrical distribution criterion. It, however, is also skewed to the right.

Furthermore, Sustainable Cocoa Production has a mean of 33.9794 and a standard deviation of 5.47577, indicating that the scores typically deviate by about 5.48 units from the mean. It also demonstrates, as in green finance, that the standard deviation is neither low nor high - it is average, indicating that the results are quite reliable. The coefficient of the Skewness

value of -0.632 is negatively skewed and, therefore, is left-tailed. Furthermore, the coefficient of Kurtosis value of 0.605 signifies that the Sustainable Cocoa Production variable does not meet the Gaussian distribution criterion. It indicates that it is not a symmetrical distribution; it falls into the mesokurtic category because the value range is between -1 and +1. Moreover, Hair et al. (2010) proposed a rule of thumb that for data to be considered normal, it should have a skewness of between -2 and +2 and a kurtosis of between -7 and +7. On the other hand, Brown (2006) argued that the acceptable value of skewness is between -3 and +3, and for kurtosis, the range is between -10 and +10.

While there seems to be an agreement among several writers as regards the value at which a distribution meets the criterion for Gaussian distribution and the value at which a distribution is symmetrical, it is not the same as the value or range of value determinant of normal data distribution. It was highlighted above that Brown (2006) proposed a general rule of thumb that considers data as normal when the data has a skewness that falls within the range of -3 and +3, while kurtosis falls within the range of -10 and +10. However, after four years, Hair et al. (2010) countered the earlier proposed rule of thumb for recognising data as normal. They reduced the value determinant for normal data to a skewness between -2 and +2 and a kurtosis between -7 and +7.

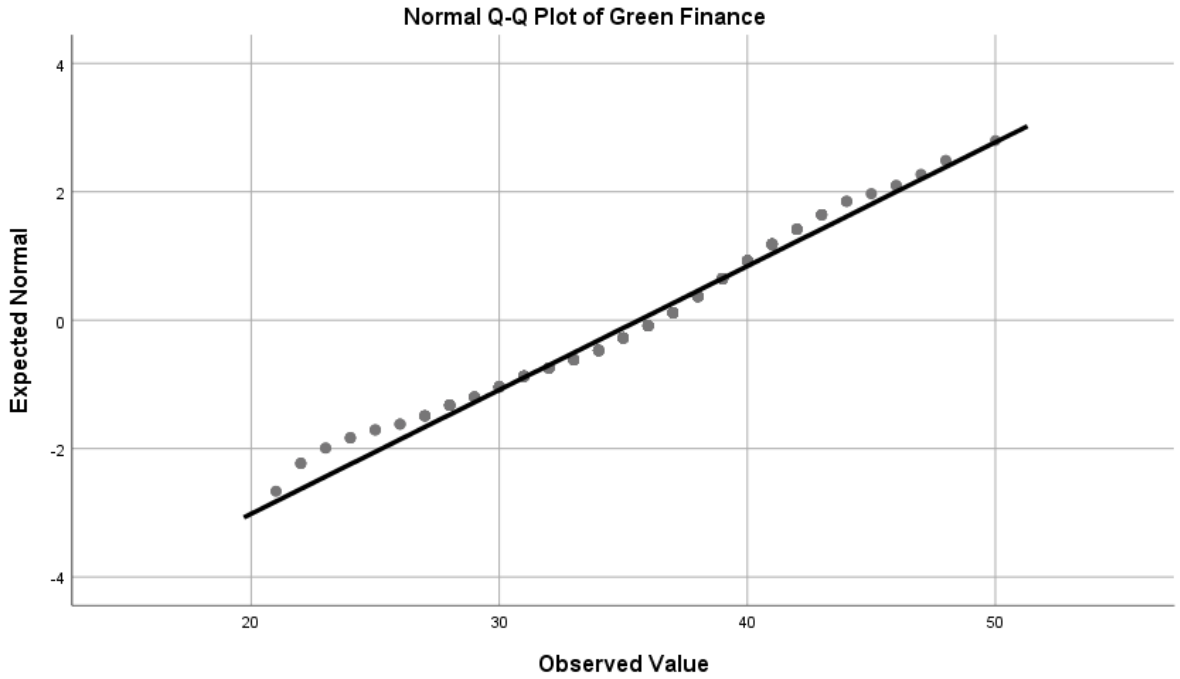


Figure 4.4-Normality Test Using QQ Plot for Green Finance

Figure 4.4 shows the normality test plot using a QQ plot for green finance. From the chart, it is observed that the data points were close to the reference line, and the reference line slopes diagonally from the bottom left to the top right of the plot. The visual alignment from the plot above suggests that the distribution of the data is close to normal; hence, the assumption of normality, which requires the dataset to be close to the reference line for the green finance variable, was considered to be met.

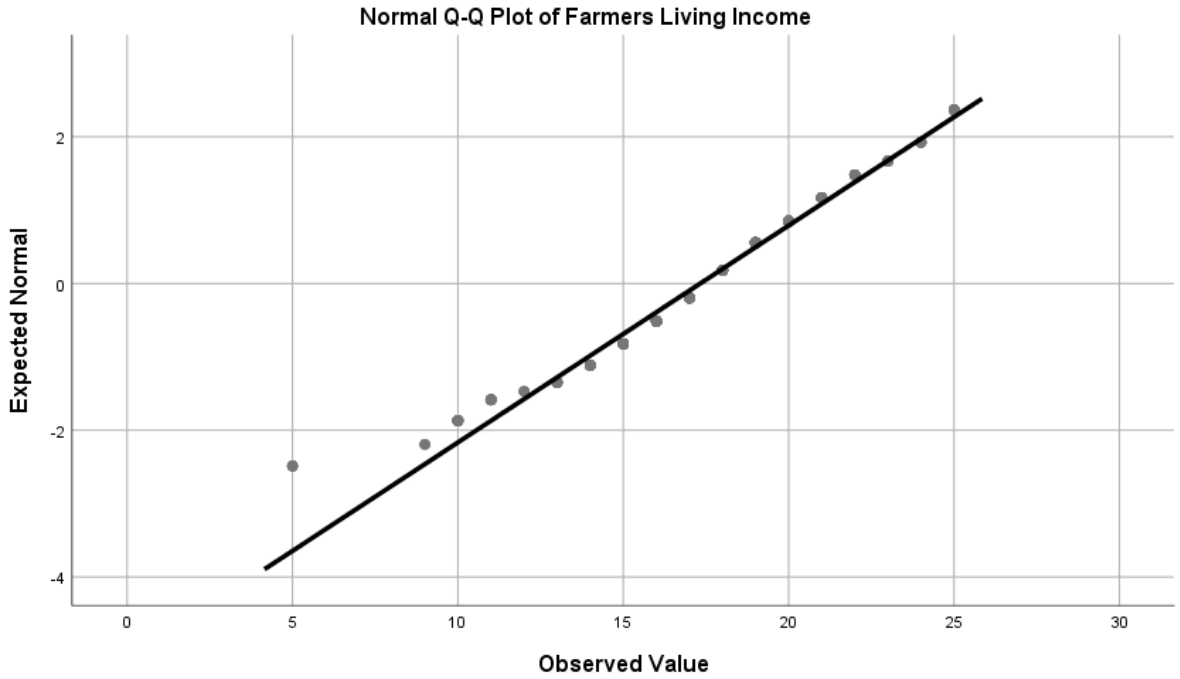


Figure 4.5-Normality Test Using QQ Plot for Farmers' Living Income

Figure 4.5 shows the normality test plot using QQ plot for farmers' living income. From the chart, it is observed that the data points were close to the reference line, and the reference line slopes diagonally from the bottom left to the top right of the plot. The visual alignment from the plot above suggests that the distribution of the data is close to normal, with only one data point slightly deviated from the reference line. Hence, although there was a single deviation, the assumption of normality, which requires the dataset to be close to the reference line for the farmers' living income variable, was considered to be met for most of the distribution.

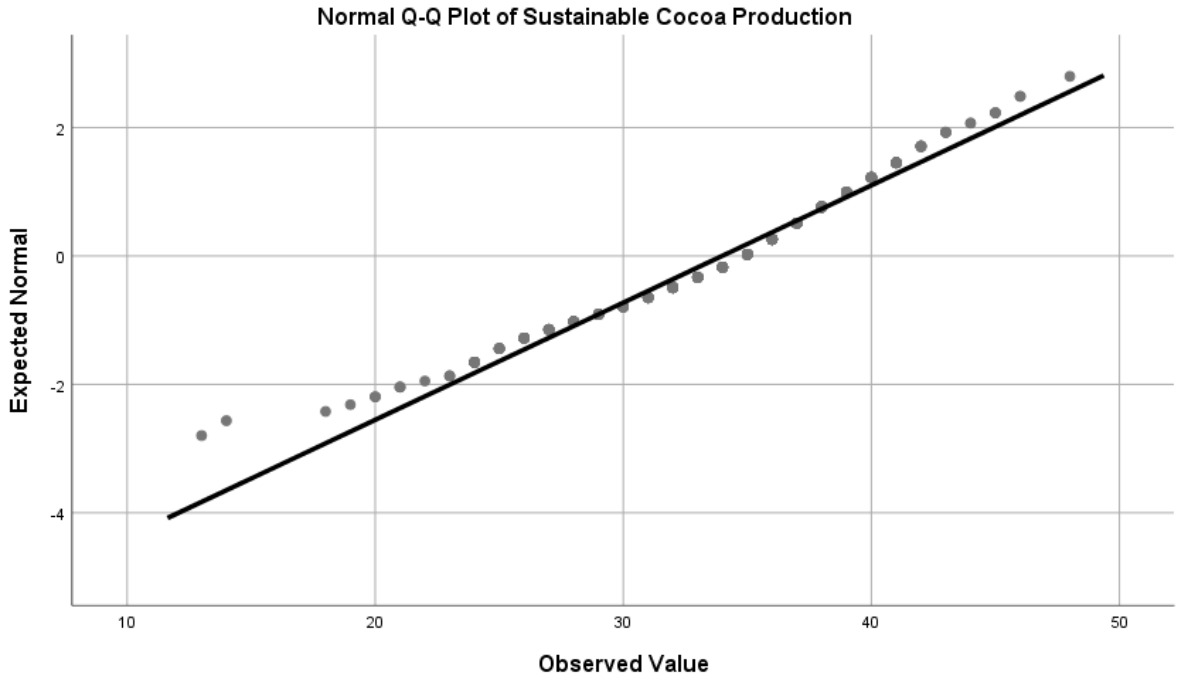


Figure 4.6-Normality Test Using QQ Plot for Sustainable Cocoa Production

Figure 4.6 shows the normality test plot using a QQ plot for sustainable cocoa production. From the chart, it is observed that the data points were close to the reference line, and the reference line slopes diagonally from the bottom left to the top right of the plot. The visual alignment from the plot above suggests that the distribution of the data is close to normal, with only a few points slightly deviated from the reference line. Hence, although there were a few deviations, the assumption of normality, which requires the dataset to be close to the reference line for the sustainable cocoa production variable, was considered to be met for most of the distribution.

Table 4.14-Correlations Between Variables

	1	2	3
Sustainable Cocoa Farming	1.000		
Green Finance	0.624**	1.000	
Farmers' Living Income	0.688**	-.026**	1.000

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is important at the 0.01 level (2-tailed).

Source: SPSS Output (23), Author's Computation (2024)

The result from Table 4.14 indicates a correlation of 0.688** between farmers' living income and sustainable cocoa farming. It also implies that some farms outperform others, suggesting a concept or idea. Farm income and chocolate price would reach their highest results if farmers utilised sustainable cocoa farming practices appropriately. The income from the farms is significantly higher than that of the bars or tail ends. Implementing measures to control cocoa planting incomes will benefit numerous farmers significantly. It also depends on the price of chocolate, as it can either increase or decrease the farmers' living income. Sustainable farming practices may also make economic sense.

These practices may lead to higher economic returns for farmers due to improvements in productivity, better market access, premium price payments for sustainably produced cocoa, or other factors. Regardless of the exact reasons for the positive correlation, the importance of sustainable practices to farmers' economic well-being strongly suggests further efforts to promote sustainable cocoa production. If the null hypothesis is true, the p-value refers to the probability of obtaining a value for the statistic (our t or z stat) as extreme or more extreme than the actual one. So, if the probability is greater than 0.05, we would not reject H0. By convention, we consider that a p-level smaller than 0.05 is a statistically significant value. Also,

the lower the p-value, the more statistically significant the value we record; as the p-value reduces, the statistical significance increases. To sum up, as far as the economic benefit of farmers is concerned, there exists a strong, significant positive relationship.

Table 4.14 shows a correlation of 0.624** between green finance and sustainable cocoa farming. The green and round border around these cells indicates a strong positive relationship, as colour-coding applied by Statistica: rounding represents a positive correlation (blue or green colour coding), while elongating cells represent a negative relationship (red or orange). Higher levels of sustainable cocoa farming typically accompany a stronger correlation between green finance and sustainable cocoa farming. Due to this correlation, financial initiatives to promote environmental sustainability will most likely contribute to extending and strengthening sustainable agricultural approaches associated with cocoa farming. The strongest correlation between the two examined pairs is among green finance, green agriculture, and wastewater treatment.

There is no linear correlation between green finance and farmers' living income. The correlation coefficient is -0.026**. The value of -0.026 is extremely close to zero, as the table above shows. It implies a real and virtually linear relationship between green finance and farmers' living incomes. Moreover, the - sign implies an almost insignificant inverse correlation between the two, such that variations in green finance do not predict changes in farmers' living income. According to Beers (2024), any p-value < 0.05 is significant; I emphasise this even if the p-value is zero, as shown above in Table 4.14.

Regression Model Summary

Table 4.15-Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.652	0.425	0.422	3.25678

a. Predictors: (Constant), Farmers' Living Income, Green Finance

Source: SPSS Output (23), Author's Computation (2024)

Table 4.15 shows that the regression coefficient of correlation (R) is 0.652. It implies a strong positive and linear relationship between the dependent variable (sustainable cocoa production) and the independent variables (green finance and farmers' living income), where the value of the coefficient of correlation fluctuates from -1 through 0 to +1. According to Frost's research thesis (2018), the coefficient sign indicates the relationship's direction. If the value of one variable increases, so does the value of the other variable. A negative sign, on the other hand, implies that when one variable's value increases, the other variable's value falls.

Furthermore, Frost (2018) elaborated that a correlation coefficient of +1 measures a perfect positive relationship. However, a coefficient value of more than 0.61 and less than 1 indicates that the trend is a fairly strong positive relationship. Based on the foregoing, this model's correlation coefficient of 0.652 falls well in the range of a strong positive relationship.

The first line of the third output shows that the predictors (green finance and farmers' living income) explain 42.5% of the variance in the dependent variable (sustainable cocoa production), as indicated by the R square value of. .425. It means a satisfactory explanatory power with a large positive beta value. We can also observe that the predictors provide a reliable and sufficient explanation and predict the inherent variability in higher farming, return on capital for investment, and sustainable trade. Additionally, the adjusted R square of 0.422 (line 2 of the above output) adjusts the amount of explained variance using the number of

predictors and degrees of freedom. The 0.422 value is close to the model's R square, meaning that the model's specifications are well-specified and the predictors used are not many, which would over-fit the model or too little (where all residuals would fall below the y-axis, showing a perfect fit), thus under-fitting the model. People commonly use R square as a criterion to determine a model's goodness of fit: A value of 0.70 or higher is considered acceptable, a value of 0.60 or higher is considered relatively good, and a value of 0.50 or higher is considered slightly good (Muralidhar, 2023). Thus, interpreting the second line in the third output, we can infer that our regression model is a good fit as the R square is close to 0.50.

Additionally, Minitab (n.d..) notes that the R square statistic indicates the proportion of the response's variance that the model explains. The F-test evaluates the statistical significance of the association between the model and the response. The estimate's standard error is 3.25678, representing the average distance between the observed y values and the regression line. The lower the standard error, the better the model fits the data. Given the agreement between the R-squared and adjusted R-squared values, which are both reasonably high and a moderate standard error estimate, we can collectively conclude that the model fits the data quite well.

Our model, which incorporates farmers' living income and green finance as predictors for the dependent variable, demonstrates high explanatory power. Furthermore, with a Durbin-Watson statistic of less than 2, the model exhibits P-correlation, indicating a strong fit to the data. Slamah (2016) notes that Durbin-Watson statistic values falling between 0 and less than 2 indicate a positive autocorrelation, aligning with the interpretation below. However, Taylor (n.d.) asserts that the autocorrelation statistic's values should not be 1. Still, they should range between -1 and 1, with the negative range indicating a negative autocorrelation and the positive range between 0 and 1 indicating a positive autocorrelation.

Table 4.16-ANOVA Test

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.365	2	6.183	.205	.044[b]
	Residual	11591.47	385	30.108		
	Total	11603.83	387			

a. Dependent Variable: Sustainable Cocoa Farming

b. Predictors: (Constant), farmersLivingIncome, green finance

Source: SPSS Output (23), Author's Computation (2024)

The ANOVA table, based on the corresponding regression section, indicates that the regression model, which includes explanatory variables for farmers' living income and green finance, partially explains the variance in the dependent variable of sustainable cocoa farming. The column regression yielded a sum of squares (SS) of 12.365, with two numerator degrees of freedom (df) and mean squares (MS) of 6.183. The F-statistic value is 0.205, with a corresponding p-value (Sig.) 0.44. The hallmarks of statistical correlation determine its ideal use. A high p-value (.44) and an F-value (0.205) near zero in the model's F-statistic column indicate that we are unable to reject the null hypothesis that there are no significant linear relationships between the predictors and the dependent variable, which includes farmers' living income, green finance, and sustainable cocoa farming.

From the residual row in the ANOVA table below, the value for the sum of squares is 11591.47. 2. The value for degrees of freedom is 385. 3. The value for the mean square is 30.108. The residual row's SS quantifies the unexplained variance in the dependent variable that remains after controlling for the predictors in the regression model. We calculate the mean square by dividing the standard deviation (SS) by the degrees of freedom (MS = SS/df). So, the mean square of 30.108 means that after taking into account the two predictors (farmers' living income and green finance) in the regression model, 30.108% of the original variance of 22,984.61 in sustainable cocoa farming (consumption per capita) is still not explained. A

relatively large MS in the residual row means that much of the original variance in the dependent variable remains unexplained, even after controlling for the predictors included in the regression model.

The total value in the table shows the total variability in the dependent variable, sustainable cocoa farming, which is 11603.83. It means that the combined variability in the data set before and after fitting the regression model and accounting for the predictors is what this means. Developing a shared understanding of the total variance is crucial. It allows us to assess how much the regression model explains the variability based on the regression and residual rows. For instance, the error term accounts for the vast majority of the total variance (11591.47 out of 11603.83), indicating that the predictors in the model do not adequately capture the variability in sustainable cocoa farming.

Overall, the ANOVA table summarises the analysis and shows that the model of the dependent variable (sustainable cocoa farming) explains 3.53% of the variance, while the residual variance is 96.47%. These results indicate that the model incorporating the farmers' living income and green finance predictors does not significantly explain the variation in the dependent variable (SCF), as evidenced by the high p-value associated with the F-statistic (0.891). It shows that there is not a significant relationship between the predictors and the dependent variable. Therefore, it may be necessary to conduct additional analysis, as the model specification may be incorrect, or to explore alternative models that could aid in predicting the dependent variable.

Table 4.17-Coefficient Test

Model	Unstandardised Coefficients		Standardised Coefficients			95.0% Confidence Interval for B	
	B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
1 (Constant)	35.529	2.437		14.579	.000	30.738	40.321
Green Finance	0.0127	0.054	0.0225	2.352	0.019	0.021	0.223
Farmers' Living Income	0.234	0.082	0.021	2.854	0.005	0.072	0.396

a. Dependent Variable: Sustainable Cocoa Farming

Source: SPSS Output (23), Author's Computation (2024)

The table displays the constant as an intercept at 35.529. It is the estimated value for sustainable cocoa farming, where both predictors (green finance and farmers' living income) have a value of 0. The standard error is 2.437, indicating that the spread encircles the intercept's estimated value. The t-value of 14.579 suggests the likelihood that the conditional effect is only due to a random phenomenon. The probability (p-value or sig.) of 0.000 confirms the t-value at a 0.05 significance level. It implies that even without any input from green finance or farmers' living income, sustainable cocoa farming has a sizeable stand-alone intercept level, and the estimate is extremely robust. The 95% CI shows that the estimated intercept (35.529) can be between 30.738 and 40.321.

The coefficient for green finance is 0.127. Therefore, keeping everything else (column variables) constant, we expect sustainable cocoa farming to change by about 0.127 per unit in green finance. As noted earlier, the standard error for this coefficient is 0.054. It is the number that tells us how precise the estimate is. The coefficient's t-value for green finance is 2.352, and its p-value is 0.019. It tells us that the coefficient for green finance is positive and statistically significant at the conventional significance level (e.g., with $\alpha = 0.05$). Thus, in this version of the model, green finance has a strongly positive linear relationship with sustainable cocoa

farming. The 95% confidence interval for the coefficient, ranging from 0.021 to 0.233, demonstrates the absence of zero in the interval and the positive nature of both endpoints.

The coefficient for farmers' living income is 0.234. It implies that a one-unit increase in farmers' living income should lead to a 0.234-unit increase in sustainable cocoa farming while maintaining the mean values of other variables. The second column represents the coefficient's standard error. The standard error precision for farmers' living income is 0.082. We compare the t-value (2.854) in the third column to 2.1 for the p-value (0.005). The t-value is greater than 2.1, and a farmer's living income is a statistically significant predictor of sustainable cocoa farming. The p-value of 0.005 indicates that random chance determines the probability of farmers' living income in a selected area and sustainable cocoa farming nationwide, provided the true regression line is present in the population.

The fourth column provides the 95% confidence interval around the coefficient for farmer living income, which states that the coefficient is between 0.072 and 0.396. A farmer's living income coefficient is estimated to be between 0.072 and 0.396, not 0, which indicates that a farmer's living income is a significant predictor and positively affects sustainable cocoa farming.

Table 4.17 above depicts the relationship between green finance and sustainable cocoa production in Ghana as demonstrated in the regression analysis, and according to Aggarwal and Ranganathan (2017), the coefficient beta (B) can be positive or negative. If the value is positive, it implies that with a 1-unit increase in one variable, the other variable also increases by the computed 1 unit. However, suppose the beta (B) value is negative. In that case, it generally implies that an increase in two variables will decrease the computed value of the second variable by its unit.

Therefore, we observed that in this study, the coefficients for green finance and farmer living income are 1.13, indicating a positive influence, and 2.22, indicating a negative one,

suggesting that both factors contribute positively to sustainable cocoa production in Ghana. Of the two independent variables, farmers' living income is more important in influencing sustainable cocoa production. Thus, for every 1 unit increase in green finance, sustainable cocoa production will likely see a 12.7% increase. Additionally, a 1-unit increase in farmers' living income is expected to lead to a 23.4% increase in sustainable cocoa production.

Since their p-values are below 5%, indicating statistical significance, we find that the coefficient estimates of green finance and farmer living income are statistically significant. On the other hand, practically, the estimates of both the coefficient of green finance and farmers' living income are very precise since their standard error is not large. It also suggests that the estimates closely cluster around the regression line, providing additional evidence of the trade-off between green finance and farmers' living income and its influence on enhancing sustainable cocoa production in Ghana. Therefore, green finance and farmers' living income have a strong statistically significant positive effect on sustainable cocoa production in Ghana.

The regression results above are based on the criterion for acceptance of regression results, which states that if the p-value is < 0.05, the results are statistically significant, while when the results are >0.05, the results are considered not statistically significant. Similarly, when the coefficients are without a negative sign, it implies that there is a positive effect detected; on the other hand, if the coefficient bears a negative sign, it implies that there is a negative effect established. From the results, the findings suggest that the significant values of green finance and farmers' living incomes (p: 0.019 and 0.005), respectively, showing the green finance and farmers' living income have a statistically significant positive effect on sustainable cocoa farming. From the results, we can confidently reject the null hypotheses, which suggest that no relationship exists between green finance and farmers' living income and sustainable cocoa farming. Therefore, the results show strong empirical support that both green finance and farmers' living income have statistically significant effects on sustainable

cocoa farming outcomes. Furthermore, from the direction of the effect, it is observed from the sign of the regression coefficients that there was a positive effect. The observance of a positive coefficient suggests that an improvement in the independent variable (e.g., green finance or farmers' living income) increases sustainable cocoa farming. Similarly, the observation of a negative coefficient would imply an inverse relationship. The above results suggest that the coefficients for green finance and farmers' living income do not have negative signs, and there is clear evidence to indicate that both green finance and farmers' living income affect sustainable cocoa farming significantly and positively. The results imply that there is a statistically significant relationship between green finance and sustainable cocoa farming, which implies that when there is an increased access for green-oriented financial instruments, such as loans that are environmentally friendly, carbon credit funding, and grants aimed at the acquisition of climate-smart technologies, tend to empower farmers and agribusinesses to invest in sustainable agricultural practices. Some of these practices may include but are not limited to agroforestry, the purchase of organic fertilisers, biodiversity preservation, and the reduction of carbon emissions (IDH, 2024; Amanor, 2023). When green finance is available, this can lower the barriers to the adoption of these technologies, which in turn will promote long-term environmental sustainability in cocoa farming. Correspondingly, the observation of a significant positive effect of farmers' living income on sustainable cocoa farming indicates the critical role that economic stability plays in improving environmental stewardship among cocoa producers. When farmers are able to earn income beyond the threshold needed to attain basic needs, such as food, housing, education, healthcare etc., they are likely to reinvest in their farms, adopt good agricultural practices (GAP), and ensure they avoid harmful coping strategies such as deforestation or overuse of agrochemicals (Fairtrade International, 2025). A well-secured living income ensures there is some form of resilience and long-term planning, two very important pillars that are essential for sustainability in agriculture.

Exploratory Factor Analysis

The research data was subjected to exploratory factor analysis to identify the core factors assessing smallholder farmers' sustainability. A Varimax rotation was carried out after applying principal component analysis to all 26 questions that evaluated the elements influencing green finance, sustainability, and control. Table 4.7 concludes with the results of the major component analysis. The results of the Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy were both obtained with a value of 0.696, respectively (approx. Chi-square=1501.814, df=325, p=0.000). The results show significant relationships between the variables and that the sample is large enough for component analysis. The data is suitable for factor analysis if the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) finds the percentage of variation across variables that may reflect common variance. A KMO score closer to 1 suggests strong appropriateness, suggesting that the variables are well-correlated and, hence, suited for factor analysis. However, factor analysis may not be the best choice when the values are close to 0.5 or below, indicating weaker relationships between the variables. With a KMO rating of 0.696, we can see that the sample is somewhat adequate. The variables contain moderate correlations. Therefore, a component analysis should be done carefully; however, it should not be extremely high.

Conversely, component analysis is only justified when there are statistically significant correlations between the variables, which Bartlett's Test of Sphericity checks for. It does this by comparing two matrices: one with uncorrelated variables (the identity matrix) and the other with correlated variables. The test produces chi-square statistics to ensure the correlation matrix is factorable; a high chi-square value indicates significant correlations between variables. In the case of uncorrelated data, the Sig. The value associated with Bartlett's test shows the probability of getting a chi-square value as extreme as observed. This case's extremely low p-value (0.000) from Bartlett's Test provides strong evidence that the variables are not

uncorrelated, as opposed to the null hypothesis. It verifies that factor analysis suits this data and that the correlation matrix is factorable. So, even with the small KMO value, Bartlett's Test shows enough large correlations between the variables to move forward with component analysis confidently. By highlighting modest adequacy in the KMO measure and considerable correlation in Bartlett's Test, the two tests provide complementary information on the data's readiness for factor analysis.

***T**able 4.18-Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity*

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.696
Bartlett's Test of Sphericity	Approx. Chi-Square	1501.814
	Df	325
	Sig.	.000

KMO, Kaiser-Meyer-Olkin; df, degrees of freedom: Sig., Significance

Source: SPSS Output (23), Author's Computation (2024)

Table 4.19-Pattern Matrix of Factor Loading

Factor Matrix[a]

	Factor							
	1	2	3	4	5	6	7	8
nGF1								
nGF2								
nGF3								
nGF4								
nGF5								
nGF6		.450						
nGF7								
nGF8		.498						
nGF9		.551						
nGF10								
nGF11		.490						
nFMl1			.506					
nFMl2								
nFMl3			.641					
nFMl4			.530					
nFMl5			.473					
nSF1	.503							
nSF2	.456							

nSF3	.455
nSF4	
nSF5	.599
nSF6	.461
nSF7	
nSF8	.467
nSF9	.462
nSF10	.551

Extraction Method: Principal Axis Factoring.
a. Attempted to extract 8 factors. More than 25 iterations are required. (Convergence=.002). Extraction was terminated.

nGF, Availability of Green Finance; nSF, Access to Sustainable Farming; nFMI, Farmers' Living Income.

Source: SPSS Output (23), Author's Computation (2024)

Table 4.19 above shows the study's factor analysis results, which indicate that the factors were loaded on three distinct factors with meaningful loadings on several variables. Factor 1 was sustainable cocoa production which loaded nSF1: 0.503, nSF2: 0.456, nSF3: 0.455, nSF5: 0.599, nSF6: 0.461, nSF8: 0.467, nSF9: 0.462 and nSF10: 0.551. It is observed from the results that all items loaded significantly on this factor. These loadings indicate that the items are more closely related and jointly depict the relevance of sustainable cocoa production, which includes practices such as environmentally friendly and responsible farming, proper resource conservation, and long-term productivity. Furthermore, the values observed to be exceeding the 0.40 threshold indicate that these items have moderate to strong correlations with the latent factor they are intended to measure, and this supports their inclusion in further analysis.

Also, the green finance variables loaded on the second factor, with items nGF6: 0.450, nGF8: 0.498, nGF9: 0.551, and nGF11: 0.490, which all together showed acceptable loading values. These results further confirm that the items selected represent the concept of green finance reliably in the context of this study. The study further identified factors such as access to credit facilities that are environmentally friendly, financing mechanisms that reliably support sustainable agriculture, and also provide investment in eco-friendly technologies. The variables

clustering together provide support for the validity of green finance as a distinct construct and strengthen its conceptual contribution to understanding the determinants of sustainable cocoa production.

Farmers' living income is loaded on the 3rd factor with items nFMl1: 0.506, nFMl3:0.641, nFMl4:0.530, nFMl5:0.473. Values with less than 0.4 loadings were dropped from further analysis in the study. The results show that these items reflect farmers' ability to meet basic needs, reinvest in agricultural inputs, and plan for the future: all of these are essential elements of a living income framework. The observation of a strong loading for nFMl3 (0.641) in particular indicates its significance as a core indicator within this construct. The results from the EFA confirm that living income is an independent factor and plays a pivotal role in influencing sustainable practices. This is likely due to its impact on farmers' decision-making, resource use, and long-term planning.

Notably, from the analysis, it was observed that all items with factor loadings below 0.40 were not considered for further analysis. Based on the analysis results, this methodological decision is in line with the guidance provided by Ximénez (2009), who posited that low factor loadings are an indication of weak correlations between a variable and its respective factor. This implies that the retention of such items can introduce unnecessary noise into the factor structure and affect the clarity of the results. By removing these weaker items, the study provides greater internal consistency and clarity in the constructs that are being measured.

Structural Model

This study will examine the data using structural equation modelling (SEM). For several compelling reasons, SEM has emerged as an indispensable analytical tool in many fields, including the social sciences. Structural equation modelling (SEM) enables researchers to examine multi-element, intricate theoretical models. Since SEM allows for the simultaneous

estimate of latent and observable variables, it offers a more comprehensive comprehension of the data's underlying structure than conventional regression analysis (Baafi et al., 201). This information is necessary to study events with complicated causal channels or analyse multi-dimensional theoretical frameworks. SEM provides a solid foundation for evaluating the reliability of data and the accuracy of the model's fit.

To verify that researchers are using accurate measurements and suitable theoretical structures, SEM uses measurement models to evaluate the reliability and validity of observable indicators. Scientists can assess how well their proposed models match the data using SEM's fit indices and goodness-of-fit tests (Maruyama, 1997). Researchers may rest certain that their results are trustworthy due to this thorough model evaluation technique, which enhances the study's validity and reliability. Researchers seeking to test challenging hypotheses and expand scientific knowledge may find SEM particularly useful due to its methodological relevance in closely scrutinising complicated theoretical models and rigorously testing measurement validity and model fit.

Byrne (2013) states that specialists in social and behavioural sciences developed structure equation modelling (SEM) as a research approach. Initially, the SEM technique was only helpful for conception since technological restrictions prohibited it from being operationalised. However, as computing power increased, the SEM method became more well-known and widely employed in management and behavioural studies (Capmourteres, 2016). The SEM method combines route analysis and multiple regression, two multivariate analytic models. According to Chang (1981), SEM enables researchers to investigate the data extensively. Thus, SEM is better than multiple regression and route analysis. Since both path analysis and multiple regression could only handle data from the entire set of research instrument items (the total variable score), it is safe to say that both models of multivariate analysis were only used to account for unobserved variables.

In contrast, SEM data analysis delves further, using the observed score of each variable item. Compared to a combination of route analysis and multiple regression, SEM's greater predictive power results from its complete variable analysis (Cohen, 2013). Using the SEM method gives a more comprehensive description of the processes under examination. The first generation of multivariate methods, route analysis and multiple regressions had their limitations and dead ends resolved by SEM (Curran, 2003). As computing power has increased, structural equation modelling (SEM) has become the de facto standard for multivariate analysis in social science, behavioural science, and management (Duncan et al., 2013). Several multivariate statistical methods, such as factor analysis, path analysis, discriminant analysis, and multiple regression with more than three independent variables, have become increasingly important since the development of the most popular computer program, the Statistical Package for the Social Sciences (SPSS).

The benefits of SEM in research

Research models containing several independent and dependent variables and intervening or moderating factors are often evaluated using structural equation modelling (SEM) (Fan et al., 1999). Study models with numerous variables may be designed, and elements that are not easily visible or quantifiable can be investigated using structural equation modelling (SEM). It verifies the theory in line with research data (confirmatory factor analysis) and tests measurement errors for observed variables. It provides a more comprehensive, illustrative, robust, and dependable approach to solving research issues than the regression model. The model features are interaction, non-linearity, measurement error, correlation among error terms, and correlation among many independent variables. Researchers have more leeway to connect theory to data using this method, which describes complex interrelationships and direct or indirect effects of one or more variables on other variables; it can replace path analysis,

factor analysis, regression analysis, covariate-based time series data analysis, and path analysis (Fritz et al., 2007).

Types of SEM

Two distinct varieties of structural equation modelling (SEM) exist: variance or component-based SEM (VB-SEM) and covariance-based structural equation modelling (CB-SEM). Two components of VB-SEM are generalised structural component analysis (GSCA) and partial least squares (PLS) (Grace, 2010). The data's variance is the degree to which it differs from the sample's average value. One way to measure variations in variables is by looking at their variance, which is a measure of how much data differs from the average value of a sample. In mathematical terms, the variance is the average of the squared deviations of each observation from the mean. That is to say, according to Haavelmo (1943), the variance is just the standard deviation squared averaged. The variance of a variable must be larger than zero at all times. You can think of a value as a constant instead of a variable if its value is zero. At the same time, the covariance measures how linearly two variables, in this case, X and Y, are related. Covariances are positive when there is a positive linear correlation between the variables. On the other hand, a negative covariance indicates a negative linear correlation. A covariance of zero indicates that X and Y are unrelated variables.

Covariance-based structural equation modelling (CB-SEM)

Covariance-based SEM (CB-SEM) uses the maximum likelihood (ML) function to minimise the difference between the sample covariance matrix and the covariance matrix predicted by the theoretical model so that the estimation process produces a residual covariance matrix with a small value close to zero. Assumptions in CB-SEM analysis include:

CB-SEM is like parametric analysis, which assumes that the observed variables must have a multivariate normal distribution and that the observations must be autonomous. A small and asymptotic sample gives poor parameter estimates and statistical models, sometimes producing a negative variance called the Heywood Case.

A small sample size usually results in a Type II error, which implies that a bad model will still result in a fit model.

4.4.3.4 Partial Least Squares Structural Equation Modelling (PLS-SEM)

By looking at the association or impact between the variables, PLS-SEM attempts to assess the predictive correlations (Hair et al., 2013). Using PLS-SEM logically allows testing to be carried out even without a solid theoretical foundation. Assumptions that are not parametric and the accuracy of the prediction model's parameters, as determined by the coefficient of determination (R2) value, are disregarded. Due to its development to circumvent experiments that cannot be executed using CB-SEM, PLS-SEM is best suited for research aiming at theory development (Harrington, 2009).

Generalized Structured Component Analysis Structural Equation Modelling (GSCA)

GSCA is a hybrid that incorporates both CB-SEM and PLS-SEM. In the same way that PLS-SEM handles unobserved variables with several indicators, GSCA does the same for correlated indicators, variables, and goodness-of-fit model requirements. Researchers seldom used the GSCA method before because it was so new. However, GSCA achieves the same goal as PLS-SEM, and it can be tested without a strong theoretical foundation, even with a small sample size. It does not require the assumption of multivariate normality data (Hoyle, 2013).

Estimation and prediction are the two branches of the quantitative paradigm that stem from the goals of empirical research.

The goal of estimation research is to put an empirical model to the test using credible and accurate measures. At the indicator level, testing and measurement occur, with the model hypothesis as the null hypothesis and the goodness of fit test as the metric for determining the model's viability (LeCun et al., 2015). CB-SEM is a good choice for researchers who are conducting estimate studies. Conversely, prediction research aims to evaluate the interplay of factors to foretell the nature of causal linkages. According to McDonald (2002), testing and measuring are conducted at the level of constructs. In most cases, the hypothesis is both a partial and a testing criterion, and it uses the t-statistic to make predictions about the relationship between variables. Thus, CB-SEM and regression approaches seem to be the best options for statistical analysis (Murtaugh, 2009). When CB-SEM fails to solve the data, component or variance-based SEM (PLS and GSCA) are used.

Structural equation modelling (SEM) is typically employed in empirical research to analyse complicated interdependencies among variables, and this study utilised it to examine the relationship among Green Finance, cocoa output, and the income of smallholder farmers. The model provides a mathematical framework for comprehending the association between smallholder farmers' living income, cocoa output, and Green Finance by factoring in the essential elements and their interactions. Structural equation modelling investigates the full scope of green financing's effect on cocoa farm viability and farmers' bottom lines. In contrast, structural analysis of variance (SEM) confirms that green finance affects the long-term sustainability of cocoa production and that smallholder farmers' earnings moderate this effect.

Confirmatory Factor Analysis (CFA)

This section provides the CFA test of convergence and discriminant validity

Convergent validity

Following Fornell and Larcker's (1981) instructions, Hair et al. (2016) recommend a minimum of 0.6 for Cronbach's alpha, 0.7 for composite reliability, and 50% (0.5) for Average Variance Extracted per item as a guideline for convergent validity assessment. Fornell and Larcker (1981) conclude that a latent construct has attained the criterion of convergent validity when the associated measures explained at least half of the variance. As shown in Table 4.19, we can affirm that all variables possessed more than 0.5 as an average variance extracted (AVE). It suggests a good level of convergent validity. After establishing convergent validity, Hair et al. (2009) say that it can be substantiated if these three conditions are met: (a) all Composite Reliability (CR) values were 0.7 or higher, (b) all standardised factor loadings were 0.5 or higher, (c) all Average Variance Extracted (AVE) values were 0.5 or higher. Since Table 12 provided us with a convergent validity finding due to meeting all three conditions, we can confirm the level of convergent validity for the three detected buildings, shown, respectively, as 0.81 for sustainable cocoa cultivation, 0.794 for green finance and 0.79 for the farmers' living income. Good internal consistency, with CR ratings higher than 0.70, is usually considered a sufficient criterion. Here, all three buildings passed such a test, which means that the measures we adopted to evaluate the three buildings captured the core idea we look to consider.

Another index is Average Variation Extraction (AVE), the ratio of variance extracted by the idea to variance due to measurement errors. Generally, an average variance extracted score above 0.50 is regarded as good, demonstrating that the indicators are sustainable cocoa cultivation (0.78), green finance (0.69), and farmers' living income (0.82).

The table above provides evidence that the measurement is appropriate since the score indicates that the constructs explain a large proportion of the variance in their indicators. Sustainable cocoa farming and farmers' living income show good construct representation, as indicated by the high average variance extracted.

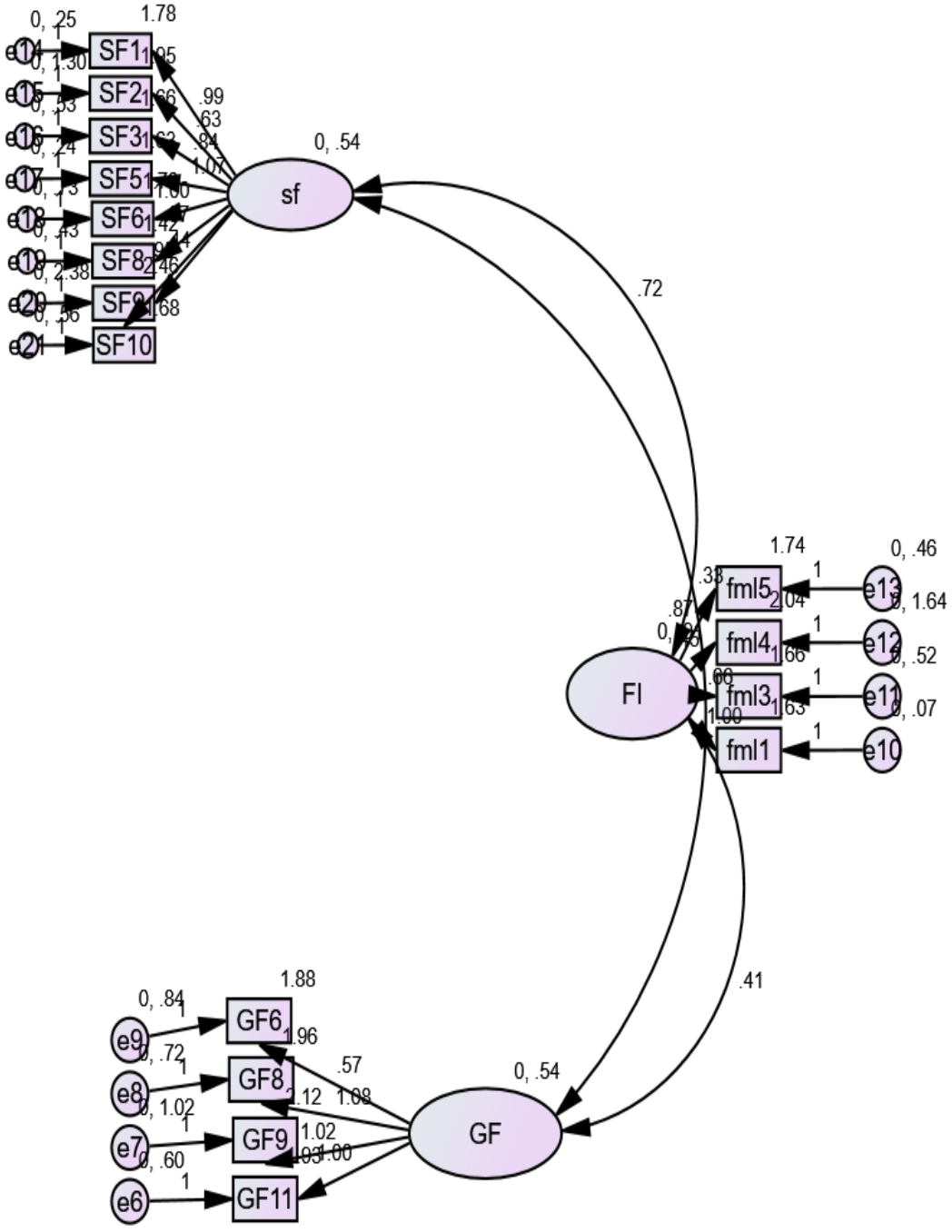
The results of our construct test and the average variance extracted confirm that the constructs are adequately represented by their indicators. It, in turn, confirms that sustainable cocoa growing, green finance and farmers' living income are drivers that are being accurately and consistently measured. Based on Cronbach's ratio of adequacy, Pearson coefficient, and average variance extracted, the choice of indicators seems apt and appropriate as the indicators accurately represent the underlying structures. In a similar vein, the constructions faithfully represent the ideas. Armed with this assurance, we can safely say that the measurement model is reliable and legitimate; hence, it can be used for further examination. The results of the convergence validity test are presented in Table 4.19.

Table 4.20-Convergent Validity

Variables	CR	AVE
Sustainable cocoa farming	0.81	0.78
Green finance	0.794	0.69
Farmers' living income	0.79	0.82

Source: SPSS Output (23), Author's Computation (2024)

Figure 4.7-Structural Model Showing the Relationship between Variables



Source: SPSS Amos Output (23), Author's Computation (2024)

1. Direct effect relationship between the variables

Table 4.21-Shows the model fit for the study's conceptual model

Model Fit Indexes: χ^2 =2369.898; d.f. =23.464; RMSEA = 0.041, CFI = 0.932; NFI = 0.923 ; IFI = 0.934; TLI = 0.944; Pcloes = 0.811			Estimate	S.E.	C.R.	P
Sustainable cocoa farming	<-->	Green finance	0.335	0.047	7.146	***
Farmers' living income	<-->	Green finance	0.407	0.053	7.621	***
Farmers' living income	<-->	Sustainable cocoa Farming	0.716	0.067	10.66	***

Source: SPSS Output (23), Author's Computation (2024)

The following model fit indicators measure how well the proposed model would fit the observed data: Chi-Square (χ^2): 2369.898, Degrees of Freedom (d.f/χ^2): 23.464, Root Mean Square Error of Approximation (RMSEA): 0.041, Comparative Fit Index (CFI): 0.932, Normed Fit Index (NFI): 0.923, Incremental Fit Index (IFI): 0.934, Tucker-Lewis Index (TLI): 0.944, P-value (Pclose): 0.811. The Chi-Square (χ^2) of 2369.898 with 23.464 degrees of freedom indicates that the chi-square has a statistically significant difference between the observed and expected covariance matrix. The Chi-Square test tends to be abundance-sensitive and achieves a considerable chi-square for most of the models with a good fit. The value of RMSEA, which is 0.041, is an effort to consider the size of the model being tested. A good fit can be achieved by values that are less than or equal to 0.08, and it can be said that a perfect fit can be achieved with a value less than 0.05, which, in this case, is the RMSEA of 0.041. Moving on to the

Comparative Fit Index (CFI), a value greater than 0.90 is generally considered a good fit. The value of CFI of 0.932 is well above 0.90, which supports that the model fits the data very well compared to a null model. The NFI value of 0.923 and the IFI value of 0.934 are also above 0.90, which implies that the model fits the data well. This index fits the model and the data quite well.

The TLI of 0.944 is also above the acceptable threshold of 0.90, which supports the notion that the model fits the data well, adjusts for model complexity, and shows that the model is very parsimonious and well-fitting. The Pclose of 0.811 is acceptable. There is agreement that lower values of Pclose would support a good model fit, and values greater than 0.05 are considered good. Finally, the model fit indices provide a good picture of the model fit. The RMSEA, CFI, NFI, IFI, and TLI all suggest a good model fit; however, the Chi-Square is significant, likely resulting from a large sample size. Nevertheless, acceptable Pclose supports that the model fits the data well. The parameter estimates show a meaningful and strong relationship among the constructs, providing an undeniable positive interaction between SFC farming, green finance, and the income level of farmers.

The positive, strong, and statistically significant relationship we see in the estimates (Table 4.20 above), for instance, between green finance and sustainable cocoa farming, tells us that any increase in sustainable cocoa farming would be positively related to a rise in green finance initiatives. This statistical relationship between these constructs was also reflected in the positive, strong, but less significant relationship between green finance and farmers' living incomes, meaning that an increase in green finance measures would also be positively related to a rise in farmers’ living incomes. Also presented is the strongest relationship in the entire model, which is between farmers’ living incomes and sustainable cocoa farming, meaning that sustainable cocoa farming has a powerful and significant relationship with the incomes of those practising it.

The result also shows that cocoa farmers need green finance to trigger green behaviour. As evidence, the green finance institution has become the revolution of the 21st century. For example, all cocoa farmers have little or no money to invest in ecological or environmental agriculture, buy their farming equipment, or invest some cash in sustainability projects. Green finance not only stimulates the green behaviour of cocoa farmers but also secures the current economic situation of cocoa farming communities.

The link between farmers' living income and sustainable cocoa farming shows a virtuous cycle where more income would enable farmers to invest in sustainable cocoa farming, which would raise revenue and livelihoods through more production and sale and a higher market price for sustainably produced cocoa. A similar virtuous circle between finance for sustainable agriculture and its technology suggests thinking strategically about agricultural investments from both of these dimensions to help ensure enduring benefits. It also suggests other implications of our results for policy interventions: the provision of initiatives that enhance farmers' access to green finance or livelihood-enhancing programs that can improve their living income can trigger a multiplier effect in encouraging scaled-up adoption of low-carbon farming practices. These measures are key building blocks to support a configuration where the economic and environmental objectives synergise through mutual interdependencies.

Thirdly, there is a correlation between the variables, which can be mapped via the mechanisms driving green finance to achieve sustainable cocoa farming. Green finance is a general term for financial services and products incentivising environmental sustainability. To envision how a farmer would switch to sustainable cocoa farming, say, through the utilisation of organic, in-field fertiliser, generic pest management systems, water conservation, and renewable energy technologies, there needs to be a capital injection to cover the cost of the transition. It is then that green finance kicks in to bring down the cost of access to these

investments. For instance, organic agriculture, a core component of sustainable cocoa, is often an upfront investment, from the costs associated with organic certification and production standards to the breaking-in or priming of the soil with green manures and cover crops, the related training of farmers, and investment in the infrastructure of composting and manure storage facilities, etc. Such upfront investment can be intimidating for smallholder farmers. Still, green financing avenues such as low-interest loans, concessional grants, microfinance, and other methods can make it more manageable. Suppose farmers receive certification for their cocoa after implementing organic agriculture. In that case, they can participate in premiums, allowing them to command higher prices for their cocoa, translating into achievable incomes. This dynamic translates to a virtuous cycle in which environmental benefits reinforce economic benefits.

Moreover, green finance can also be used to support agroforest systems, in which cocoa trees are interplanted with other tree species to diversify and enrich shade, thus developing a more productive ecosystem by increasing the flourishing of biodiversity. These systems have the additional potential to provide a linear yield of other products (e.g., timber, fruits, or other forest products) for extra income for the farmers, which reduces the financial risk and boosts their resilience to both market fluctuation and climate risks. Beyond the well-being of farmers, another key outcome concerns the extent to which cocoa farming is occurring more sustainably. Because living income can identify these aspects of sustainable livelihoods, it can help us understand real opportunities for farmers to operate more environmentally and economically soundly. Farmers with higher incomes will be less likely to respond to short-term pressures in urgent survival mode and more likely to take a longer-term view of their farming. Higher living incomes may also encourage farmers to switch from selling their cocoa to survive each day to investing in their farms financially, where actions taken today could yield substantial, longer-term rewards, for instance, by investing in soil health, water management, and biodiversity.

In addition to bringing peace of mind on a need-to-eat basis, if farmers' household incomes increase due to enhanced productivity, better market prices, and improved management skills, then it offers more scope to 'pay it forward' to the rural communities clustered around the farmers by improving access to education, healthcare, and other public services. It can spark a powerful ripple effect towards a sustainable way of life and more resilient communities that will lead to a flourishing social fabric, one step at a time. Beyond the social dividends, if the adoption of more sustainable modes of production starts delivering clear benefits in the form of improved quality of life for farmers and other stakeholders within the cocoa value chain, these can cascade rapidly through the contagion effect of word-of-mouth, especially if the spin-offs for the community and its members are self-evident.

Relatedly, training and capacity-building dimensions are also to be considered.

Training or capacity-building efforts are generally part of green finance. However, assessing the extent to which they are deployed is more challenging. Indeed, almost all the above-mentioned case studies explicitly mention that significant efforts are made to provide training and technical assistance to actors across the supply chain (or at the community level) to help them learn how to 'do things well' and deliver successful best practices. Increased technical knowledge is needed so that the money deployed can be deployed to provide the desired sustainable outcomes. Capacity-building elements can relate to anything from best agricultural practices through sustainable business management knowledge, efficient post-harvesting methods, adequate handling and storage methods of various products and services, and understanding the requirements to access specific markets and the correct certification schemes.

More optimistically, the positive correlation between "green finance" and sustainable cocoa production suggests that public-private partnerships remain a possible avenue for progress towards sustainability. Governments, international NGOs, and the private sector can

work together on green finance, so financial institutions find the de-risking of green finance products aimed at small-scale farmers worthwhile. NGOs can also offer additional training and technical support to give smallholder farmers the capacity to thrive. Given the mutually reinforcing reciprocal relationships between green finance, sustainable cocoa farming, and farmers' living incomes, the findings emphasise the complementarities between economic and environmental sustainability within modern cocoa farming.

As such, repayable access to green finance allows farmers to implement sustainable practices, enhancing farmers' living incomes and contributing to broader environmental goals and vice versa. Such complementarities between the factors could multiply the respective effects to reinforce each other mutually, leading to a virtuous 'sekinyan' (literally translated as an interactive rhythmic pattern but regularly repeated in a cocoa farm). This iterative and reinforcing concept of sekinyan could have huge externalities in promoting a virtuous cycle of sustainability and resilience in cocoa-farming villages. Policies or other exogenous direct or indirect interventions that can enhance access to green finance and farmers' living incomes could have multiplicative effects on adopting sustainable practices and achieving larger economic and environmental benefits. Such a robust and holistic approach is needed to ensure the sustainability of cocoa farming, livelihoods, and income generation for farming communities in the long run.

Hypothesis testing

The study sought to test the following hypotheses:

H1: There is no relationship between green finance and sustainable cocoa production.

H2: There is no evidence that farmers' living income substantially impacts the relationship between green finance and sustainable cocoa production.

Green finance plays an important role in influencing the use of good green practices in cocoa production because it provides the financial means needed for investments in good green practices. Finding that green finance impacts sustainable cocoa practices resulted in rejecting the null hypothesis (H1) and accepting the alternative hypothesis. The collected data also demonstrated that green financing and a farmer's living income form a positive feedback loop: green financing and sustainable cocoa go hand-in-hand. As a farmer's income increases, he is financially able to invest more money in green farming. Green financing 'de-risks' cash flows to farmers and helps them to invest their revenues more efficiently, yielding even higher incomes. Then the bad and virtuous dynamics in agriculture switch: the good one might well become one where a greater abundance of cash in the hands of farms and farmers becomes a positive association: when more money is around, more of it ends up being invested in being green, and green financing helps in doing so.

These findings illustrate how financial and economic stability support agroecological stability. Stabilisation in the production and consumption of agricultural products is greater with sustainable techniques when green financing makes them more affordable and when farmers' living incomes increase, where they can afford farm practices with a longer outlook and higher willingness to pay. Second, the results highlight the need for a synergistic use of public policy; namely, project funding for technical assistance must incentivise nature-positive outcomes. Green finance solutions may comprise low-interest loans or grant programs to subsidise nature-positive activities and build technical capability.

These findings prove that green finance can make the cocoa sector more sustainable, allowing farmers to have higher long-term incomes. They also shed light on the importance of monetary and economic integration for cocoa sector sustainability.

Table 4.22-Summary of Hypotheses

	Hypothesis	Results (+/-)	Outcome	Empirical Conclusions
H1	There is a relationship between green finance and sustainable cocoa production.	+	Significant	Supported
H2	Farmers' living income significantly impacts the relationship between green finance and sustainable cocoa production.	+	Significant	Supported

Source: SPSS Output (23), Author's Computation (2024)

Qualitative Data Analysis

To supplement survey-based analyses and increase contextual knowledge, qualitative research has grown in popularity in several management areas (Soltani et al., 2011). Triangulation in research refers to combining two or more methods to acquire a complete picture of human behaviour (Gordon, 2011). Hair et al.. (2012) state that qualitative research involves gathering primary data from small samples through observation or interviews. Nevertheless, they refrained from delving into ways to reduce subjectivity in content analysis. The software has greatly diminished subjectivity in qualitative analysis. Using software for qualitative analysis guarantees methodological rigour, according to Houghton et al. (2013). It includes the study's credibility, reliability, conformability, and transferability. There are three ways to organise content analysis when studying qualitative data, according to Oliveira et al. (2015). The first is lexical analysis, which examines the language's richness and nature. The second is syntactic analysis, which examines verb tenses and modes. The third is thematic analysis, which finds themes and how often they occur. Depending on the study's aim, these approaches can be utilised alone or together. Nevertheless, thematic analysis was employed in this study with the help of NVivo to facilitate the investigation of topics.

According to Bardin (2011), using data analysis software for thematic content analysis offers various benefits, such as increased productivity, more methodological rigour, flexibility in analysing from several perspectives, and easier data replication. The purpose of thematic analysis is to identify overarching themes or patterns in qualitative data. Its goal is to shed light on the data's underlying meaning and offer useful insights.

The three phases of thematic content analysis are preparation, investigation, and analysis and interpretation. The three main components of preliminary analysis are content analysis objectives, relevant data, and data organisation. The content might be presented verbally or in writing. Finding the code and the unit of analysis are tasks that fall under the purview of exploration. A word or subject can be the unit of analysis, the smallest part of the text that can identify an element.

In contrast, coding entails classifying the text into subheadings that expose a hierarchical organisation of theme ideas. Based on the goals of the investigation, descriptive or analytical codes are utilised in research. The codes should be comprehensive, concept-oriented, research-relevant, conclusion-capable, and objective (i.e., different people should be able to arrive at the same result). Following content coding, the researcher draws findings from the treatment and interpretation phase. At this stage, the researcher's inherent bias is the main issue. Verifying reliable coding may help eliminate this prejudice. Accuracy, reproducibility (by having another person repeat the procedure), and stability (by having the same person repeat the process) are the ways to ensure code reliability. Data analysis software enhances precision, provides flexibility, and makes data replication easier during the investigation and treatment phases.

Although some academics do not see thematic analysis as a separate approach, it is widely used to assess qualitative data. While some see theme analysis as an individual approach, others see it more as a practice or tool; examples of the latter include Boyatzis (1998)

and Morse (2021). Although Braun and Clarke (2006) laid out a framework for building themes, thematic analysis is still a widely used method with several theoretical and epistemological approaches and numerous applications in other disciplines of study, including ethnography and case study. So, it is safe to say that theme analysis can apply to any paradigm or school of thought. Since it is not tied to any one theory or epistemology, theme analysis, the author said, is very adaptable, diverse, and compatible with other methods. Theoretical frameworks are purposefully avoided in this study since they use an inductive method for theme analysis. Researchers instead started with brainstorming ideas for potential themes before coding them.

Data coding, topic identification and refining, and finding reporting are all essential components of thematic analysis. These guidelines are similar to those used in discourse analysis and other qualitative approaches (Flick, 2022). One way to look at qualitative data is via thematic analysis. This method finds patterns in the information, documents them, and interprets them to determine their meaning (Liebenberg et al., 2020; Xu & Zammit, 2020). A rigorous methodological approach known as systematic theme analysis was employed in this investigation. Creating transcripts and getting to know the data were the first two phases in this six-step process. Then came finding keywords, picking codes, establishing themes, interpreting codes, themes, and keywords to produce ideas, and building a conceptual model. These methods offer a structured way to handle qualitative data, improving the precision and comprehensiveness of the research and the study's findings.

The theme analysis's systematic nature stems from the fact that it presents research findings in a structured and organised manner. The method is structured so that each stage improves upon the one before, with the last step producing a thorough understanding of the data. This methodical approach makes a clear link between data, interpretation, and conclusion

possible, improving the results' uniformity and reproducibility. This systematic approach lessens the likelihood of bias while assuring thoroughness.

Step 1: Transcription, Familiarization with Data, and Selection of Quotations

The theme analysis process begins with reading the content and getting to know it through transcribing. Experts in the field carefully examine the material to extract key ideas and passages that support the study's aims. They then choose quotes that amplify these points and show other points of view.

Step 2: Selection of Keywords

This stage emphasises analysing the results of the focus groups and interviews. The researcher looks for recurring ideas or phrases and uses them as keywords. These terms are derived from the data and concisely summarise the respondents' experiences and opinions.

Step 3: Coding

The third phase, coding, involves assigning brief phrases or words, called codes, to data parts that convey the data's essential message, meaning, or subject. In this stage, components connected to the study topics are identified, and complicated textual data is made more understandable by transforming it into a theoretical form. Keywords are fundamental to the coding process and are the building blocks of the analysis, as well as how raw data is converted into understandable, manageable chunks.

Step 4: Theme Development

Developing a theme means sorting codes into meaningful categories and looking for connections and trends to learn more about the research topic. It is when the researcher moved

from a category code-based analysis to a more conceptual, theme-based interpretation. The themes were more than just recurring parts; they also included deeper, more systemic implications that linked the research questions to the results.

Step 5: Conceptualization through Interpretation of Keywords, Codes, and Themes

The term "conceptualisation" refers to the steps used to understand and define ideas that emerge from data. In line with the research results, the researcher identified societal trends and then developed exact definitions. Naeem et al. (2023) propose using models or diagrams to help understand how these ideas are related. We rank these definitions according to how well they fit the criteria of clarity, precision, validity, reliability, practicality, and theoretical and practical contributions.

Step 6: Development of Conceptual Model

In thematic analysis, developing a conceptual model is the last step. This approach creates a unique picture of the facts. The model answers the research questions and highlights the study's contribution to knowledge. It is the last step of the research process since it compiles all findings and conclusions. The researcher used NVivo 12 Plus Software to code and analyse the data. By encouraging originality and making data retrieval easier, NVivo improves the researcher's analytical skills (Zamawe, 2015). There is more leeway in NVivo's coding options, as Basit (2003) agrees.

More accurate and transparent data analysis is possible with NVivo because it allows for fast code and node framework change and reorganisation (McLafferty & Farley, 2006). Consequently, it makes qualitative research more accurate (Bazeley, 2009). Qualitative data may be more easily collected, organised, analysed, visualised, and reported (Dhakal, 2022).

Additionally, NVivo is used for both qualitative and mixed-method research, according to Kent State University (n.d..). Unstructured data in many forms, including text, audio, video, and photos, may be examined with this application. It may be used to analyse information from social media, academic papers, focus groups, surveys, and interviews. While NVivo might help organise and structure the data collected, it cannot replace human researchers. With its powerful features and intuitive interface, NVivo is a great choice for theme analysis.

Finding commonalities and trends in massive datasets is possible via NVivo data analysis. An ideal tool for theme analysis, NVivo simplifies classifying, analysing, and displaying large datasets. Following data loading into NVivo, there are four steps to assessing qualitative data using the software: creating a coding framework, coding the data, analysing the data, and interpreting the results (Success Team, 2023). Building a coding system entails classifying data to find specific information. To organise and categorise the information for future analysis, data is "coded" by assigning pre-established codes to the gathered data. It is possible to code more quickly with NVivo's coding tools than manual coding since they simplify assigning codes. Using NVivo for analysis has these benefits, among others. Among NVivo's many features are tools for coding, classification, and mapping (Dhakal, 2022). The efficient arrangement of data made possible by these technologies allows for more effective querying and analysis. Query and visualisation tools are used to analyse the data and find the link between the codes. The influence of qualitative analysis on the study can be better understood by deciphering data patterns and themes.

The researcher utilised the coding comparison query tool to ensure the validity and reliability of the conclusions reached from the qualitative data during the thematic analysis. Since the researcher lacked experience with NVivo coding prior to beginning this project, this tool was used to determine the extent to which two individuals' coding processes overlapped. There was much overlap in the results, which bodes well for the validity of the coding technique

utilised here. The limited variety of accessible hues is the only restriction of the coding tool, according to Dhakal (2022). It implies that the researcher will have to pick and choose which codes to colour-code by hand if there are more codes than colours. NVivo's sentiments and relationship kinds are used as additional analytical tools. Data may be labelled as positive or negative using the sentiment tool. The relationship type tool shows whether the relationship is one-way or two-way.

Using NVivo for qualitative data analysis has several strong advantages. According to Amaratunga et al. (2002), researchers may efficiently store and organise many types of data using NVivo's systematic approach to data organisation. It includes publications, field notes, interview transcripts, and more. Researchers may utilise the intuitive interface to sort data according to themes, codes, or other pertinent criteria, allowing for a more organised and methodical investigation. The researcher may go deeper into the data and offer more important insights by employing this organisational framework to facilitate the study of patterns, correlations, and themes. Data analysis and classification are two areas where NVivo shines. Scientists can sort large amounts of text or other data sources into meaningful categories according to relevant themes, concepts, or patterns using NVivo's coding tool. This method streamlines analysis and lets researchers spot themes and patterns (Antwi & Hamza, 2015). Researchers may easily find coded data and compare it to other sources using NVivo's powerful search and query capabilities, allowing for a full examination of the dataset. These methods let researchers find subtle but significant discoveries that would be hard to find by hand without the use of Nvivo.

Lastly, NVivo encourages openness and cooperation regarding data classification and qualitative analysis. Multiple researchers can work together on the same issue using this method, which promotes teamwork and the exchange of information (Flick, 2007). Everyone involved in the analysis can quickly see who is responsible for what, thanks to NVivo's audit

trail tool, which also logs project modifications. The researcher utilised the coding comparison query tool to ensure the validity and reliability of the conclusions reached from the qualitative data during the theme analysis. Since the researcher lacked experience with NVivo coding before beginning this project, this tool was used to determine the extent to which two individuals' coding processes overlapped. There was much overlap in the results, which bodes well for the validity of the coding technique utilised here. According to Dhakal (2022), a restricted palette is available in the coding tool.

So, the researcher must decide which codes to colour if there are more codes than hues. Use NVivo's Sentiments and Relationship kinds as additional analytical tools. Data may be labelled as positive or negative using the sentiment tool. The relationship type tool shows the direction of the link between two data sets, which can be either one-way or two-way. The researcher utilised the coding comparison query tool to ensure the validity and reliability of the conclusions reached from the qualitative data during the theme analysis. Since the researcher lacked experience with NVivo coding before beginning the project, this tool was necessary to determine how much the two coders' work overlapped. The great degree of concordance provides credence to the study's classification system. The coding tool has a limited colour palette, according to Dhakal (2022). So, the researcher must decide which codes to colour if there are more codes than hues. Use NVivo's Sentiments and Relationship kinds as additional analytical tools. Data may be labelled as positive or negative using the sentiment tool. The relationship type tool shows whether the relationship is one-way or two-way.

Using NVivo in their case study research, Braun and Clarke (2012) collected a large quantity of data from several sources, adding to the evidence supporting the theoretical advantages of NVivo. While analysing data collected from interviews, media reports, field notes, internet maps, children's artwork, and interviews, a problem emerged. The study used NVivo to organise and analyse the data, making sure that the child's viewpoint, which was

important to the study, was appropriately conveyed. This quality is highly useful in scientific contexts, where the ability to repeat experiments and accept new ideas is crucial because of its extensive feature set; NVivo is a must-have for any serious researcher interested in qualitative data analysis. Consequently, this study's focus group and interview data were analysed using NVivo.

Qualitative Results

Twenty-four farmers participated in the interview to provide insights into the research questions and hypothesis.

Table 4.23-Age Distribution of Qualitative Respondents

Age Group	Frequency	Percentage
21 – 30	3	12.5%
31 – 40	10	41.7%
41 – 50	8	33.3%
51 – 60	3	12.5%

Source: Focus group discussion 2024

The age breakdown of our sample of respondents is presented in the table above. It can be seen from the above table that the largest age group of the respondents is between 31 and 40 years old, or around 41.7%. The second-largest age group is 41–50 years old. The least likely age group is between 21 and 30. 51-60 and 31-40 are the same, 12.5%.

Table 4.24-Showing the Educational Qualification of Participants

Educational Qualification	Frequency	Percentage
High School Diploma	9	37.5%
Bachelor	9	37.5%
Masters	5	20.8%
Others	1	4.2%

Source: Focus group discussion 2024

Among the responders, 37.5% have a bachelor's degree or above, indicating that a sizeable fraction has completed either the high school diploma or the equivalent. The percentage of respondents with a Master's degree is 20.8%, with 4.2% falling into the "Others" group. The respondents come from various educational backgrounds, as seen by this distribution. The majority of them have finished either a high school or undergraduate degree. The qualitative study aimed at the following research questions: Question 1: From 2011 to 2020, what kinds of green finance policies and incentives did the Ghanaian government implement? Second Research Question: How do cocoa farmers in Ghana deal with the difficulties of securing green loans? Question 3: Does eco-friendly financing correlate with eco-friendly cocoa-producing methods? Fourthly, how do the incomes of smallholder farmers in Ghana relate to the link between eco-friendly financing and sustainable cocoa production?

Following the analysis, here are the results of the qualitative study: answers to the research questions derived from the in-depth interviews with the 24 people who made up the study's sample. For the sake of anonymity, they were identified as Respondents 1–24.

Research Question 1: How effective are the green finance policies and incentives that the government of Ghana enacted between 2011 and 2020?

The diverse list of green finance legislation and incentives cited by respondents, including at least one Ghanaian law or policy passed per year between 2011 and 2020, illustrates the range of knowledge about the topic and an effort by the Ghanaian government to support its implementation. Like any other country, Ghana's government is always talking about green finance and supporting farmers with incentives like subsidised credit facilities and grants to help them adopt some climate-smart technologies in agriculture.

"*I know such green finance policies and incentives implemented over the past 10 years."* Respondent (1)

"*I have some knowledge of some green programmes driven by the government of Ghana for the past 10 years. For example, I know programmes that preserve the environment by planting cocoa under the Cocoa Forest REDD+ Programme. That is basically for carbon preservation for the future. The other one (the Cocoa Livelihoods Programme) is driven by the Enhancing Cocoa Productivity and Sustainability project to improve farmers' livelihoods."* Respondent 2

"*I know they have many policies governing green finance and incentives that the government of Ghana has implemented in the last decade, especially the cocoa rehab. (the) national climate change policy*." Respondent (3)

From the summary of the reply, the Ghanaian government has certainly passed 36 policies and incentives, according to the consultants' responses. It is naturally due to the implicit reason that all the respondents repeated the policies. The policies and incentives are

shown below. Subsidised credit facilities for sustainable agricultural practices Grants for climate-smart technologies Cocoa Forest REDD+ Cocoa Livelihoods Programmes Cocoa Rehabilitation Programme National Climate Change Policy. Their answers to the above question reflected a unanimous verdict that they are aware of policies enacted by the government of Ghana for green finance and sustainable practices over the past decade; all respondents mentioned at least two government policies on green finance and sustainable practices enacted within the past 10 years.

From the interview extract, it is clear. It is indicated that the Ghanaian government's intent to create an enabling environment for green finance is the reason behind the policy. According to the policy, Ghana's main partner in the cocoa trade has committed to ensuring that cocoa comes from a sustainably produced, certified system based on four principles. The four principles are clean, better lives for farmers, their families, and communities, and deforestation-free. The above proves that green finance is the only significant sustainability finance that can help achieve the sustainability of cocoa farming.

"*They do agree that these policies have worked; bureaucracy is the sole reason these incentives and mandates were not more effective. These policies and incentives are helping promote more sustainable cocoa farming, but more could be done with their implementation and targeting of smallholder farmers*." Respondent (1)

"*Some incentive approaches have increased farm productivity while contributing to the conservation of forests, whereas others failed to materialise or were poorly implemented. Still, others who suffered from poor monitoring have varied in their degree of success in encouraging sustainable cocoa production. On the one hand, some efforts have helped to improve cocoa farms' productivity and environmental protection. On the other hand, some*

activities offer no added benefit to the farmers." Respondent (4)

Moreover, the challenges of bureaucratic processes and implementation must be considered alongside these policies and incentives. The resources and means required to execute such policies and ensure their tracking, financing, and promotion will always pose a daunting task. In further advancing the green finance initiatives and their successful actualisation as a determinant in promoting more green practices in cocoa production in Ghana, despite the anticipated short-term gratification captured within the earlier phase of these policies and incentive implementations, the jubilation could not be sustained, and this is indicative of the shortfall within the bureaucratic processes, insufficient finance, and the small gathering of resources available to implement these policies.

Their responses to the question above revealed a unanimous success in government policy. "*These policies and incentives have been somewhat effective in promoting sustainable cocoa farming*" (Respondent 1). "*These policies and incentives have had mixed effectiveness in promoting sustainable cocoa farming*" (Respondent 3). "*These policies and incentives have had varying levels of effectiveness in promoting sustainable cocoa farming*" (Respondent 4). Although the respondents concluded its effectiveness, Respondents 3 and 4 indicated the obstacles associated with its implementation, monitoring, coordination, and funding, such as increased efforts in monitoring the implementation of the integrated programmes, which are challenging because only a few staff have been hired to pursue these aspects of the programmes.

The interview responses showed that the government of Ghana's policies and incentives were successful, but they faced some challenges in their implementation and coordination; there was no adequate funding. In conclusion, the above proves that proper coordination and monitoring of policies and incentives are needed for more effective implementation; policies

and incentives also need more finance. They agreed on the ineffectiveness of the former and decided on the detrimental influence of bureaucracy on the latter two.

"*We cannot say that these policies and related incentives have been very effective, and we have yet to apply them properly or make them accessible to the farmers*", Respondent (1).

"*I have been partially successful in making cocoa farming more sustainable*", Respondent (2).

'*The programmes have simultaneously improved farm efficiency and environmental conservation*", Respondent (3).

"*Most of the initiatives have led to improved farm productivity and better conservation of the environment. However, others have suffered implementation, funding, and coordination challenges"* (4).

Some of the challenges mentioned in the policies and incentives the Ghanaian government implements include bureaucracy, implementation, monitoring, funding, and awareness of these policies and incentives. These green finance initiatives and policies were supposed to strengthen the Ghanaian government's policies and incentives, and this has helped Ghana a lot, especially in sustainable cocoa production.

However, the benefits of introducing these policies and incentives lasted for a short period. They were only briefly sustained, primarily due to the bureaucratic process involved in these green finance initiatives and policies and the lack of funds and resources to make them safe and effective. The answers to the question above (please indicate whether the government has implemented policies and incentives to promote sustainable cocoa farming). We came to a unanimous conclusion that the policies and incentives implemented by the government have been effective.

"*These policies and incentives have been somewhat effective in promoting sustainable cocoa farming"* (Respondent 1).

"*The policies and incentives have had mixed effectiveness in promoting sustainable cocoa farming*" (Respondent 3).

"*The policies and incentives have had varying effectiveness in promoting sustainable cocoa farming*" (Respondent 4).

Although respondents 3 and 4 concluded that the policies were effective, they also mentioned that they faced challenges in their implementation, monitoring, coordination, and funding. From the interview replies, we noticed that the government of Ghana's policies and incentives were successful, but the policies and incentives had some drawbacks in their implementation and coordination; there was also no adequate funding. In conclusion, we can see that good coordination and monitoring of government policies and incentives were vital for effective implementation. The policies and incentives also require financial aid. Subsidised credit facilities have served as an impetus for farmers to adopt sustainable practices.

"*The most important constraint has been the absence of proper outreach and tedious bureaucracy*." Respondent (1).

For the Cocoa Forest REDD+ Programme, which also reduced greenhouse gas emissions through actions to reduce deforestation and forest degradation, "*The low level of funding, combined with the bureaucratic complexities, meant it has been difficult for these projects to make big impacts in making land use practices more sustainable and protecting*

the forest areas." Respondent (8).

It has been much more effective than the Cocoa Rehabilitation Programme, which supports the rehabilitation of cocoa farms in ageing cocoa areas and the transition to more sustainable cocoa cultivation.

"*It was not very effective because it is a bureaucratic action because of the cocoa areas and inadequate resources.* "Respondent (13).

Sustainable production and socio-economic support of cocoa farmers via the Cocoa Livelihoods Programme have positively and effectively impacted farming communities for sustaining livelihoods.

"*Politically and bureaucratically, the programme has, however, been unable to reach all cocoa-growing communities due to very slow and complicated administrative processes and a shortage of resources.* "Respondent (14).

" *Another challenge that weighed against the policies and incentives the government implemented were the issues of bureaucratic hurdles*" (Respondent 1).

"*Lack of enough funding and complex bureaucracy*" (Respondent 8)

"*Bureaucratic processes and lack of access to resources*" (Respondent 13).

In summary, other challenges that pose problems with government policies and incentives include bureaucracy and a lack of access to resources. The responses offer ideas on how the government can improve the effectiveness of these policies and incentives in promoting human rights.

"*Reducing red tape and administrative hurdles that hinder access to subsidised credit schemes; increasing outreach or communication efforts to increase the participation of cocoa farmers; introducing improved programme performance monitoring and evaluation metrics*." Respondent (1).

"*Strengthening coordination among governmental agencies and other stakeholders on the ground for policy enforcement, expanding investment in infrastructure and extension services, and ensuring equal access to resources and support for smallholder farmers*." Respondent (2)

"*Enhanced investment and support in agricultural research and extension services, greater availability of credit and insurance schemes, and more strategic engagement with private sector entities to promote responsible supply chain practices*." Respondent (3).

"*To improve the transparency and accountability of green finance, improve access to technical assistance and training programmes, and foster stronger coordination among government agencies, NGOs, and the private sector*". Respondent (6).

"*Increasing investment in agricultural research and innovation, strengthening extension services and improving policies that include women farmers, smallholders, and sabla producers*", Respondent (17).

Respondents' responses to the query above were suggestions to strengthen the impact of the policies and incentives. Their responses emphasised a range of suggestions to ensure the continued effectiveness of government policies, such as *simplification of the application process, better outreach and raising awareness, and more effective monitoring and evaluation* (Respondent 1); *better coordination among the stakeholders; more investment in infrastructure and extension; and equitable access to resources* (Respondent 2).

Respondent 3: '*Increasing investment in agricultural research and extension, expanding access to credit and insurance schemes, and promoting partnerships with the private sector*' Respondent 6: '*Increasing transparency and accountability, improving access to technical assistance and training programmes, and intensifying the coordination among the parties*' Respondent 17: '*increasing investment in agricultural research and innovation, improving extension services, and promoting inclusive policies.*'

Some of the policies will be more effective if the application process is shortened, there is more awareness, better coordination and monitoring, more funding and investment in health, and access to training and extension services, and stakeholders are more collaborative and work together when strengthening their health systems.

Research Question 2: What challenges do cocoa farmers in Ghana encounter when trying to get environmentally friendly financing?

Besides the challenges constraining the efficacy of the government's policies and incentives geared towards green financing in Ghana, the farmers are also confronted with certain challenges in their efforts to access environment-friendly financing from financial institutions. The respondents who tried to access the environment-friendly funding highlighted their experiences:

"*Our biggest challenge was understanding the requirements for application and documentation.*" Respondent (5)

"*One obstacle I faced was finding the paperwork needed to prove the environmental sustainability of my farm*". Respondent (9)

"*The biggest challenge was meeting the demanding standards about environmental sustainability and social impact*", Respondent (12)

"We had difficulty because we did not know how to apply for green finance. In addition, it is necessary to have sufficient information, appropriate connections with potential borrowers, and spare time. During a collaboration with project companies, we had difficulty because we did not know how to apply for green finance." Respondent (15)

" *The biggest challenge was the strict eligibility criteria for environmental sustainability and social impact*." Respondents 18

The answers from respondents highlight some key challenges in navigating and satisfying the application process criteria commonly expressed within these domains. The application processes that aim to focus on environmental sustainability, social impact and green finance are apparent in the common issues flagged up about understanding documentation requirements (Responders 5 and 9), proving ecological sustainability (9), providing evidence, and fulfilling stringent criteria (12 and 18). These findings expose the rigorousness of these selection processes, where these young professionals noted their efforts, highlighted the intricacy of the paperwork and elaborated plans that were required as part of their applications. Alongside these challenges of knowledge and resources (adapted from Respondent 15) were also a few responses that hinted at how the experience of practical barriers was made worse by the emotional implications of having to present in official, quantified terms a public proof of an impact on the environment and social good.

The difficulties farmers often encounter in accessing green farmers include complicated administrative registration processes, complex documentation requirements, in-depth requirements linked to sustainability objectives and impact in the social and

environmental sphere, and lack of awareness and resources to proceed through the application process. The strict requirements were:

"*Demonstrating environmental sustainability and social impact made it challenging to secure green finance*." Respondent 5

Farmers had to prove and demonstrate (through evidence) and provide a track record (or demonstrate their track record) for the environmentally sustainable management of their cocoa farms. These obligations required farmers to document and report on environmentally sustainable activities. Without these bottlenecks and requirements, all estate parties agreed that green finance presented considerable promise in Ghana for enhancing environmentally sustainable cocoa farming by providing incentives for environmentally sound practices and facilitating investments in climate-smart agriculture and cocoa growing.

Research Question 3: What is the relationship between green finance and sustainable cocoa farming practices?

The questions are meant to determine whether there is any association between eco-friendly funding (green finance) and eco-friendly cocoa farming practices (sustainability practices); considering the participants' responses, the consensus is that there is a direct relationship between the two variables.

"*There is a direct link between the availability of green finance and the ability to grow cocoa sustainably. With green finance, there are resources and incentives to build up and enrich biodiversity, which we have not had at our disposal before, offering improved measures to grow cocoa more sustainably (for example, agroforestry, organic farming, planting trees), all of which help to boost the health of the soil. Such measures can increase resilience in the face of a changing climate*". Respondent (2)

"*We see a clear connection between access to green finance and the sustainability of cocoa production. Access to green finance can help invest in sustainable practices, technologies, and facilities, improving the sustainability of the environment and society*." Respondent (3)

"*This is due to the direct correlation between the development of green finance and the expansion of sustainably produced cocoa. Green finance will contribute to improving the health of the soil, the preservation of biodiversity, and the resistance to the effects of climate change, all of which are essential to sustainably producing cocoa*." Respondent (4)

"*Green finance provides funds and incentives to adopt sustainable farming practices to ensure the sustainable use of cocoa and the natural environment*." Respondent (9)

Their answers to the above question unanimously concluded that shoppers buying green finance will lead to green farm practices. Each answer explains some relation between the concepts of green finance and green farm practices and how the main influence on them is through funding and subsidies for environment-friendly agriculture. More than all the respondents agreed that green finance plays a role in sustainable cocoa farming. Most of them also maintain that green finance availability provided the needed funds, which motivated them to farm sustainably. Again, this indicates the perceived high acceptability of the relationship between finance and farming in terms of sustainability.

As Respondent 2 put it, "*With green finance, more nature-based production systems can be supported, e.g., agroforestry and organic farming, which improve soil health and biodiversity and ensure more climate-resilient production.*"

Equally, Respondent 3 noted: *"We can see that with proper measurement of green finance, our farmers can invest more into production in a more sustainable way. For example, more investment in infrastructure*."

Many of the responses featured sociological answers, such as increased soil health, prevention of flooding, increased biodiversity, and mitigation of the impacts of climate change.

"*Green finance provides funds for the community for the application of green fertilisers and good practices in farming, which will lead to good soil health and an improvement in the overall biodiversity*", Respondent (4).

"*Through green finance, green practice will be practised, green infrastructure will be constructed and produced, green finance will be provided, and grower productivity in cocoa production will be enhanced, which does not affect the environment*" (Respondent 9). Although rarely explicitly mentioned, a few authors hint that the green driver can be conceived as a subsequent set of prerequisites for promoting the social sustainability of many cocoa farmers through improving infrastructure or productivity.

The data in the interview responses reveal the obvious influence of green funding or eco-friendly finance as the most crucial enabler of sustainable cocoa farming. The association between them is approached more by their means of funding, which is given out as an incentive to cocoa producers to gradually practice sustainable farming methods, which results in more favourable environmental and social effects for cocoa farming communities. The above justifies green finance's significant role in providing sustainability to cocoa farming.

Most respondents did not enjoy green finance, and only one confessed to having gained it. He also enlightened me on the impact of green finance on implementing sustainable cocoa production practices on his farm.

"*This will change the way I source cocoa beans for export. I will focus more on working with farmers who use sustainable methods because this is what green finance institutions and buyers expect."* Respondent (3)

It indicates that green finance impacts green production and also promotes partnering with farmers who practice green production, encouraging other farmers to practice green

production. The respondent said, "*Encourage the farmers to practice shade-grown cocoa cultivation and organic farming*." Respondent (4)

Respondent 3, in his response, elucidates how green finance has shaped his sourcing practices and interactions with the farmers: If we buy at the lowest price, this could affect the buyer's price paid for the cocoa. However, we have built a policy to get connected with whoever deals with the farmers practising shade and organic farming so that we pay farmers not only for their cocoa but for the extra efforts that they put in them. He is willing to pay more than the market price for this extra product from the farmers, not out of altruism but because green finance and its ethical buyers are raising demand for sustainability.

In addition, the respondent's reported efforts to persuade other farmers to reduce their use of inputs help to demonstrate the ripple effects—decisions that those who interact with the respondent will incorporate into their practices, too. The efforts of Respondent 3 can grow these practices among other small farmers, larger plantations and other agricultural operations in the sector, expanding the environmental sustainability of cocoa production and the resilience of local farming communities.

More broadly, Respondent 4's narrative shows that green finance connected to the sustainability agenda is moulded by itself, benefiting the company and the overall market by adhering to supply chain decisions under the guise of sustainable agriculture and its promotion among supply chain peers. This unique example shows that when financial incentives for sustainability are directed towards strategic sectors, it can change how financial incentives reshape markets in ways that also benefit the sustainability of the landscape and the livelihoods of citizens.

Research Question 4: What role does farmers' living income play in connecting green finance

and sustainable cocoa production in Ghana?

The study further tried to determine the interference (if any) of the farmers' living incomes in the correlation between green finance and sustainable cocoa practice; the living income of the average cocoa farmer in Ghana was first established to measure the interference of their incomes.

"*It is somewhere in the middle. It depends on farm size, the productivity of the farm, market prices, and input costs*.' Respondent (1).

"*It is strongly variable, subject to conditions including farm size, productivity, market prices, and access to resources and services. Many cocoa producers struggle to achieve income stability due to fluctuations in market prices and production challenges*." Respondent (2)

"*It depends on the farm size, its productivity, fluctuations in market prices or production risks, and whether they can access or receive support from the provision of products and services*." Respondent (4)

Their responses to the above question depict the fact that a small farmer's income is not entirely certain but relies on a few factors. In addition, the factors influencing small farmers' living income came out unanimously: farm size, productivity, market price, input costs, and availability of resources. Market prices are the apprehension factor that causes farmers' living income to increase or decrease, depending on the market price attached.

In addition, as the average income for a cocoa farmer cannot be pinpointed, this sector can only be attributed to the moderate- or average-income earner, which was one of the questions adopted by our respondents. RESPONSES Yes, it should be accessible exclusively to low-income households. No, I believe that the level of income contributes to the level of access to green finance. While it does not directly affect households, my understanding is that it affects businesses passionate about sustainability.

The farmers' incomes will affect their access to green finance. Financial institutions must force the farmers with high incomes to provide more green financial aid. Once the farmers with high incomes receive the assistance, they can have more money to develop the farmland and repay the aid. On the contrary, farmers with low incomes will lose their chances to access green finance because they cannot provide any collateral, monetary capacity, or credit risk for the lenders.

This respondent's perspective is so apt because financial institutions are always inclined towards friendly customers with a great financial base, and they are always believed to be more likely to be paid back on the facility. Green finance is a situation in which the farmer's income might matter. Farmers with higher incomes might have access to financial instruments. Financial institutions might see them as lower-risk borrowers than other farmers, making them more eligible for green finance. In contrast, other farmers (with a lower income) might have challenges getting finances with limited collateral and financial capacity and might be seen as a higher risk by financial institutions. Unfortunately, several people did not respond to follow-up questions by email or because their emails were inaccessible. The first three quotes are from a female respondent (aged 57) representing a fisherfolk-based autonomous progressive organisation in India; the second three quotes are from a male respondent (aged 41) working with a sustainability and social enterprise in Indonesia.

The above respondent supports all that was ascertained from the first respondent and says that he considered farmers with higher earnings as low-risk borrowers. It is another stereotype perception that financial institutions possess: since they are in business for generating wealth or profit, they invest in low-risk assets, that is, farmers who have higher earnings, while farmers who are low-risk members could not have access to green finance or any other kind of credit facility.

In this regard, our respondents all reached the same conclusion: the higher the farmer's income, the better they will have access to green finance, citing that higher-income farmers have access to more financial resources. As such, they can meet the presentation requirements for green finance and are also seen as low-risk customers in any transaction with a financial institution. Conversely, lower-income farmers are seen by financial houses and agencies as risk credits and, as such, have very little access to all forms of economic resources. Ultimately, this all goes to confirm the role of farmer income in accessing green finance.

Furthermore, respondents assessed farmers' living incomes compared to agriculture using sustainable cocoa production, and we received both positive reflections.

"*The government can incentivise us farmers in several ways to extend their cocoa farming activities more sustainably. With higher (income) levels, they can invest in sustainable agricultural inputs, technologies, training, and education. They will also have the means to adopt conservation practices and techniques for better soil management in cocoa trees. They will have some opportunity to diversify their livelihood in other sectors to ensure that their livelihood is secured so that their cocoa farm will be more productive and, at the same time, ensure the good stewardship of the environment*." Respondent (1)

." *With higher incomes, farmers could afford to invest in sustainability-enhancing inputs, technologies, and practices like agroforestry, organic farming, and soil conservation practices. With higher incomes, farmers could have access to financial services, professional extension training, and inputs important for the sustainability of their enterprise. For instance, advanced and certified nurseries use organic resources and NPK fertiliser at an early stage of sapling growth so that the process hastens successfully. At a higher income, farmers could diversify their incomes, reduce their dependency on cocoa alone, increase their economic resilience, and survive financial shocks more easily. They could withstand climate change impacts*." Respondent (3)

"*Green finance will increase in general the sustainability of the farming activities of cocoa farmers in the following way: with an increased income, cocoa farmers will also be able to obtain more sustainable farming inputs, technologies, and practices such as agroforestry, organic farming, soil conservation, etc. Secondly, income will increase the ability of farmers to obtain training and extension services and implement climate-smart agricultural practices and productivity. Thirdly, it will improve the sustainability of farming activities in communities in general.*" (Respondent 8)

Higher income can bring more opportunities to access green finance or favour reformation to expand farmers' abilities and increase the area of plantations. Participants 'responses to the above question have shown a unanimous opinion that farmers' living income positively affects the sustainability of cocoa farming practices. Respondents further indicated that sustainable farming technologies can be employed with financial capacity. Those technologies include conservation practices, implementation of soil management (Respondent 1), implementation of agroforestry, organic farming, and soil conservation (Respondent 3), and implementation of agroforestry, organic farming, and soil conservation (Respondent 8).

Interview responses reveal that higher income allows for introducing and scaling sustainable farming technologies, building resilience to economic shocks and climate impacts, giving access to quality extension services, and early adoption of climate-smart best management practices for improved productivity. Therefore, the factors highlighted above basically affirm the critical role of farmers' living income levels in the sustainability of cocoa farming in the community.

Evaluation of Findings

The research findings show that farmers at the small-scale level in Ghana know about green finance, and many of them have tried to gain access to green funds. The farmers also know about climate-smart green policies and incentives identified and scheduled by the government of Ghana between 2011 and 2020. Between these six policies and incentives that have been endowed by the Ghanaian government, including subsidised credit facilities for sustainable agricultural practices, grants for climate-smart technologies, the Cocoa Forest REDD+ Programme, Cocoa Livelihoods Programmes, the Cocoa Rehabilitation Programme, and the National Climate Change Policy, only two of them are well known by farmers.

However, issues such as improper implementation, monitoring, long-term funding, coordination, and awareness have affected the efficiency of these policies and incentives. Besides these setbacks, bureaucratic processes and the lack of affordable resources are the main reasons for the problems.

To make the policies and incentives more effective, the application process for accessing subsidised credit facilities should be simplified, and the awareness and outreach mechanisms should be increased to enhance participation among cocoa farmers (see Krantz, 2001, who found that sustainable policies motivate farmers).

More mechanisms should be implemented to track the processes, protect them, and effectively clean up questionable dealings. Governmental agencies and stakeholders should coordinate implementation. There is also a need to scale up investment in infrastructure and agricultural research and provide equitable access to green finance for smallholder farmers.

Besides the challenges of green finance policies and incentives, some smallholder farmers who have tried to apply for green finance products have experienced a tedious application process with stringent requirements regarding proof of environmental sustainability and social impact. The rigorous requirements state that smallholder farmers should demonstrate

environmental sustainability and social impact. Also, most farmers were unaware of how to complete the application process. Farmers were required to prove and have a record of environmental sustainability, as shown in the box below. It, in turn, required documentation and reporting of ecological sustainability activities and practices requirements that the farmers have since manifested. From the table below, only 1 out of 24 respondents has accessed Green Finance and confirmed that it has impacted how they farm or do business because he prioritises eco-friendly practices on the farm and works with farmers who practice sustainable farming practices. Therefore, without the challenges and stringent requirements above, it was concluded that green finance has much potential to incentivise environmentally sound practices and bring investments into climate-smart agriculture in Ghana.

The survey also showed that green finance availability influenced the sustainability of cocoa farming. Green finance funding and subsidies create incentives and resources to adopt sustainable practices such as agroforestry or organic agriculture, which could boost the health of the soil and biodiversity, among others, and enhance climate resilience (Su et al., 2021). The study also showed that the level of the farmer's income influences access to green finance. The cocoa farmers with higher incomes appear to have higher financial stability, which makes them more attractive creditworthy borrowers to lenders for their higher ability to meet capital calls. Financial institutions view higher-income farmers as lower-risk borrowers because they are less likely to default on loan repayment (Kumar et al., 2018). The same might not hold for cocoa farmers with lower incomes. Farmers with lower incomes might have limited financial capacity to serve as collateral and might be viewed as higher-risk clients by financial institutions. This leads to restricted access to green finance.

Furthermore, from the evidence gathered, it was confirmed that the income of the people directly encourages their cocoa farming activities from the viewpoint of sustainability. The reason is that, due to the farmers' improved income level, they might be affluent enough

to purchase the needed sustainable agricultural inputs and technological innovations alongside tailored training programmes (Gockowski & Afari-Sefa, 2016). Afterwards, they may be well positioned to administer various conservation schemes, establish effective soil management techniques, and diversify their sources of income. Consequently, yield will improve, coupled with effective and reasonable environmental maintenance. Again, increasing the income of producers gives them room to seek, receive, and make use of training and extensions on sustainable farming operations, which will, in turn, improve their productivity while tending to put less pressure on the natural environment, which invariably ensures their survival against potential economic shocks and impacts of climate change. As the income flow increases, the opportunity to access green finance opens up, which is geared towards enabling the farmer to adopt and implement sustainable cocoa production practices.

Chapter Summary

The Ghanaian smallholder farmers are adequately trained in green finance, its products, benefits, and the rules and incentives that back them. Ghanaian farmers dominated the Asante kingdom sugar plantations of the Ashanti Empire in the 19th century. The government documents extremely well-intentioned programmes and incentives. Still, they are also entirely devoid of the steps needed to implement them, monitor and follow up on them, finance them, and coordinate all of them to make its green finance products work. Despite the laudable intentions of the government's climate and environmental sustainability rules, they fail to influence the techniques of cocoa production by smallholder farmers due to poor awareness, monitoring, finance, coordination, and implementation. The extremely strict rules demanding proof, reporting, and documentation of environmental sustainability efforts and the cumbersome manner in which green finance is accorded make it difficult for smallholder farmers to access green funds. The accessibility of green financing is collinear with the

sustainability of cocoa farming, and the farmers' living incomes are also collinear with the sustainability of cocoa farming techniques. The fact that farmers' living incomes and the accessibility of green financing are collinear is corroborated by this.

To assure the trustworthiness (verification) of the study, internal validity (credibility), external validity (transferability), reliability (dependability), and objectivity (conformability) must be achieved (after first introducing these criteria in the chapter). To ensure that the data are reliable enough to draw conclusions from, the text briefly describes what was done to meet each reliability criterion. If the results from the respondents' responses are credible, then we can assume they are reliable and trustworthy. Transferability can be defined as the extent to which the findings and conclusions of a study can be appropriately transported to a different but comparable setting. The reproducibility of the results is what we mean when we speak about the dependability of a survey. Researchers who can maintain objectivity during data collection, analysis, and reporting (thanks to methods such as triangulation and reflexivity) are described here as conformable.

We pre-tested the questionnaire to ensure it represented the target constructs intended to be measured. We administered a pilot survey to 10 participants to test the instruments' efficacy and ensure that the items were clear and the responses were straightforward. Based on comments from the pilot survey respondents, we fine-tuned the questionnaire before distributing the main research. Similarly, to ensure credibility and reliability, the research instrument has to be in harmony with the intentions of the research topic. Some examples of these methods used in the study are respondent verification, a well-documented audit trail of research materials and processes, and first-level triangulation of researchers. To increase validity, reflexivity was employed. Only then did researchers deliberately become aware of their agency and how it could affect the study. Other methods, which include auditable, systematic approaches for collecting and analysing data and the systematic and transparent

ways they documented and reported these, together with peer review, were employed. This peer review is the process of other researchers commenting on the methodology, data, and results used in the study. Here, the cocoa farmers are categorised using stratified random sampling methods. We analysed the agriculture census records of cocoa farmers to determine the sampling frame. We developed a specific recruitment strategy to ensure that the study's sample was representative of the total population of cocoa farmers. To ensure that the quantitative data is credible, we employed a randomised sample procedure within each group to give every farmer an equal chance to participate in the study. We collected quantitative data on sustainable chocolate production and green funding through in-depth interviews and focus groups. We used NVivo thematic coding to capture patterns and iterations in the qualitative data.

In summary, to ensure that the complexity of the relationship between green finance, cocoa production, and farmer income is well understood, we will combine our quantitative and qualitative findings. This method is called triangulation, which is defined as comparing and cross-verifying findings. These approaches enhance the credibility and reliability of the study.

The study used a mixed-method approach, contributing to data triangulation and positively contributing to its validity and reliability (Creswell & Clark, 2018). The two major instruments used were a structured questionnaire and a focus group session. The major instruments used in a research project are normally the most important factor in determining the validity and reliability that can occur in a project. Statistical adjustment is employed to avert the common method variance when variables collected in a project are influenced or exposed through the shared method. The data collected from the two sources (survey questions and focus group sessions) must be separated, and the technique employs several techniques for data gathering to evade the common method bias. Focus groups and interviews are used in this study to acquire data results, which help prevent frequent technique bias. The qualitative

analysis of the data from the focus groups and interviews was done using theme analysis. Theme analysis was done using NVivo, a computer-assisted qualitative data analysis software (CAQDAS), which allows for the collection, arrangement, analysis, mapping, and reporting of qualitative data. Because the researchers will use the programme firsthand, they wrote this together to create more legitimacy, ensuring the reliability and validity of the results. In this study, 24 respondents participated in the interview and focus group sessions.

As a researcher, you cannot have prior experience with the data. Still, there is an NVivo command called the coding comparison query to check the overlap between two coders, which researchers will code to ensure they are reliable. The darker the colour in the corresponding row or column, the more overlap between the different coders and the better and more dependable they are for this project. The green colonies created, with the higher overlap, indicate good work between the two coders using NVivo in this project. Because the major instruments were core during the study, about 318 questionnaires were gathered for the quantitative analysis; there were 82 female and 102 male participants, with a percentage of the majority of the male participants. Most participants are in the age bracket of 31–40; about the same percentage have never received green finance training or are even members of the Cocoa Farm Cooperative.

To exemplify our model of the driving forces of green finance and sustainability, 26 questions were tested along the drivers of green finance, sustainability, and control variables using principal component analysis and a variance rotation. Through this study, the sample has been proven to be large enough for a factor adequacy test and that the variables correlate effectively. This paper has used further discriminant and convergence validity tests to illustrate that the factor analysis has been conducted well. The results from convergence validity tests show that all the variables satisfy the convergent theory validity, as all variables are bigger than the suggested minimum. A discriminant validity test was performed on the variables using the

Fornell-Larcker criterion and the heterotrait-monotrait rule. Furthermore, Figure 1 presents the structural equation model, where the independent variables influencing green financing are understood as the moderator variables, sustainable agricultural techniques, and government rules and motivations.

Moreover, market demand and the money farmers gain from cocoa are observed as influential variables in driving the green financing effects. The variables drive the effects of green finance on sustainable cocoa output in Ghana through the structural equation model. However, the amount of money that smallholder farmers make decides the variables' impact.

CHAPTER 5: IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

Implications

The study found that cocoa farmers are aware of green finance mostly through grants from chocolate makers who allocate grants through their suppliers to farmers as part of the CRS initiatives; smallholder farmers in Ghana have unsuccessfully tried to use green funding from the banks and the government. Cocoa farmers in Ghana have a fair understanding of the green finance(sustainability) policies, programmes, and incentives that have been in place between 2011 and 2020. However, Hernandez et al. (2022), in their work, Greening the Cocoa Sector in Ghana: A Review of Government Policies and Incentives, argued that issues of awareness, financing, monitoring, and implementation procedures have hampered the effectiveness of the six policies and incentives that Ghana has implemented over the years. Despite this, bureaucratic bottlenecks and inadequate resources significantly worsen the situation. Implementing a process for applying to subsidised loan facilities would enhance the effectiveness of the policies and incentives. To strengthen the effectiveness of the policies and incentives, it would be beneficial to increase awareness and implement policing measures to encourage more cocoa growers to participate in the processes.

As it stands, cocoa farmers who have tried to apply for green finance products have gone through what the authors of Mensah (2023) call extensive documentation requirements and a bureaucratic paperwork application process. Strict social impact and environmental sustainability standards also apply to these farmers. High standards not only make it challenging for these farmers to obtain green finance but also require them to demonstrate their actions' social advantages and environmental sustainability. Moreover, farmers often lack sufficient information about the requirements and procedures of the application process. Farmers who want to prove that they are environmentally conscious in the way they farm need

documents and reports to file to meet these ends, which, most of the time, are extremely cumbersome.

They would shift smallholder practices to be more environmentally sustainable. The findings suggest that green financing, especially the chocolatier grants, has resulted in changes to agricultural practices, including more sustainable farm practices, working with farmers already practising sustainable farm practices, and motivating other cocoa farmers to do the same. If these barriers and regulations were absent, green financing could encourage eco-friendly practices and investments in climate-smart agriculture, which could be more sustainable for cocoa production in Ghana.

Smallholder farmers should welcome investments in infrastructure and agricultural research to prepare them for the development of improved cocoa strains, and they should also be able to take advantage of the influx of green finance. However, each company, organisation, and individual are unique, making comparisons impossible. Khan et al. (2023) note that this perspective highlights the possibility that a firm's resources are inherently likely to be unpredictable in their emergent effect, and this unpredictability may lead to the creation of a sustained competitive advantage. Research has focused on organisational performance and the Resource-Based Theory (RBT). Some companies may perform better after utilising the resource-based theory (Naidoo & Gasparatos, 2022). The RBT provides a strong theoretical framework for analysing the relationship between Ghana's sustainable cocoa production and green finance. Furthermore, the Resource-Based Theory highlighted the importance of a firm's strengths in its distinct resources and capabilities for sustained competitive advantage (Khan et al., 2023).

Companies in Ghana's green finance infrastructure use green finance, but not all businesses are equally accessible. The biggest question is how much Green Finance actually gives us an edge in the space. Some data shows that companies that can obtain green finance

and invest it in sustainability are more likely to outperform competitors who cannot since green finance is not widely available. Variations in a company's resource base influence its capacity, and Green Finance influence the overall business model of a company. If we can understand what effect green financing will have over the long term on cocoa sustainability, then perhaps we can see how it will support resilience and productivity. In addition, as RBT proposes, resource immobility provides a competitive advantage. Companies that borrow green finance can use this in ways that others cannot, giving them an undoubted, long-term competitive advantage. Green finance could provide companies in the cocoa industry with an oversight advantage. If research on the effects of resource immobility on company performance, particularly sustainability, is any indication, companies operating in the cocoa industry could gain a competitive advantage by using green finance to plant trees. The sector urgently needs this advantage, particularly because companies that fail to comply with laws and other international regulations risk facing penalties. Furthermore, tropical forests brimming with biodiversity cultivate cocoa, and shifting production towards sustainable practices may, over time, preserve the myriad ecological benefits, including pollination, watershed management, soil fertility, and carbon stock sequestration. Preventing deforestation and forest degradation protects animals' habitats and enhances people's livelihoods in regions with limited or no trees.

As pointed out by Naidoo and Gasparatos (2022), the small-scale income of a farmer is a kind of "comorbidity". It can affect their ability and willingness to embrace new practices, standards, and technologies, which come at an initial cost and with some risk. Better-income farmers are more likely to adopt eco-friendly practices such as agroforestry, cocoa under the shade, organic fertilisers and insecticides, irrigation systems, and renewable energy technologies. These practices could be encouraged through "new and sustainable financing models", which enable a green and multi-ethnic economic recovery along the entire value chain from crops to chocolate production and post-harvest infrastructure. In addition to mitigating

climate change, sustainable management can increase yield without quality losses while providing ecosystem services and protecting biodiversity. Additionally, the more income farmers receive, the more negotiating and bargaining power they have in the cocoa supply chain and the more equitable their role becomes.

This research showed that farmers' access to green investments is inversely proportional to their incomes. Farmers with higher incomes, whose yields are more predictable and less prone to natural hazards, may be a better risk for financiers and have more ability to meet the green-financing requirements. Furthermore, financial intermediaries may be willing to provide green finance to these farmers because the lender considers them less risky borrowers. However, previous literature on credit risk and low-income borrowers highlights that small-holder farmers, particularly women, may face challenges in obtaining loans due to their threshold incomes, lack of resources, or reluctance to risk credit denial. Less-well-off farmers may also have difficulty obtaining loans because they have little collateral, do not have cash or money to put down, and/or are risk-averse concerning credit bureaus.

Farmers with more disposable incomes may be able to bargain for market prices, gain access to new markets, obtain green loans from the banking system, and unlock greater value-added pathways, as the European Commission further confirmed. Additionally, farmers are not always aware of the application process. Farmers must measure, value and report on their operations as evidence of how they apportion funds to environmental conservation and sustainability. The research confirmed that green finance was indeed changing how farms are operated. In Ghana, more emphasis was placed on having a sustainable production landscape, the use of 'proven' green farmers to lead the way, and how to propagate their successes. Green finance can encourage adopting green practices and investments in 'climate-smart' agriculture. Provided the state's alleged greenwashing, the 'green deserts' and the rules do not stifle the

eco advantages, guardianship and exclusive ownership of eco-farms become the much-needed key to more sustainable cocoa production in Ghana.

To conclude, businesses in Ghana's sustainability finance and cocoa-growing sector with access to eco-loans can use such resources in ways other companies which do not have eco-loans cannot. Empirical investigations into how resource immobility affects firm outcomes, particularly climate change, suggest that cocoa companies within and beyond Ghana could be afforded an advantage vis-à-vis other competitors in the chocolate-producing industry by leveraging their green-finance disparity in the form of competitive advantage. More so, the chocolate industry is sorely in need of a novel competitive advantage. More disposable income can improve a person's willingness and ability to adopt the practice, norms and technology that cost cash upfront (or otherwise involve some risk); possible funding to eco-literate practices like agroforestry, shade-grown cocoa, organic fertiliser and pest control, irrigation infrastructure, renewable energy technologies, etc. Apart from mitigating the high cost of climate change, adopting sustainable techniques in the chocolate industry could, in theory, translate into high yield with commensurate levels of quality and even improve ecosystem services and biodiversity.

Furthermore, systems have to be put in place to check progress across actors and stages of implementation so that the strategy is implemented as intended. One of the theoretical underpinnings of this research was to bring systems and actors together to address problems systemically. However, the factors found to be most relevant and important for choosing their theoretical frameworks for this study are those addressing green finance effects on Ghanaian cocoa farmers, as they are by far dominant in the full presentation. This framework shows how intricate the diverse aspects of agricultural advancement are; it calls upon individuals, groups, and organisations to be involved in offering solutions. Therefore, because of the huge nature of this framework, it was not left out among the theoretical frameworks used in this research.

It shows the intricate diversity of agricultural advancement activities, with no single challenges or solutions. Individuals, groups, and organisations should make a concerted effort to offer various solutions. There was an increase in the use of enhanced farming techniques and technology by farmers in Kenya. According to Herbert et al. (2017), this coincided with efforts to improve the capability of farmers and other crucial actors. It was possible through Agricultural Innovation Systems.

The Agricultural Innovation Systems framework was critical in this research because it made it easier to put measures in place to use agricultural innovations by interventions that enhance people's skills. The researchers posit: 'By 2017, farmers report consistent use of improved farming practices, shedding light on (AIS) as both a process and a framework for studying agricultural knowledge domains and the institutions that generate and disseminate such knowledge.' According to the works by Lamprinopoulou et al. (2014) in their paper titled 'Financial Systems and Green Policies: Towards Sustainable Cocoa Farming, ' one of the things they will be measuring is the existence of a friendly funding system and support from the government on sustainable cocoa farming. Some of the things that will constitute the programme are research into sustainable farming practices, the farmers' cooperative system, and the development of sustainable cocoa farming (longer-term options for farmers, financially and non-financially).

This study used the AIS framework to examine how cocoa is produced in Ghana and what the country has been doing to develop policies for sustainable cocoa farming. Part of the research's statutory duty was to look at how to strengthen the innovation system for sustainable cocoa farming and to encourage cooperation among cocoa value chain actors. These are people role players: agricultural producers, sprout suppliers, Agro-processors, Exporters, Financial institutions, Government agencies, and others. As implementation takes place, these stakeholders and government agencies must collaborate.

Second, there is a significant and evident direct relationship between access to green finance and the sustainability of cocoa production. Green finance and incentives to support agroforestry systems, the use of organic fertiliser, and integrated pest management (IPM) can promote soil health, biodiversity, and climate change resiliency. Several financial tools and mechanisms can help farmers implement sustainable cocoa production, such as organic cocoa, fair trade, and green cocoa, according to Deschryver and de Mariz (2020). Studies show that access to green finance prompts farmers to adopt and implement sustainable cocoa production practices, such as certification and good agricultural practices. Studies also show that those green finance tools incentivise cocoa sustainability by reducing prices and encouraging subsidies through awareness programmes, education, good farming practices, and certification programmes. For instance, Wang et al. (2018) argue that farmers' living income is one of the main variables in modelling green financing-sustainable cocoa output in the medium- and long term. Wang et al. (2018) conducted several studies about the financing of cocoa sustainability practices and their impact on cocoa production outcomes in West Africa. In a notable position, Adenle et al. (2019) explicitly depict how access to Green Finance influences farmers' production. Several recent studies on Green Finance provided critical insights into how chocolate is produced in West Africa.

Adom et al. (2023) suggest that control variables will allow us to know the factors that affect cocoa production sustainability in the long run. As intentionally stated by the researchers, control variables are determinants in studying the influence of green finance on the output of sustainable cocoa production in Ghana. 'Green finance' constitutes financial services and products facilitating the transition towards a more sustainable and environmentally friendly economy. Cocoa producers could access up-to-date information, tools and money to reduce their environmental footprint. For example, they can invest in green finance to implement agroforestry, shade-grown cocoa, organic fertilisers and insect management, irrigation systems,

and renewable energy. These climate-smart agricultural technologies conducive to more efficient and high-quality cocoa production are believed to be one of the crucial steps to cut methane emissions, which is closely related to climate change and associated issues, such as water scarcity and flooding, pests, and diseases.

Producing cocoa that meets current needs without compromising the ability of future generations to meet their own needs economically, socially and ecologically. To achieve this goal, efforts are made to reduce greenhouse gas emissions, fight biodiversity loss and increase the provision of ecosystem services. According to the World Cocoa Foundation (2020) and the European Commission (2020), sustainable cocoa production can improve quality and quantity, increase farmers' resilience and income, and protect and restore forests. Cocoa growth might increase the quality of life of the many subsistence farmers who depend on cocoa for their income and food. In some parts of the world, growing cocoa could help improve life quality by fighting poverty, increasing women's participation in social cohesion, and building a society with respect for human rights, among many others. More than that, the vast biodiversity of these tropical forests that host cocoa production might remain where it is and continue to contribute by providing a range of ecological benefits such as pollination, water management, soil fertility and carbon sequestration. Besides regenerating their environment, deforestation and forest degradation affect people living in forests and their surroundings, where trees are absent or just about.

Increasing farmers' living income might encourage them to stay committed to sustainable cocoa farming techniques (European Commission, 2020). Since time is money, the incidence of income could increase farmers' willingness and capacity to adopt new practices, norms and technologies that require initial investments and carry some level of risk. Agroforestry and cocoa are grown with shade, organic fertilisers and pest control, irrigation infrastructures, and renewable energy technologies. Funding for these environmentally friendly

practices could enable sustainable cocoa production. In addition to climate change adaptation, using sustainable techniques in the chocolate industry might also contribute to increasing the yield without sacrificing quality.

Furthermore, such actions could contribute to keeping ecosystem services and biodiversity sound. On the other hand, the knowledge and competencies of farmers in negotiating and engaging in the cocoa supply chain could also be affected by their income levels. The study found that farmers' access to green finance is directly linked to their income levels. With more money, farmers could be safer financiers for lenders and better able to qualify for green finance. Lenders would also be comfortable providing green finance to wealthier farmers for economic reasons, as they could be considered less risky borrowers.

On the demand side, low-income farmers might be more inflexible in applying for loans since they lack collateral money or are afraid to be considered credit risks. The same applies to less well-off farmers who could lack collateral cash or might be scared of the credit bureaus. The European Commission (2020) also found that thanks to their incomes, wealthier farmers might have increased their bargaining power about cocoa prices, access to new markets, opportunities for green loans in banks, and increased value-added potential. The research also revealed that the farmers' living income generated a range of positive effects on sustainability and increased the resilience of their cocoa-producing operations. The Sustainable Livelihood Approach (SLA) based on the framework (Morduch, 1997) has received widespread use in research and development practice by rural dwellers and urban communities as well as different subsectors such as agriculture, health and education (Morse et al., 2013; Shen et al., 2008; Su et al., 2021; Tao, 2009).

Using this technique in the agricultural sector helps researchers gain more insights into the options available to subsistence farmers at the micro level. It may present itself as inputs, markets or extended services. The Sustainable Livelihood Approach in the fisheries sector has

helped researchers define the factors that motivate the sustainability of livelihoods based on fishing. These factors include access to fishing grounds, market pressures, and regulation regimes. The sustainable livelihood method has been used to assess the impact of various incentives to improve means of subsistence, e.g., micro-finance programmes, agricultural development programmes and rural programmes, and laws and regulations related to natural resources management. In rural places that are more vulnerable to ecological threats, the sustainable livelihood method has been used to study how the capacity to maintain a livelihood may be affected by climate change. With the Sustainable Livelihood Approach, it becomes visible how financial interventions such as green finance may impact the lives of the farmers and the communities.

Researchers will explore the impact of green finance on the assets of cocoa farmers, including social networks, knowledge and practices regarding sustainable farming, and access to credit. According to research, these policies could have a negative impact on the lives of Ghana's farming outgrowers. With more money, they could spend more on green investments, such as tools and equipment for sustainable farming practices and education programmes. Farmers could enhance farm production and environmental preservation if they had more resources to diversify their incomes and invest in conservation measures and soil management. Gains in earnings allow farmers to access extension services and training programmes, boosting productivity and encouraging more green farming practices.

If farmers have more money, they can become more self-sufficient, less dependent on cocoa, and more resilient to climate shocks and market volatility. The rise in revenue allows the farmer to embrace and apply sustainable cocoa production techniques, improving their chances of getting green financing.

The study findings showed that cocoa farmers in Ghana generally have some knowledge on green finance: this knowledge was through grants offered by companies that

produced chocolate, which forms part of their CSR efforts, however many smallholder farmers go through challenges to access formal green financing because of the stringent documentation, bureaucratic processes, inadequate information and knowledge on the application process. These challenges, as well as strict environmental and social standards, have made it very challenging for small-scale farmers to satisfy the criteria for loans or subsidies. Nevertheless, access to green finance has been identified as positively influencing sustainable farming practices among some farmers, with the improvement in environmental consciousness and climate-smart agricultural practices emerging as significant outcomes. Consistently, the effectiveness of policies on green finance in the Ghanaian context has been disadvantaged by limited awareness, lack of proper implementation, and inadequate systems aimed at monitoring its implementation. In order to improve this, there is a need for systems to be implemented to improve awareness and rationalise access to financial support and, at the same time, put in place mechanisms to enable farmers to demonstrate adherence to sustainability criteria through manageable and inclusive processes. Additionally, in this study, the Resource-Based Theory (RBT) and Agricultural Innovation Systems (AIS) were used as guiding frameworks to gain an understanding of how green finance can be used to create a competitive advantage and foster systemic agricultural innovation. RBT highlights the importance of the presence of unique, inimitable resources in providing firms with an advantage. On the other hand, AIS sheds light on collaborative efforts among stakeholders' farmers, suppliers, researchers, financial institutions, and government to enable them to strengthen sustainable cocoa production. This implies that farmers with higher incomes and more stable yields are better positioned to have access to green finance and implement sustainable practices, which leads to a more unbiased participation in the cocoa value chain. The study goes on to conclude that a streamlined green finance system can support the extensive implementation of eco-friendly practices, improve productivity, and preserve biodiversity. Consequently, the promoting of green financing

mechanisms, as well as policy reform and stakeholder collaboration, is essential for attaining long-term sustainability in Ghana's cocoa sector.

Recommendations for Application

The success of the green finance initiative in Ghana's cocoa sector depends on capacity-building, wherein the farmers are assured of understanding, skill, and grasping the necessary tools that ensure the adoption of climate-smart agriculture and hence explore avenues towards financial resource accessibility (Jeucken, 2001). Enhancements in the capacity of farmers translate to heightened and sustained productivity for improved livelihoods and increased living incomes within the population. It should ensure training in sustainable farming methods, with the result that environmental damage from farming can be curtailed accordingly. Farmers should be trained in such agroecological practices as agroforestry, organic farming, and integrated pest management. These methods have been observed to reduce synthetic fertilisers and pesticides while increasing biodiversity and soil health (Kehinde, 2021). In addition, agroforestry can improve farmers' diversification of sources of income and, hence, increase resilience to climate change. The training should also focus on using organic composts, adequate irrigation methods, and land management to improve yields. It will eventually help them meet sustainability certification requirements, improving market access and profitability. Most farmers usually lack the knowledge in financial literacy that could enable them to manage loans or understand financial instruments.

Farmers need training in interest rates, loan repayment schedules, and cost-benefit analysis. Full training in this area would equip farmers with the proper knowledge to take loans or invest in the best manner possible in their farming practice. Improved financial literacy reduces the risk of defaults and empowers farmers to better negotiate terms with financial institutions (Attipoe et al., 2021). Besides, financial literacy sensitises farmers on income

investment and savings advantages. These, therefore, are geared towards the motivation of accumulating financial cushioning. Farmers with potential in profit and loss understand how well their activities should be selected so they develop effective tactics to respond to seasons and changes in the production and profit costs. Digital financial services demand farmers to acquire digital capabilities (Morse & McNamara, 2013).

Farmers need training in using mobile applications for record-keeping, mobile banking, and loan applications. Such digital platforms improve farmers' access to financial services and enhance financial inclusion. Additionally, digital literacy might enable farmers to use e-wallets and digital payment systems, improving transparency and accountability in all transactions.

Digital literacy also creates access to online learning platforms for farmers, where they can complete e-learning modules on sustainable cocoa production. Integrating digital tools can enable farmers to link directly to buyers and suppliers, cutting the intermediaries and raising the farmer's profit level. Given that women are very valuable stakeholders in cocoa production, such capacity-building training should address aspects of gender sensitivity. (Elasha et al., n.d.). However, targeted support will ensure that women farmers have access to financial literacy and digital tools for equal opportunities in green finance. This training, focusing on gender, addresses their specific challenges in accessing financial services. It is yet another element that increases inclusiveness and equity in this process relating to the sustainable production of cocoa.

The programmes should, therefore, focus on strengthening women's leadership to increase female representation within farmer cooperatives and decrease gender-based discrimination in access to credit. In empowering women farmers, the sector benefits from a more diverse and productive workforce. Agricultural extension services can be critical in farmer capacity building (Attipoe et al., 2021). It is accomplished by deploying extension agents with expertise in sustainable farming and financial literacy to support and guide farmers

constantly. For instance, extension officers may track progress, identify shortfalls, and recommend remedial measures to sustain improvements in farming practices. Extension officers support the farmers directly on the ground in practical applications, such as shade-grown cocoa and agroforestry systems. Site visits make it possible to find problems quickly and adapt best practices to local contexts. In this way, farmers' assurance increases, and green finance initiatives can be joined.

A sustainability manual is a comprehensive guide for stakeholders in the cocoa sector. It ensures that there is standard best practice for sustainable cocoa production and access to green finance. The sustainable production techniques, certification processes, and guidelines for accessing green finance are all part of what the manual should include. It must show the step-by-step approach toward adopting climate-smart agriculture and advice on achieving sustainability certifications (Ollendorf et al., 2023). The manual should also contain templates to make it easier for farmers to undertake financial planning and loan applications. The content of this manual should also cover, under one section or another, basic information on risk management, market access, and compliance with global environmental standards. This manual will provide a common understanding of sustainability among all the stakeholders in the cocoa sector, hence raising coordination and accountability. It must be well publicized in print and electronic copies to be effective. Training sessions and stakeholder workshops have to be used to introduce the farmers to the manual. Its use can also be promoted through awareness campaigns. Cocobod is supposed to liaise with farmer cooperatives, cocoa-buying companies, and financial institutions to cross the manual into remote areas and to less literate farmers. Radio programmes, social media, and community forums can promote awareness of the manual's existence and importance.

Translation into local languages ensures that even illiterate farmers can benefit from the manual. The revision of this manual will be needed from time to time, considering the

stakeholders' new research, best practices, and contributions. It may be done with the support of universities, research institutions, and development partners. Involving farmers in revising this manual will enhance its relevance and utilization. The update process should be transparent and participatory, considering the contributions of farmers, cooperatives, and government authorities. Regular updates will ensure the relevance of the manual to changing circumstances, such as climate change and changes in global standards for cocoa (K.-H. Wang et al., 2022). A strong monitoring and evaluation framework must be implemented to track the adoption of sustainability practices outlined in the manual. Regular impact assessment of this manual will provide areas that might need improvement and inform the development of revised editions. Cocobod will measure farmers' adherence through key performance indicators. All monitoring teams could visit the sites to assess the impacts of adopting the manual on farming methods and loans taken up by farmers or otherwise. Farmers' feedback, on the other hand, will highlight those areas where either revision or expansion of the document needs to be done in this manual.

Access to low-interest finance ensures that cocoa farmers go into sustainable practices. Therefore, Cocobod and the various cocoa-buying companies should advocate for developing green finance programmes and partnerships with international organizations such as Mastercard Foundation, Bill and Melinda Gates Foundation, and USAID, among others. It can provide a window of opportunity for affordable financial support to cocoa farmers. The Cocobod can secure technical assistance, capacity-building programmes, and grant funding through partnerships.

It is possible to have collaborative funding towards purchasing sustainable inputs by cocoa farmers, such as organic fertilizers and environmentally friendly pesticides (Akomea-Frimpong et al., 2022). The partnership can also finance the construction of processing facilities and infrastructure to enhance value addition. Cocobod should develop proposals that outline the potential socioeconomic and environmental impacts of low-interest finance for cocoa

farmers. Proposals must be accompanied by firm business cases, including but not limited to the return on investment, to attract potential donors and impact investors. As Amanor (2023) claim, "By articulating the environmental and social co-benefits of green finance, Cocobod would therefore be able to bring on board development finance institutions and climate change mitigation funds". A successful proposal shall underpin its expected impact on climate resilience, reduced deforestation, or poverty reduction in cocoa-producing communities.

Government incentives make it very appealing for financial institutions to finance farmers. The government can facilitate this by giving tax breaks, subsidies, and low-interest loans to lighten the burden on the farmer and the lender (Kaba et al., 2022). One of the most effective means of encouraging lending to cocoa farmers is by offering tax incentives to financial institutions. The government can make lending to the agricultural sector more attractive by allowing corporate tax reductions for the banks that extend green finance loans to farmers. Tax reductions decrease the overall cost of financial operations, enabling financial institutions to provide loans at lower interest rates (Migliorelli, 2021). This incentive might be given based on the volume or value of loans disbursed to farmers, encouraging the various financial institutions to support cocoa farming more sustainably. Secondly, such tax incentives would also be extended to the MFIs and credit unions doing direct work with the smallholders, thus widening access. Loan guarantees are another viable mechanism for encouraging lending to cocoa farmers. The government can form a guarantee fund to pay financial institutions part of the default risk. In such a scheme, if a farmer fails to repay the loan amount, the guarantee fund compensates for the loss to the lender.

Loan guarantees reduce perceived lending risk to smallholder farmers, increasing the possibility of financial institutions providing credit. This intervention will work most effectively for farmers who do not have collateral since this addresses the main constraint in accessing credit. It will be conditional: the farmers must participate in sustainability

certification programmes so that only those genuinely committed to green practices benefit from this support.

The government may also subsidise cocoa farmers' interest rates through financial institutions. Under this arrangement, the government pays part of the interest on the loans provided to farmers, reducing their repayment burden (Ollendorf et al., 2023). Subsidised loans are particularly important in promoting the adoption of green finance initiatives whereby farmers can borrow money for inputs and technologies at cheaper interest rates. These can be tied to certain end-uses, such as purchasing organic fertilizers or investing in renewable energy technologies. Subsidized interest rates tend to incentivize farmers to venture into sustainable farming practices while keeping the repayment rate at more affordable levels, enhancing farmers' creditworthiness. Sometimes, the government can give loans directly to cocoa farmers or offer grants. Direct loans can be issued through state-owned development banks or agricultural banks, offering farmers access to affordable capital without needing private financial institutions as intermediaries.

Other grants are available to farmers with non-repayable finances to improve farm work and adopt sustainable production methods. These may be more targeted and dedicated to interventions like setting up agroforestry systems or purchasing renewable energy machinery and equipment. In essence, offering direct loans with grants would mean that farmers are covered in different capacities, from capacity building to large investments in green finance (Lv et al., 2021). It is the support to the government for incentives concerning green finance that a proper policy framework should achieve. Here, policies should be very clearly explained to obtain tax breaks, subsidies, and loan guarantees related to eligibility criteria, disbursement procedures, and monitoring mechanisms that are required to be harmonised in a manner ensuring consistency with the national goals relating to the attainment of sustainable development and reduction in climate change. Regulatory support, which includes establishing

green finance guidelines for financial institutions, provides transparency and accountability in public funds. A sound policy framework may attract development partners and international financial institutions to co-finance green initiatives, expanding the pool of available resources for cocoa farmers.

Getting good results with eco-friendly financial plans in the cocoa industry depends on teamwork and making connections. Banks, farmers, helpers, and the government all must work together. It is because working together means we can make cocoa farming better for the environment faster. (Wang et al., 2021). Public-private connections are when people who work in public and private sectors put their heads together. In these situations, banks, helper groups, and companies that buy cocoa can combine what they have and make eco-friendly finance easier for farmers. It might include help from the government and the private sector, giving technical help and entry to markets. PPPs also mean we can research together to invent new financial products that match exactly what cocoa farmers need. A good example is that connections between different banks and agri-tech firms can result in new online platforms for giving out loans, monitoring, and keeping track of repayments. Regular conversations with everyone involved are a key way to make teamwork better. Conversations with cocoa farmers, banks, helper partners, and regulatory groups will be key when discussing challenges, sharing the best ways to do things, and working together to design eco-friendly finance solutions.

Stakeholder engagement adds to the voices of cocoa farmers and designs financial products with specific needs. The stakeholders' engagement, through constant contact, allows them to check new opportunities for collaboration and disputes arising in the implementation phase of green finance initiatives. The development partners include organisations such as USAID, Mastercard Foundation, and the Bill and Melinda Gates Foundation, as well as technical assistance and advisory services. It includes capacity-building workshops, best practice training, and financial literacy programmes. All these trainings improve the farmers'

ability to access and utilise green finance effectively. Development partners can also go a step further and advise financial institutions on how they can design products that could meet the needs of the cocoa farmers. Partnerships with universities and research institutions leverage the latest research in sustainable cocoa production. Collaboration should also involve joint monitoring and evaluation processes. Stakeholders must develop mutually agreed-upon frameworks to track the realisation of sustainability goals. Joint monitoring allows for identifying the bottlenecks and properly measuring the impact to understand how best strategies can be adjusted. Besides, keeping all its partners on board allows all participation in assessing responsibility and transparency. It is also important that monitoring reports be done to inform policy adjustments and attract more support from donors and investors.

Stakeholders can form funding consortia to pool financial resources and distribute the risks of lending to smallholder farmers. Blended finance models blend public, private, and philanthropic funds and are particularly effective in mobilising large-scale investments. (Tuninetti et al., 2022). Through blended finance, development partners and private investors share the financial risks of green finance projects. For example, public funds act as the first-loss capital that takes on initial risks to provide a comfortable platform for other private investors. In general, blended finance would catalyse major green finance initiatives in the cocoa sector by various development banks, cocoa-buying companies, and philanthropic organisations. The digitisation of records and putting farmers into cooperatives would help facilitate access to green finance for cocoa farmers. The financial institutions could evaluate their creditworthiness, reduce lending risks, and increase loan approval rates if the farmers were organised into cooperatives and had digitalised records.

Farmer cooperatives bargain jointly for better terms from financial institutions, input suppliers, and cocoa-buying companies. Cooperatives pool resources, facilitate joint procurement and offer a collective savings and loan disbursement platform. The cooperatives

enable farmers to access larger loans and to benefit from economies of scale in purchasing inputs. Cooperatives also ease loan disbursement and repayment by acting as contact points for such financial institutions. The various forms of training and extension provided to the members under cooperatives ensure improved economies in the adoption of agroecological practices as well as enhanced farm economies. Digitisation of Farmers' Records: Increased clarity, traceability, and access to finance due to digitisation.

In many cases, the farmers have no or limited institutional credit history; hence, cooperatives can establish farmers' credit profiles based on periodic electronic records of the crop produced, their financial cycle, and repayment behaviour. Banks use these profiles to check if farmers can pay back loans. It makes it easier to approve loans. Digital records help track loans given and paid back. Mobile banking, blockchain, and online wallets use tech to make loan-giving more efficient. It is part of green finance. Digital platforms also help farmers by providing them with online training, market updates, and advice. It helps them be productive and adjust to climate change.

Table 4.25-Summary of Recommendations (Application)

Recommendation	**Stakeholders Involved**	**Implementation Strategy**
Simplifying Access to Credit	Financial Institutions, LBCs	- Develop flexible, low-interest loans for LBCs to facilitate cocoa purchases. - Leverage Village Savings and Loan Associations (VSLAs) and susu groups for farmer credit access. - Introduce mobile banking for easy loan repayment and financial transactions.

Strengthening Sustainability Training for Farmers	Chocolate Makers, NGOs	- Fund and implement climate-smart cocoa farming programs. - Use farmer cooperatives for peer-to-peer learning. - Introduce incentive-based training where farmers receive inputs for participation.
Developing a Cocoa Sustainability Manual	COCOBOD	- Establish a standardised manual on eco-friendly cocoa farming. - Provide printed and digital copies for farmers, cooperatives, and LBCs. - Work with LBCs and NGOs to ensure widespread adoption.
Diversifying Farmer Livelihoods	Chocolate Makers, NGOs	- Introduce alternative income-generating activities like beekeeping and agroforestry. - Provide start-up grants for alternative ventures through NGOs. - Strengthen farmer cooperatives for better market access.
Integrating Cocoa Farmers into Carbon Credit Markets	Chocolate Makers, COCOBOD	- Develop a framework for carbon credit certification. - Provide training on sustainable land-use practices. - Link farmers to carbon trading platforms for additional revenue.

Promoting Green Lending for LBCs	Financial Institutions, COCOBOD	- Offer lower interest rates to LBCs that commit to sustainability. - LBCs are required to allocate funds to eco-friendly farming practices. - Digital tracking systems are used to monitor sustainability commitments.
Enhancing Certification and Price Premiums	COCOBOD, Chocolate Makers	- Simplify certification processes for smallholder farmers. - Ensure premium pricing for certified sustainable cocoa. - Strengthen monitoring to prevent certification fraud (greenwashing).
Advancing Digital Finance and Traceability	LBCs, Financial Institutions	- Expand mobile payment systems for cocoa transactions. - Blockchain technology can be used to trace cocoa transparently. - Provide financial literacy training to farmers to improve savings and credit access.

Recommendations for Future Research

Harnessing green finance can revolutionise sustainable agriculture in a globalised world. Nevertheless, the impact of green finance may differ from one industry to another, depending on the country's socioeconomic status and culture. A large-scale study on these variables is necessary to apply the green finance strategy. In this part, the researcher offers general recommendations for further studies concerning regional disparities, the effects over a

longer period, comparison with similar experiments, new technologies, social and economic advantages, and governmental and institutional directives.

Further studies should establish the impact of regional economic factors on the degree of adherence to and efficiency of using financial incentives. The present study highlights a crucial point that warrants further investigation: Due to economic disparities across regions, the practical application of green resource plans may also vary substantially, making them unsustainable. Organizational cultures, which include the provision of finance, infrastructure, and technology in affluent regions, may help implement sustainable practices. On the other hand, areas with limited economic capital may struggle to secure the necessary funds, thereby hindering their ability to implement sustainable practices. This hypothesis suggests that regions with resource access will adhere to existing financial incentives more effectively and quickly than those with limited resources. Methodologically, researchers could conduct comparative case studies and surveys across districts to gather quantitative data on the financial resources, infrastructure availability, and compliance level with the integrated monetary policies of the districts. So, understanding the economic enablers and barriers to resource planning can assist in identifying the factors that either enhance or inhibit resource planning's success. The information gathered can thus be useful in devising appropriate intervention measures to help underprivileged regions maximise their natural resource endowment to offer equal opportunity.

As a result, social norms, specifically gender roles, play an important role in green finance and its practice. Limitations such as inadequate access to training and other resources influence women despite their involvement in many aspects of agriculture in most parts of the world. For instance, enforcing proper fertiliser and pesticide application methods may be challenging if women in certain regions and locations lack the education, training, or empowerment to seek employment. Implementing training programmes and policies favourable to green finance can modify the aforementioned social norms, thereby improving

their effectiveness. This argument led to the hypothesis that areas with more tolerant attitudes towards women will demonstrate better outcomes in green finance, especially in education and support for female employees. Researchers conducted an ethnographic analysis of gender norms, conducted focus groups to understand their impact on green finance implementation, and compared the regions with varying levels of gender equity. More of these studies can be useful in formulating strategies to eliminate gender-related barriers to green finance efforts.

Structural equation modelling analysis was critical because it helped determine the long-term effectiveness of green finance and its influence on the environment and economy. While short-term gains may occur, long-term growth was the researcher's primary focus. Given the continuous enhancement of both environmental and economic indicators, the researcher expects the positive impacts of green finance to either increase or remain constant. Surveys conducted on a group of farmers across years, with changes in farming practices, yields, and the environment monitored, are useful. It can also indicate if the benefits of green finance specified at the initial stages continue or grow further or if there is a need for further actions. These studies can be used to develop green finance programmes that will positively impact the environment and locals.

Green finance has the potential to enhance agriculture's resilience to climate change. Cross-sectional research should assess the relationship between green finance and farmers' capacity to adjust to climate change. It leads to the hypothesis that green finance reforms enhance farmers' ability to adapt to the impacts of climate change, thereby boosting their resilience to these changes. Longitudinal surveys and environmental monitoring can compare the effect of green finance on farmers' climate resilience before and after its provision, aiming to enhance the integration of climate adaptation measures into green finance. Hopefully, this research will provide some insights into how green finance can assist farmers in addressing the climate change factors affecting them and improving sustainable farming.

It is important to find out what works or does not in green finance to increase the likelihood of success in cocoa-growing countries; comparative case studies of different cocoa-producing countries will help. Analysing green finance outcomes in Ghana, Côte d'Ivoire, Nigeria, and Indonesia will allow researchers to determine the impact of national policies, markets, and conditions. Such comparisons make it possible to discover the practices and approaches that work in certain situations and, consequently, apply them to the context of Ghana. For instance, the experiences of green finance in other countries will assist in designing suitable approaches to encourage sustainable cocoa farming in Ghana. The researcher can also emphasise the context of comparative case studies to demonstrate that, despite the active discussion of green finance, certain context-specific factors can significantly impact its effectiveness, necessitating the development of more effective green finance models.

China's experience with green finance shows that other countries would benefit from similarly contextual policies. Researchers might not only be able to show 'What works?' in Ghana's cocoa sector, but they could also apply a comparative case study approach to illuminate context-specific reasons behind differential outcomes in the Chinese provincial context. When government support was stronger and economic opportunities were greater, a province's environmental quality improved (up to a point), and its technological innovations flourished by understanding why some cases of green finance work and why certain factors are more or less important in creating synergy, researchers might be able to develop more contextualised solutions to the problem in the current cocoa production landscape.

Furthermore, green finance improves efficiency. For example, advanced modern production tools such as precision farming, irrigation systems, and pest and disease controls can improve productivity and sustainability. Satellites or drones can provide information about the health of crops and the soil environment without damaging the ecosystem. Applying these technologies reduces the risks of output loss and resource utilisation. The development level

of green technology plays a very important role in future research. It will quantify the number of these tools implemented in agriculture during the green finance period, determining whether green finance policy can enhance sustainable farming practices.

The study can also facilitate innovation and green technology use. Evidence demonstrates that green finance stimulates technological innovation and contributes to environmental sustainability. The technological adaptation of cocoa farming helps to mitigate the impact of climate change and other degradative factors on this crop. For example, developing drought-tolerant seeds and farming technologies improves farmers' adaptation to harsh climatic conditions while reducing the use of fertilisers and chemicals. This endeavour to explore the arrangement of green finance to green technologies and the impacts of these innovations on sustainable cocoa production has yielded valuable insights, providing us with a glimpse into the most effective technologies for sustaining and naturalising cocoa farming.

Moreover, green finance has the potential to generate positive socio-economic effects concurrently with environmental benefits. The increase in income from sustainable farming has a great chance of increasing access to education and health facilities in society. For instance, increased income can lead to improved education and health facilities, enabling families to send their children to school and enhancing health standards to promote a healthier society. Researchers can conduct further research to evaluate the additional social benefits of the green finance scheme, such as education, health, and social cohesion, to better understand the diverse benefits of green finance and its potential as a development strategy.

In the case of farming, green finance may boost a community's income because it reduces farmers' dependence on expensive inputs such as fertilisers, making them less vulnerable to extreme weather conditions such as drought and floods. Agroforestry and organic farming, for instance, add fertility and infiltration to soils; farmers with more fertile and better-hydrated soils can better withstand weather variations and produce crops, increasing food

security and making crops less vulnerable, thus leading to improved stability for rural people. Now, researchers need a second round of research to address the impact of community resilience and identify the optimal array of actions to bolster resilience in different environments. The results of such a study could guide us towards effective strategies for developing stable farming methods that match the needs of communities in areas where resiliency proves to be a challenge.

It is equally important to assess the role of the government and institutions in shaping the policies that hinder or encourage green finance. Regulations that weaken the financial elements of a project, such as tax incentives for environmentally friendly solutions or government-sponsored programmes promoting green technologies, are particularly effective. For example, cheap credit facilities from government ministries and agencies can help smallholder farmers access green finance by lowering interest rates. However, we should continue to examine which types of policies are most appropriate for green finance and test these policies in practice. The findings can guide green finance policies that promote and enhance their practice and usefulness at sustainable agricultural sites.

Therefore, designing solutions for policy problems will ensure that green finance is efficient across different contexts. It means creating initiatives to help improve the adoption rate of sustainable practices. One of the measures, for instance, might be steps to eliminate the barriers to smallholder farmers' access to green finance. Some steps could include providing technical education on eco-friendly products, expanding eco-friendly banking facilities, and offering discounts on eco-friendly cocoa farming. Information about the policies and institutions inhibiting the green finance grant in Ghana or other countries will be useful in designing context-specific measures to improve sustainable cocoa farming. Future studies should focus on identifying policy interventions that may be appropriate for a specific context and agribusiness and measuring their effectiveness. One way researchers can do this is by

identifying the best ways to sensitise people to green financing and sustainable farming practices.

International organisations and development agencies' participation in local green finance schemes to help countries select and achieve local sustainability goals can help advance green finance. International organisations and development agencies could provide technical assistance, financial resources, and policy guidance to countries to identify their green finance strategies and implement such an approach. For instance, in recent years, the World Bank and other international agencies have supported many green finance projects worldwide, bringing tangible environmental and socio-economic benefits. Future literature could investigate the role of such external organisations in supporting green finance initiatives and their impact.

Future studies can also apply a different methodology to analyse the data. Instead of a mediation approach to SEM, they can use a moderation analysis.

The findings of the study align with the objective set out by the researcher, which highlights that green finance is a key driver of sustainable cocoa farming, improved farmer income, and environmental and socio-economic resilience. Through exploratory and confirmatory factor analyses, three key dimensions emerged to indicate that sustainable cocoa production, green finance, and farmers' living income were found to reflect on the study's aim of assessing how eco-focused financial mechanisms support agriculture and livelihoods. Furthermore, strong factor loadings on the sustainable cocoa production construct provided evidence to show that green finance supports eco-friendly practices, thereby reducing harmful inputs.

The study further confirms its role in the advancement of sustainable farming. It was further observed that the green finance factor, which covered access to green financial products, also confirmed that it influences farming sustainability. Furthermore, the third factor, farmers' living income, had links with financial support, which increased productivity and reduced input

costs, leading to greater income stability. Finally, this study presents green finance as a very powerful tool that has benefits that are relevant to the environment and socio-economic context. Notwithstanding, there are variations in infrastructure and access to resources that may hinder equitable implementation. Therefore, there is a need for further research that seeks to examine regional differences in adoption and effectiveness. There is a need to consider social factors, particularly gender norms, and assess how they influence outcomes. As observed, women's major limitation, which is the access to finance and training, affects their participation in green initiatives. This study suggests the need for gender-inclusive policies and capacity-building to improve equity in sustainable agriculture. From the findings, it was observed that Structural Equation Modelling (SEM) confirmed both short- and long-term effects of green finance by showing its lasting influence on farming outcomes and farmer resilience. This calls for future longitudinal research aimed at tracking these effects over time.

Conclusion

Overall, the analysis showed that Ghanaian cocoa farmers have a reasonable knowledge of green finance, its products and benefits, and the governing laws, incentives and government initiatives regarding green finance. Nonetheless, the local utilisation of these programmes targeted at the sustainability of cocoa farming is low, with their outcomes somewhat vague. However, the analysis has found that the lack of awareness, poor financing, poor monitoring and follow-up, and poor cooperation are the main impediments which hinder the implementation of the government's programmes and incentives to change cocoa farming practices by smallholder farmers.

Strict regulation step, procedures and processes requires them first to prepare a lot of dense documents and reports on the efforts being taken towards sustainability; the more

information access to apply to the green funds becomes difficult and a tougher process to prepare for the sustainability process for the green funds.

These factors prohibited smallholder farmers from accessing and benefiting from the green funds. The government of Ghana has already established various policies and strategies for sustainable agriculture, particularly within cocoa production. These policies include funding subsidies for farmers using organic and environmentally friendly farming inputs, tax credits for investors to invest in green investment, and educating farmers on sustainability farming standards.

While workers and investors access the information and benefits, farmers' access remains a blurry dashed line. The awareness and information about the opportunities are still low. The main weakness of the organisation is the lack of communication and publicity for smallholder farmers. Farmers will, here and there, sometimes in the rural part of towns, receive information on various programmes or incentives allocated to them over time.

Lastly, green finance credit accessibility is also dimming, as most smallholder farmers are illiterate and likely to breach some formalities. However, the farmers learn about the possibility of loans; not having this information makes it almost impossible to apply for the loan for the purpose for which they want to use it.

Also, there is a lack of monitoring and evaluation of these programmes, so even when the cocoa farmers contribute, there is no real module for getting the endpoints of their efforts. It hampers the real-time evaluation of government policies and the possibility of correcting them for more effective coverage and outcomes. Thus, the study could not support the null hypothesis but support the alternative (i.e. the study does help that there is a positive relationship between green financing and cocoa production in Ghana). Therefore, the findings indicate a relationship between green financing and cocoa farming. From our findings, researchers can conclude that farmers earning more income increase their ability to invest in

measures that improve cocoa production sustainability. It explains why green finance is important to enhancing sustainable farming systems. Whereas farmers can utilise environmentally themed financial products in farming, this also increases the likelihood of such farmers doing conservation tillage. Hence, better cocoa production also enhances standards; this means better outcomes for the farmers, the community and the environment.

Interestingly enough, the same can be said of the impact of farmer income on the Green Finance-Sustainable Cocoa Production Nexus (GFCSNN), as shown by Wang et al. (2018), as it also corroborated with the findings. Hence, it can be asserted that including wealth control variables such as age, gender, education, and marital status in the above study has clarified what affects SCP. The fact, however, that the best relationship was found to hold in the presence of such control factors could suggest that the assertion that GFCSNN holds is quite strong. The green finance scheme, after all, is bearing fruit for cocoa yielding, meaning its benefits could go a long way in making cocoa production more sustainable in Ghana.

It strengthens earlier studies and lends credence to the notion that the association of green finance with sustainable farm production will be differential neither in space nor in time. This increases the chances that income-enhancing or green finance policies will spread beyond the Ghana case, which is good news for smallholder cocoa farmers in other producing countries.

To do so, it also applied the sustainable approach to assessing the impacts of different intervention measures that may impact the livelihood status of smallholder farmers before evaluating the impact of green finance. People have used the approach to examine the effects of microfinance products, ranging from microloans and insurance to mobile money, and various agricultural and rural development projects and natural resource management policies on people's capacity to engage in income activities. In Ghana, it explained how green finance

and other financial instruments operate through a circuit of social relations, knowledge and credit access.

Through their study, Tolliver et al. (2023) collected data relating to experiences on the relationship between green and, in some contexts, blue finance and smallholder livelihoods. They identified green finance as enabling sustainability and ending this practice. They also documented green finance as increasing farmers' social capital, knowledge and skills, and credit access, all of which help to improve the resilience and sustainability of smallholder farming communities.

The findings suggest potential policy implications for the practice regarding raising awareness and completing the green finance process. However, limited communication and understanding of the programmes result in farmers' lower access to green finance due to a lack of information about the available programmes and incentives for green finance. Eliminating or reducing lengthy procedures and providing support for logistics-related guidelines can enhance the availability of green funds and allow more clients to access green funds. Policies should also allocate sufficient revenue and remuneration for farmers, given the strong correlation between income and investment in sustainable farming practices.

Improved knowledge and dissemination of information may include working in local languages, engaging with chiefs or traditional institutions, and using mobile devices to share information. Simplified green application processes can consist of simple application forms, assistance from local agricultural extension offices, and other associated green finance application procedures.

While green finance opportunities are high, the following constraints prevent smallholder farmers from accessing it. Challenges to Health Insurance Implementation: The primary challenges associated with the implementation of health insurance are as follows: There are many steps to the application process. Many smallholder farmers do not have the

required educational levels or exposure to bureaucracies to complete the sometimes-complex processes of applying for green finance.

In addition to facing procedural barriers, many smallholder farmers may lack basic literacy skills of any sort, much less the financial literacy required to understand green finance products. It entails grasping not only the cost of funding expressed through interest rates but also the repayment duration, the green lender's use of the money, and other financial jargon. Such financial illiteracy could disincentivise economic agents from adhering to the policy or even discourage them from applying for a green finance product, should such an option become available.

The last constraint pertains to access to green finance in the relevant local zone. Although there are programmes available at various state levels, most of them are either not easily accessible at the regional level or operate in a skewed manner due to factors such as poor infrastructure, a lack of skilled human capital at the programme level, and a limited budget to support all farmers.

As previously stated, one of the interventions could streamline the application for green finance by making it simpler and less time-consuming. It could include creating a simple form to fill out, sharing contact details, assisting farmers in filling out the forms, getting the required permits, or helping them adhere to the regulations in their area. Alternatively, researchers could create financial literacy interventions that support the farmers in understanding the meaning of loans, where to get green finance from, and how to use it once they have it. Education and training about green finance for farmers could drive such understanding. Workshops, community meetings, or mobile tool applications could administer these initiatives. Equity among all farmers in green finance distribution, regardless of geographical location, is another problem. Given the distance between farmers and providers, bridging the gap would be difficult. Researchers could address this issue by building infrastructure in rural areas,

developing human resources for green finance implementation, and ensuring sufficient capital funding to implement green initiatives for all deserving farmers.

Therefore, one can highlight the importance of green finance and how it affects farmers and their lives. Green finance helps farmers access credit facilities, adopt environmentally friendly farming practices and ensure sustainable farming that is not harmful to the environment, such as using sensitive inputs in farming, conservation agriculture, and good soil management. As such, the primary responsibility of stakeholders within this green finance space should be to ensure that cocoa production becomes more sustainable and that farmers do not have to produce under harsh working conditions for a low and underpaid working permit. Stakeholders can ensure that farmers gain more income from organically produced cocoa. Farmers can improve their standard of living. Farmers can invest in quality housing, education for their children, and treatment for their illnesses. It, in turn, helps to bolster the farming communities' standard of living and general development. Secondly, it can help farmers adapt to climate change in a green finance environment by adopting several strategies to escape its impacts, such as land degradation, water scarcity, and increased pests and diseases. Farmers can ensure that climate change does not affect their farms negatively and that their income is stable despite the weather changes.

The study found that income has an important effect on farmers' sustainable farming practices. Only well-resourced farmers are financially capable of purchasing the equipment, materials, and information necessary for the implementation of sustainable farming practices, including buying quality seed, pure organic fertilisers, and green chemicals for controlling pests and diseases and arranging training on ecological farming. It also significantly influences farmers' ability to manage risk. Richer farmers have the financial means to assume higher production risks, leading them to implement new practices and high-tech techniques on their farms. It is because they can afford to lose a certain amount if these new practices or high-tech

farm techniques fail. Such willingness is an important precondition for the transition to green finance.

Moreover, with a higher income level, farmers will find themselves in a more stable financial situation. They cannot resort to destructive farming practices, such as clearing forests to create new farmlands or applying excessive amounts of chemicals when their income is insufficient to feed their families. For example, well-endowed farmers cannot resort to destructive practices such as transforming forests into farmlands or excessive applications of chemicals because they can afford new and good high-tech practices. Education and training are two important green finance enablers. It is a necessary conveyor for sustainable agriculture practices.

Education can address many issues, including soil management, water management, organic farming, and financial literacy. Educational programmes can raise awareness about other sustainable agriculture issues, such as climate change, conservation, and biological diversity management. It could potentially encourage farmers to adopt and replicate green farming practices. Green technology adoption and upgrading can greatly enhance sustainable farming and green financing. Mobile technology primarily contributes to green finance by facilitating information exchange, providing training, and supplying green finance. Mobile apps can offer farmers real-time information on the weather, pest and disease outbreaks, and market prices. Mobile apps can also train farmers on sustainable farming practices and financial literacy and help them acquire the necessary skills to adopt and maintain friendly environmental practices.

Community-based organisations (CBOs) advocate for sustainable farming by raising awareness about green finance, and their long-term interactions with farmers provide them with an easier channel to connect farmers to formal sources of credit. CBOs have a major role in creating awareness about green finance amenities, and they also play a mediatory role for other

amenities. It also includes guiding farmers on sustainable farming strategies. CBOs can organise farmers into groups or cooperatives, enhancing their bargaining power and offering additional incentives for sustainable production. It is a crucial step in promoting sustainable agriculture, as it involves allocating funds for necessary training and seminars. All other stakeholders should participate in creating a system that enhances farmers' access to the required inputs for adopting the most effective sustainable practices. It entails the collaboration of all other stakeholders, providing some form of input to support each other in establishing the appropriate environment and conditions. It, in turn, will facilitate the adoption of sustainable farming practices, thereby directly contributing to the sustainability of the cocoa industry. To enhance collective effort, capacity, and human resource development, the government ministry, finance institutions, CBOs, and other key stakeholders should establish a framework that supports cocoa farmers and provides them with the necessary resources for adopting and maintaining sustainable practices. This earlier illustration delineates the various actors that are involved in achieving sustainable cocoa production in this country.

Additional research should be done on the effects of green finance on sustainable agriculture and the reasons why many smallholder farmers have difficulties accessing green funds. There is a question of whether, and to what extent, green finance is sustainable in supporting cocoa farming and farmer well-being in the long run. Such understanding is critical in ensuring that policies and their practical implementations are effective. Other studies might analyse different funding alternatives like blended finance, impact investment, or carbon market approaches. These approaches might be more effective than more conventional funding systems. These models encourage more resource capital for farmers, which eases the gap between funding and sustainable agriculture.

In addition, more research is needed on the relationship between climate change and the results of green finance within the agriculture sector. The way climate change affects cocoa

production and farmers' income should inform the design of green finance schemes for a society that is destined to be less agriculture climate resilient. Ghana's green finance has generally progressed, but researchers must direct these top-down initiatives to achieve sustainable and large-scale cocoa farming. On the major challenges highlighted in the optimistic outlook above, the researcher provided simple solutions that are beneficial in building a better and brighter future for Ghana's cocoa industry. Solving existing gaps and assisting farmers with improvement can enable the conversion of green finance into productive funds for Ghanaian cocoa farmers. This variety of cocoa fundings enable green finance in Ghana to be functional in affecting the necessary change in cocoa farming and bringing the needed good practices. To accomplish this, researchers must overcome the obstacles that green finance faces in funding cocoa farming in Ghana and provide training and support for farmers. It will enable stakeholders to create the necessary tools for fostering a favourable farming environment, potentially leading to changes in farming practices. It will increase the productivity of cocoa farmers and, consequently, boost the inflow to rural Ghana. As mentioned above, the process is a highly effective method for advancing development processes in rural Ghana, as it generates additional income that remains viable as long as development processes continue. A community that supports its development is capable of providing for its people.

In conclusion, the study finds that although Ghanaian cocoa farmers generally had a fair understanding of what green finance was about, they also understood the benefits that could be derived from it, the incentives available and government initiatives, the actual adoption remains low due to numerous key challenges. These challenges comprise the nature of bureaucratic complexities involved in accessing funds, the lack of awareness, low financial literacy, weak monitoring systems, and frail collaboration among stakeholders. It is also seen that most farmers struggle with the complex application processes, which is often characterised by low education levels and difficulty in accessing relevant information, which usually

prevents them from having the privilege of fully benefiting from available programmes. While the government has provided supportive policies such as subsidies and tax incentives, the communication and awareness given to these policies are not well done, especially in rural areas. The absence of equitable access to green finance, specifically for smallholder farmers, further hinders sustainable cocoa production. Regardless of these limitations, it was confirmed by the researcher that there is a positive relationship between green finance and sustainable cocoa production; that is, farmers having higher incomes were more likely to engage in environmentally friendly practices such as conservation tillage and organic fertilisers that have led to the improvement of productivity and sustainability. Based on the conclusions drawn, the study proposed the simplification of application procedures, improvement in education and financial literacy, and improving communication through the use of mobile technology and community-based organisations. It also recommends stronger stakeholder engagement and collaboration, as well as more equitable resource distribution. Furthermore, there is a need for further research into alternative funding models, such as blended finance and carbon markets, to make sure that there is long-term sustainability as well as broader access to green finance among Ghanaian cocoa farmers.

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APPENDICES

Appendix A

Survey instrument

GREEN FINANCE AND SUSTAINABLE COCOA PRODUCTION IN GHANA: THE ROLE OF FARMERS' LIVING INCOME

You are invited to complete the following questionnaire, which aims to examine green finance and sustainable cocoa production in Ghana: the role of farmers' living income. The questionnaire should only take 15 minutes to complete, including 35 questions. Your responses are anonymous and will not be identified with you in any way. By participating in this survey, you are indicating that you understand that your responses are anonymous and will not be identified with you in any way. You may skip any question that you find intrusive or offensive, but it will help me if you respond to as many questions as you feel comfortable with. You have the right to withdraw at any stage (before or after the completion) of the research without any consequences and without providing any explanation. In this case, the data collected will be deleted.

I have read the foregoing information about this study, or it has been read to me by the researcher. I have had the opportunity to ask questions and discuss them. I have received satisfactory answers to all my questions and enough information about this study. I understand that I am free to withdraw from this study at any time without giving a reason for withdrawing and without negative consequences. I understand that my data will remain anonymous and confidential unless stated otherwise. I voluntarily consent to participate in this study.

Please tick to [ ] if you consent to the above.

For questions 1-9, kindly circle the correct answer.

Demographics

1. Gender:
    a) Male
    b) Female
2. Please state your age

    ---

3. Educational Level:
    a) No formal education
    b) Primary education
    c) Secondary education
    d) Vocational/Technical Education
    e) Tertiary education (e.g., University degree)
    f) Postgraduate degree (Masters, PhD, etc.)
    g) Other (please specify):.....
4. Occupation:
    a) Cocoa farmer
    b) Financial institution worker
    c) Government official
    d) NGO or advocacy worker in agriculture/environment
    e) Other (please specify):.....
5. Years of Experience in Current Occupation:
    a) Less than 1 year
    b) 1-5 years
    c) 6-10 years
    d) 11-20 years
    e) Over 20 years
6. Farm Size (if applicable):

a) Small-scale (up to 5 acres)

b) Medium-scale (6-20 acres)

c) Large-scale (21 acres and above)

7. Marital Status:

a) Single

b) Married

c) Divorced

d) Widowed

e) Separated

f) Cohabiting

8. Number of Dependents (i.e., family members relying on your income):

a) None

b) 1-3

c) 4-6

d) 7 and above

9. Have you received any formal training on sustainable farming practices?

a) Yes

b) No

10. Are you a member of a cocoa farming cooperative or association?

a) Yes

b) No

Choose one option for each statement presented in the table below. Tick in the box that represents your opinion. Objective i: Assess the obstacles cocoa farmers in Ghana face in gaining access to green funding.

No.	Statement/Question	Strongly Disagree	Disagree	Neutral	Ag
1	I am aware of the green funding options available for cocoa farmers.				
2	Accessing green funding for my cocoa farm has been challenging.				
3	Some specific criteria make it difficult for me to secure green finance.				
4	I have sufficient information on how to access green finance.				
5	Local banks and financial institutions adequately support green financing for cocoa farming.				
6	I find it easy to access markets for my sustainably produced goods.				

Adopted from: Nkamleu, G. B., & Kielland, J. (2006). Modelling farmers' decisions on child labour and schooling in the cocoa sector: A multinomial logit analysis in Côte d'Ivoire. *Agricultural Economics, 35*(3), 319-333.

Choose one option for each statement presented in the table below. Tick in the box that represents your opinion. The objective is to evaluate the relationship between sustainable cocoa production and green finance in Ghana.

No.	Statement/Question	Strongly Disagree	Disagree	Neutral	Ag
6	Green finance plays a significant role in promoting sustainable cocoa farming in Ghana.				
7	There is a direct connection between the availability of green finance and the sustainability of cocoa farming.				
8	Green finance has positively impacted the way I manage my cocoa farm.				
9	I have adopted new farming practices due to green finance incentives or support.				
10	Green finance initiatives in Ghana have a direct link to improved cocoa yield and quality.				

Adopted from: Nkamleu, G. B., & Kielland, J. (2006). Modelling farmers' decisions on child labour and schooling in the cocoa sector: A multinomial logit analysis in Côte d'Ivoire. *Agricultural Economics, 35*(3), 319-333.

Choose one option for each statement presented in the table below. Tick in the box that represents your opinion. Objective iii: Assess how smallholder income moderates the link between green finance and sustainable cocoa production.

No.	Statement/Question	Strongly Disagree	Disagree	Neutral	Ag
11	The average income of a cocoa farmer affects their ability to access green finance.				
12	Increasing a farmer's income influences the sustainability of their cocoa farming practices.				
13	Higher-income farmers are more likely to adopt sustainable practices due to better access to green finance.				
14	The living income of a farmer affects their willingness to repay green loans.				
15	I would more likely seek green finance if my farming income increased.				

Adopted from: Volz, U., Beirne, J., Ambrosio, N., Catão, L., McDaniels, J., Ocampo, J. A., ... & Zhang, Y. (2020). On the Role of Green Finance in Sustainable Infrastructure in Developing Asia. World Development.

Choose one option for each statement presented in the table below. Tick in the box that represents your opinion. Objective iv: Analyse green finance policies and incentives implemented by the government of Ghana over the past 10 years (2011-2020).

No.	Statement/Question	Strongly Disagree	Disagree	Neutral	Ag
16	I am aware of the green finance policies or incentives implemented by				

the government of Ghana from 2011 to 2020.

17 These government policies/incentives have been effective in promoting sustainable cocoa farming.

18 Specific government policies/incentives have been particularly impactful for sustainable cocoa farming.

19 The government could do more to promote green finance for cocoa farming.

20 Awareness campaigns about green finance policies have been sufficient over the past 10 years.

21 The government provides enough training on sustainable practices linked to green finance incentives.

22 I believe there are enough incentives for banks and financial institutions to provide green loans for cocoa farming.

23 It has become easier to access green finance due to government interventions in the past 10 years.

24 The government should prioritise green finance policies for the cocoa farming sector in the future.

25 There has been a visible transformation in cocoa farming due to green finance policies from 2011 to 2020.

Appendix B

Qualitative Data Instrument

FOCUS GROUP GUIDE ON GREEN FINANCE AND SUSTAINABLE COCOA PRODUCTION IN GHANA: THE ROLE OF FARMERS' LIVING INCOME

I have read the foregoing information about this study, or the researcher read it to me. I have had the opportunity to ask questions and discuss them. I have received satisfactory answers to all my questions and enough information about this study. I understand that I am free to withdraw from this study at any time without giving a reason for withdrawing and without negative consequences. I consent to the use of multimedia (e.g. audio recordings, video recordings) for my participation in this study. I understand that my data will remain anonymous and confidential unless stated otherwise. I voluntarily consent to participate in this study.

Please tick to confirm your consent to the above.

SECTION A: Demographic Information

1. How old are you?
2. Are you married or single?
3. What is the highest level of education you have attained?
4. Please provide a brief overview of your involvement in the cocoa farming sector.
5. How long have you been involved in cocoa farming?
6. Are you familiar with the concept of green finance? If so, can you describe it in your own words?

SECTION B: Access to Green Funding

4. Have you ever tried accessing green funding for your cocoa farm?
5. Can you describe the challenges or obstacles you faced (if any) when trying to access green finance?
6. Are there specific requirements or criteria that made it difficult for you to secure green finance?

7. In your opinion, how important is green finance in promoting sustainable cocoa farming in Ghana?

SECTION C: Relationship Between Green Finance and Sustainable Cocoa Production

8. Do you think there is a direct connection between the availability of green finance and the sustainability of cocoa farming? Why or why not?
9. How has green finance (if accessed) impacted how you manage your cocoa farm?
10. Have you adopted any practices due to green finance incentives or support?

SECTION D: Role of Smallholder Income

11. How would you describe the average income of a cocoa farmer in your community?
12. Do you believe a farmer's income level affects their ability to access green finance? How so?
13. In what ways do you think increasing a farmer's income might influence the sustainability of their cocoa farming practices?

SECTION E: Green Finance Policies and Government Incentives (2011-2020)

14. Are you aware of any green finance policies or incentives the Ghana government has implemented in the last 10 years?
15. How effective do you believe these policies or incentives have been in promoting sustainable cocoa farming?
16. Are there specific policies or incentives that you believe were particularly impactful or, conversely, ineffective?
17. What changes or additions to these policies would you recommend to support cocoa farmers better?

SECTION F: Closing

18. Are there any other thoughts, experiences, or suggestions you would like to share related to green finance and sustainable cocoa production in Ghana?

19. Do you know of other farmers or stakeholders we should speak to in order to better understand this topic?

Appendix C

UREC Approval

UNICAF UNIVERSITY

UREC Decision, Version 2.0

Unicaf University Research Ethics Committee Decision

Student's Name:	Ibrahim Menkeh Muafueshiangha
Student's ID #:	R2104D12085348
Supervisor's Name:	Dr Mary Mandiringana
Program of Study:	UU-DOC-900-3-ZM
OfferID / GroupID:	O60057G65200
Dissertation stage:	DS3
Research Project Title:	GREEN FINANCE AND SUSTAINABLE COCOA PRODUCTION IN GHANA: THE ROLE OF FARMERS' LIVING INCOME
Ethical conditions for approval:	No comments.
Methodological recommendations:	
Decision*:	A. Approved without revision or comments
Date:	December 12, 2023

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3. The student is allowed to proceed to data collection following the final approval.

Appendix D

Informed Consent Forms

UNICAF UNIVERSITY

UC_IC - Version 2.1

Informed Consent Form

Part 1: Debriefing of Participants

Student's Name: Ibrahim Menkeh Muafueshiangha

Student's E-mail Address: menkibra@gmail.com

Student ID #: R2104D12085348

Supervisor's Name: Dr. Mary Mandiringana

University Campus: Unicaf University Zambia (UUZ)

Program of Study: Doctor of Philosophy

Research Project Title: GREEN FINANCE AND SUSTAINABLE COCOA PRODUCTION IN GHANA: THE ROLE OF FARMERS' LIVING INCOME

Date: 12-Dec-2023

Provide a short description (purpose, aim and significance) of the research project, and explain why and how you have chosen this person to participate in this research (maximum 150 words).

The purpose of this study is to examine the relationship between green financing and sustainable cocoa production, with a focus on the role of farmers' living income.
The issues influencing the sustainability of cocoa production are overwhelming, and the possible loss of employment, money, greenery, and delectable chocolate products, together with climate change, do not make the situation any easier. This study sheds light on the crucial role of green finance in promoting sustainability in the cocoa industry and provides a comprehensive understanding of the current scenario. The findings of this study can help policymakers and stakeholders develop effective policies and initiatives aimed at promoting sustainability in the cocoa industry. Also his study lies in its contribution to the growing body of knowledge on green finance and sustainable development. You are being selected to take part in this survey because of your years of experience in the cocoa sector in Ghana. The researcher will appreciate if you would provide this reasearch with your candid information on the sector.

The above named student is committed to ensuring participant's voluntarily participation in the research project and guaranteeing there are no potential risks and/or harms to the participants.

Participants have the right to withdraw at any stage (prior or post the completion) of the research without any consequences and without providing any explanation. In these cases, data collected will be deleted.

All data and information collected will be coded and will not be accessible to anyone outside this research. Data described and included in dissemination activities will only refer to coded information ensuring beyond the bounds of possibility participant identification.

I, Ibrahim Menkeh Muafueshiangha, **ensure that all information stated above is true and that all conditions have been met.**

Student's Signature: Ibrahim Menkeh Muafueshiangha

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