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EXPLORING THE MEDIATION EFFECT OF PERCEIVED USEFULNESS ON CROP DIVERSIFICATION DRIVERS AMONG SMALLHOLDER COCOA FARMERS IN TANZANIA

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Abstract: *Despite recent transformations in the marketing structure that led to sharp increases in cocoa prices, the living standards of smallholder cocoa farmers in Tanzania remain low. This study examines the drivers that influence smallholder cocoa farmers in Kilombero, Tanzania, to engage in multiple-crop farming as a strategy for poverty alleviation.Using a cross-sectional survey design, primary data were collected from 501 cocoa farmers who were selected based on convenient sampling technique from 162 Agricultural Marketing and Cooperative Societies (AMCOS) in Kilombero District. Data were analyzed based on covariance-based structural equation modeling (SEM) which was run using Analysis of variance Structure (AMOS) software.Results revealed that cocoa market price, payment waiting time, farm size, and cocoa farm income significantly influenced farmers' investment decisions, mediated by their perceptions of success. In contrast, off-farm income showed no statistically significant effect on investment decisions when perception was considered.The study focused exclusively on investment decisions among smallholder cocoa farmers in Tanzania, limiting the generalizability of findings to other contexts.Policy makers should strengthen marketing factors such as cocoa pricing and payment timelines to enhance farmers' financial capacity. Farmers, on the other hand, are encouraged to expand farm sizes and adopt improved agronomic practices as promoted by extension officers to boost productivity.This study contributes to the literature by highlighting cocoa-specific factors that shape smallholders' decisions to diversify into other crops, addressing a gap left by previous studies that emphasized non-cocoa factors.*

Keywords: *Smallholder Farmers; Cocoa; Crops Diversification; Perceived Usefulness; Kilombero*
(JEL code: Q12, Q14)

INTRODUCTION

Agriculture remains the backbone of Tanzania's economy, employing the majority of the rural population and contributing significantly to food security and livelihoods (Kitole et al., 2023). Within this sector, smallholder farmers play a critical role, yet they often face challenges such as fluctuating commodity prices, climate variability, and limited access to markets and inputs (Choruma et al., 2024). Cocoa, though not as dominant as coffee or cashew in Tanzania, has emerged as a promising cash crop in certain regions (Molela, 2017). However, reliance on cocoa alone exposes smallholder farmers to economic risks, including price volatility in global markets and vulnerability to pests and diseases (Ebenezer, 2023). Crop diversification has increasingly been recognized as a sustainable strategy to enhance resilience, improve household income, and ensure food security (Mihrete and Mihretu, 2025). By integrating cocoa with other crops such as maize, cassava, bananas, or horticultural produce, farmers can spread risks, stabilize earnings and strengthen ecological sustainability (Amuda and Alabdulrahman, 2024). Diversification also aligns with Tanzania's broader agricultural development goals, which emphasize climate-smart practices, value addition and poverty reduction (Jones, 2023).

Crop diversification is rarely a single decision, it emerges from a web of human, institutional, and biophysical factors (Blesh et al., 2023). Higher education levels tend to increase adoption of diversification because farmers better interpret market signals, manage risk, and integrate new practices (Bodago, 2024). Education is often associated with greater use of information, planning, and record-keeping that support diversified systems. More years of experience can cut both ways. In some contexts, experience strengthens adaptive strategies and local knowledge of mixed cropping; in others, it entrenches specialization in familiar cash crops (Holmelin, 2021). The study stated further that, empirical results often

show a positive association with diversification when experience is coupled with access to information and markets.

Regular contact with extension officers and participation in trainings increase awareness of agronomic options, intercropping benefits and market opportunities, thereby raising the likelihood and intensity of diversification (Ongachi & Belinder, 2025). Not just access, but relevance, consistency, and participatory approaches matter. Tailored advice on crop rotations, input management, and post-harvest handling supports viable diversification pathways (Mihrete & Mihretu, 2025). Availability of basic equipment (tillers, sprayers, irrigation kits) reduces labor bottlenecks and enables cultivation of multiple crops with timely operations (Gautam et al., 2023). Studies note that better equipment access correlates with more diversified cropping portfolios, especially when paired with input supply chains. Seeds, fertilizers and pest management tools for different crops are prerequisites; diverse input availability and reliability push farmers beyond monoculture. Heterogeneous plots (variation in fertility, slope, microclimate) encourage crop matching and diversification to exploit niches and spread risk (Mihrete and Mihretu, 2025). Poor soils can either discourage diversification (limited viable options) or motivate shifts into resilient crops depending on advisory support and markets (Mihrete and Mihretu, 2025). Larger holdings allow experimentation and spatial diversification; fragmented plots can also foster diversification if micro-conditions differ, though they raise transaction and labor costs. Stable water access enables year-round and multi-season cropping, horticulture, and higher-value diversification (Traoré et al., 2025). The study stated further that, unreliable water typically narrows options to drought-tolerant staples and reduces diversification intensity. More labor (family or hired) increases the feasibility of managing diverse crops with staggered calendars (Onyekuru, 2024).

Labor constraints often push specialization unless mitigated by equipment or cooperative arrangements. Liquidity and access to credit reduce the risk of trying new crops, cover input costs and bridge cash-flow gaps until harvest (Boansi, 2024). Prior studies consistently find that financial access is a strong positive driver of diversification. Proximity to markets, road quality, and buyer networks translate diversification into revenue (Blesh et al., 2023). Where market linkages and price information are strong, farmers diversify toward profitable crops; weak markets bias toward subsistence staples. Membership in farmer groups increases information flow, collective bargaining, and input access, all of which support diversification decisions (Blesh et al., 2023). In the absence of formal insurance, diversification itself acts as a household risk management strategy (Mihrete & Mihretu, 2025). Where safety nets or off-farm income exist, farmers may diversify more confidently into higher-value but riskier crops. Likewise, gendered control over land, labor, and incomes can shape which crops are chosen (Kocabicak, 2021). Evidence suggests women's participation, especially in horticulture and legumes, increases diversification where they have decision authority and market access (Dessalegn, 2022). Input subsidies, climate-smart agriculture campaigns, and value-chain initiatives can tip choices toward diversified systems when they support multiple crops rather than single-commodity models (Muoki, 2025). Access to ICT (phones, radio, platforms) improves price discovery and agronomic knowledge, nudging diversification where opportunities are visible and timely (Singh et al., 2023).

While studies on crop diversification often emphasize general market access and price signals, few have examined how cocoa-specific price volatility influences decisions to diversify into food or alternative cash crops. Farmers' perception of cocoa's usefulness as a reliable income source may decline when prices are unstable, potentially motivating diversification. Yet, empirical evidence on this perception-driven decision-making remains scarce. Cocoa farmers often face delays between harvest and payment due to marketing structures, cooperative processes or buyer arrangements. Long waiting times reduce liquidity, constrain investment in other crops, and may push farmers toward diversification for quicker cash flows (Demir et al., 2025). Existing literature on diversification rarely integrates payment timing as a determinant, leaving a gap in understanding how cash-flow constraints shape cropping choices. Off-farm income (e.g., trading, wage labor) can buffer households against cocoa income risks (Waarts et al., 2021). Research has shown that off-farm income generally supports diversification, but specific interactions between cocoa-related off-farm activities and crop diversification in Tanzania are underexplored. Although farm size is widely studied in agriculture, the cocoa-specific context in Tanzania where cocoa is still a relatively minor crop compared to coffee or cashew has not been sufficiently examined.

Farmers' perception of usefulness may differ as larger farm owners may see cocoa as sufficient, while smallholders may perceive diversification as more useful (Attiogbé, et al., 2024). Household reliance on cocoa income directly affects diversification decisions. High cocoa income may reduce the perceived need for diversification, while low or unstable income may encourage it. Prior studies often treat farm income in aggregate, without isolating cocoa-specific income streams and their influence on diversification strategies. Understanding farmers' perception of cocoa's usefulness as a livelihood anchor is critical, yet under-researched in Tanzania. This research seeks to explore the challenges faced by smallholder cocoa farmers in Tanzania to engage in other crops apart from cocoa farming while taking into account the mediation effect of farmer's perceptions. It examines the socio-economic drivers behind diversification and the potential impacts on livelihoods focusing on personal income. Ultimately, the study aims to provide insights that can inform policy interventions, extension services and market linkages to support smallholders in building more resilient and profitable farming systems.

LITERATURE REVIEW

Overview of Cocoa Production and Agribusiness Status in Tanzania

Small-scale cocoa agribusiness in Tanzania is a growing but underdeveloped sector, with significant potential for expansion and value addition (Molela, 2016). The study stated further that, the agricultural sub-sector is dominated by smallholder farmers

cultivating 1–3 acre plots, mainly in Mbeya and Morogoro regions, and has begun attracting attention for its fine-flavor cocoa quality. About 25,000–30,000 households (nearly 100,000 people) are engaged in cocoa farming, producing 14,000–16,000 tonnes annually. Tanzania ranks 18th globally in cocoa output (Wetengere, 2021). Most cocoa farms are small-scale, intercropped with bananas and often organically managed. Farmers rely on low-input systems, using natural pest control methods like neem and aloe vera (Ghosh & Das, 2025). Common cocoa species include Forastero, Criollo, and Trinitario, often mixed within farms. Average yields are around 540 kg/acre/year, but with improved practices, yields could reach 650 kg/acre/year (Molela, 2016).

Cocoa agribusiness in Tanzania is a relatively small but rapidly growing sector, driven by smallholder farmers and increasingly recognized for its fine-flavor cocoa potential (Lwesya, 2018). It plays an important role in rural livelihoods, export diversification and agribusiness development, though challenges in productivity, market access and financing remain (Molela, 2017). The trading is organized through a formalized system that relies on auctions and warehouse receipt mechanisms, designed to stabilize prices and ensure transparency for smallholder farmers (Molela, 2025; Carodenuto et al., 2025). Dry cocoa beans are sold through auctions under predetermined terms and conditions, similar to systems historically used in Ghana and Côte d'Ivoire (Tanzania Mercantile Exchange Market [TMX], 2024). Farmers deliver their cocoa to certified warehouses, where quality is assessed and recorded. Payments are then made after auctions. The system is regulated by Tanzanian authorities to protect farmers from exploitation and to promote fair trade practices.

Potentiality for Crops Diversification by Smallholder Cocoa Farmers in Kilombero, Tanzania

Kilombero is not just a cocoa growing area, it is a multicrop hub where rice, maize, sugarcane, bananas, cassava, legumes and horticultural crops dominate (Gebrekidan, 2020; Sulle, 2017). Cocoa fits into this mosaic, often intercropped with bananas, but rice and sugarcane remain the district's economic backbone (Isager et al., 2021). According to the study, Kilombero Valley is often called the "rice bowl of Tanzania." Both irrigated and rain-fed rice are grown, with large-scale schemes and thousands of smallholder farmers. Rice is the main cash crop and staple food in the area (Isager et al., 2021). On the other hand, maize is widely grown for household consumption and local markets (Gebrekidan et al., 2020). Often intercropped with legumes to improve soil fertility. Likewise, Kilombero hosts one of Tanzania's largest sugar estates and processing factories making it one of the districts with abundant production of sugarcane hence contributes significantly to the district's economy (Sulle, 2017). Another crop grown in Kilombero is bananas which are commonly intercropped with cocoa and maize (Isager et al., 2021). The major banana variety grown in the district is plantains which serve as both food and income sources. Furthermore, cassava and sweet potatoes are grown in small scale and serve as important food security crops in the district (Lala et al., 2023). According to study, the crops are more resilient to drought. Other crops grown in small scale include the legumes such as beans, cowpeas, pigeon peas and groundnuts which are consumed locally and sold in nearby markets (Fwaya et al., 2025; Musi and Doctor, 2021). Horticultural crops such as vegetables and fruits as well as tomatoes, onions, leafy greens, mangoes, and citrus are grown in smaller plots (Lala et al., 2023).

Theoretical Literature Review

This study integrated the internal funds theory of investment and Prospect theory to explore the drivers for crops diversification by smallholder cocoa farmers in Kilombero, Tanzania. Jan Tinbergen is credited as the proponent of the internal theory of investment, first advanced in 1938 (Klein, 1951). The theory emphasizes preferences in investment financing by distinguishing between internally generated funds and external debt (Jansen et al., 2023). It posits that firms or individuals generally prefer to rely on internal funds rather than external borrowing, primarily due to the costs of credit and the risks associated with indebtedness (Ahmad et al., 2023). The strength of the theory lies in its focus on the efficient use of retained earnings to expand businesses and acquire new sources of finance, while minimizing exposure to debt-related risks (Bui et al., 2023). Applied to smallholder cocoa farmers in Tanzania, this perspective suggests that income generated from cocoa farming serves as the primary source of financing for crop diversification. Farmers are more inclined to reinvest their earnings into new crops rather than seek external loans, given the high interest rates and repayment uncertainties in rural credit markets. However, the theory does not adequately capture situations where farmers have limited or no retained earnings and are compelled to rely solely on external financing. In such cases, investment decisions including diversification into other crops are shaped not only by financial constraints but also by farmers' perceptions of risk, debt sustainability, and long-term livelihood security. This gap highlights the need to integrate farmers' subjective interpretations into the analysis of investment behavior, thereby extending Tinbergen's framework to the realities of smallholder agriculture. This weakness of the theory is addressed in the prospect theory below.

Prospect theory, introduced in 1979 by Daniel Kahneman and Amos Tversky, provides a framework for understanding decision-making under conditions of risk and uncertainty (Trichilli et al., 2021). The theory distinguishes between two behavioral scenarios: risk aversion in situations of potential gains and risk-taking in circumstances of potential losses (Wang et al., 2024). In doing so, prospect theory addresses a limitation of the internal funds theory, which does not adequately explain investment decisions when internally generated funds are insufficient. Unlike the internal funds approach, prospect theory recognizes that investors whether firms or individuals—evaluate risks and returns before committing resources, regardless of whether those resources are internally retained earnings or externally sourced capital (Wang et al., 2025).

Applied to smallholder cocoa farmers in Tanzania, both theories offer complementary insights. Internal funds theory highlights the reliance of farmers on income generated from cocoa sales as the primary source of financing for crop diversification. Prospect theory, however, extends this understanding

by explaining how farmers make diversification decisions when internal funds are inadequate, requiring them to weigh the risks and potential returns of external financing options. Together, these perspectives suggest that cocoa farmers' engagement in crop diversification is shaped not only by the availability of internal funds but also by their risk perceptions and willingness to commit resources under uncertain conditions.

Empirical Literature Review

In Tanzania, the trading of dry cocoa beans is conducted through auctions under predetermined terms and conditions, a system reminiscent of the price-setting mechanisms historically employed in Côte d'Ivoire and Ghana (United Repbilc of Tanzania [URT], 2024; Staritz et al., 2022). The establishment of price ranges serves a dual purpose: not only to provide farmers with premium returns but also to stabilize prices, which is critical for securing a living income for cocoa producers (Boysen et al., 2023). Nevertheless, despite government interventions aimed at regulating prices, market dynamics driven by demand and supply continue to exert significant influence. These forces often undermine stabilization efforts, thereby disrupting farmers' ability to achieve sustainable incomes (Musselli et al., 2025). Moreover, Ahmad (2025) highlights that unexpected price fluctuations have detrimental effects on farmers' financial capacity, particularly in limiting their ability to reinvest earnings into other agribusiness ventures. Such volatility constrains diversification and long-term resilience. However, existing analyses of the relationship between cocoa price instability and multidimensional poverty indicators remain incomplete. Specifically, they fail to incorporate farmers' perceptions, which are essential for understanding the lived realities of price shocks and for accurately gauging the strength of the relationship between market fluctuations and poverty outcomes.

The formalization of the cocoa trading system in Tanzania was designed to empower smallholder farmers by improving their access to reliable and structured markets (Molela, 2017). Despite these intentions, delays in payment following auctions have been reported to negatively affect the living income of smallholder cocoa farmers, many of whom rely on daily earnings for subsistence (Tuffour et al., 2023). Under the warehouse receipt system, Tanzanian authorities have reduced the average waiting time for payments to approximately three days (URT, 2024). This marks a significant improvement compared to earlier practices, where farmers often waited more than a month to receive proceeds from their sales.

Nevertheless, prolonged delays in payment even when shortened continue to pose challenges. Studies by Kimbi et al. (2024) and Belair (2021) highlight that such delays undermine farmers' capacity to reinvest in their farms and other agribusiness ventures, thereby constraining long-term productivity and financial resilience. Importantly, existing analyses of this relationship have overlooked the mediating role of farmers' perceptions. Understanding how farmers interpret and respond to payment delays is crucial, as perceptions shape both their economic behavior and the extent to which delayed payments translate into broader livelihood impacts.

Mutsami et al. (2025) define off-farm income as earnings generated by farmers through activities outside agriculture, either via self-employment or wage employment. Anang et al. (2023) earlier observed that such off-farm work is often pursued with the intention of generating additional income that can be reinvested into farming activities, thereby supporting agricultural productivity. Conversely, Mapunda (2024) cautions that farmers' involvement in off-farm activities reduces the time and labor available for farming, which in turn diminishes on-farm productivity.

Mtaturu (2024) further notes that both the positive and negative effects of off-farm work are weighed when farmers make decisions about investing in other agribusiness ventures. However, this analysis does not explicitly consider whether farmers' perceptions mediate the decision-making process. Since perceptions influence how farmers interpret risks and opportunities, overlooking this dimension leaves an important gap in understanding the extent to which off-farm activities shape agribusiness investment choices. Accordingly, the following hypothesis was formulated to examine whether farmers' perceptions are central to decision-making when confronted with the mixed effects of off-farm activities. Statistics indicate that more than 80% of cocoa farmers in Tanzania are smallholders, cultivating farms ranging between 0.1 and 2.5 acres (Temba and Njau, 2025). While farm size largely determines production volume, the productivity of these farms is more strongly influenced by the adoption of improved agricultural practices (Justine et al., 2025). Ayalew et al. (2024) emphasize that the effect of farm size becomes particularly significant when both production and productivity are jointly considered. Similarly, Adesiyan and Kehinde (2024) identify farm size as a critical factor influencing crop diversification among smallholder farmers. Other studies have treated farm size as a controlled variable when examining investment decisions, operating under the assumption that larger farms inherently possess greater capacity to invest in diversification and other agribusiness ventures (Tennhardt et al., 2024). Collectively, these findings suggest that cocoa farm size exerts a direct influence on investment in crop diversification. However, previous research has not adequately explored the indirect pathways through which farm size affects diversification decisions. Specifically, the mediating role of farmers' perceptions has been overlooked. Introducing farmers' perceptions as an intervening variable helps to bridge this gap, offering a more nuanced understanding of how farm size shapes diversification outcomes beyond its direct effects.

Income from cocoa farming constitutes the primary source of earnings for 73.1% of farmers in cocoa-producing areas of Tanzania (Temba and Njau, 2025). On average, a farmer cultivates 1.27 acres, generating an annual income of USD 1,643.70, which translates to approximately USD 1,294.25 [1 USD ≈ TZS 2,410] per acre. Molela (2017) estimated the total production cost of operating one acre of cocoa from land preparation to harvesting at USD 228.97 [1 USD ≈ TZS 2,410]. This cost structure leaves farmers with a gross margin of USD 1,065.29 [1 USD ≈ TZS 2,410] per acre per annum. However, when household expenditures are factored in, the gross profit is effectively eroded, resulting in a net loss of USD 101.49 [1 USD ≈ TZS 2,410] per acre per annum (Harris et al., 2024).

Under such circumstances, farmers are left with little or no surplus to invest in crop diversification schemes. Despite this financial strain, Dogeje et al. (2024) found that cocoa income nonetheless plays a significant role in enabling investments in crop diversification. This apparent contradiction underscores the need for further inquiry. Specifically, previous studies have not examined whether farmers' perceptions mediate the relationship between cocoa income and diversification decisions. Introducing perception as an intervening variable provides a more nuanced understanding of how income constraints and subjective interpretations jointly shape investment behavior. To narrow down this gap, the following alternative hypotheses were statistically tested:

H1: Perceived usefulness positively mediates the relationship between cocoa price and crop diversification among smallholder farmers in Tanzania.

H2: Perceived usefulness positively mediates the relationship between cocoa payment waiting time and crop diversification among smallholder farmers in Tanzania.

H3: Perceived usefulness positively mediates the relationship between off-farm income and crop diversification among smallholder farmers in Tanzania.

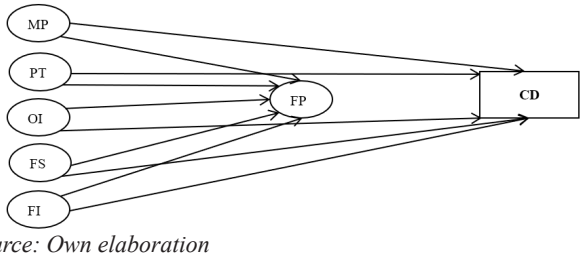
H4: Perceived usefulness positively mediates the relationship between cocoa farm size and crop diversification among smallholder farmers in Tanzania.

H5: Perceived usefulness positively mediates the relationship between cocoa farm income and crop diversification among smallholder farmers in Tanzania.

Conceptual Framework

The following conceptual framework summarizes the five hypotheses above while taking into account the theoretical framework.

Figure 1. Conceptual Framework



Source: Own elaboration

Where;

CD stands for Crop Diversification
MP stands for Market Price Fluctuations
PT stands for Payment Waiting Time
OI stands for Cocoa Off-farm Income
FS stands for Cocoa Farm Size
FI stands for Cocoa Farm Income
FP stands for Farmer's Perceptions

MATERIALS AND METHODS

Research Approach and Design

This study adopted a quantitative research approach to test the causal relationships among three groups of variables. A cross-sectional survey design was employed to examine the effects of cocoa-related factors on the marginal propensity to invest in crop diversification schemes, while explicitly considering the mediating role of farmers' perceptions. The approach enables the use of statistical techniques to validate hypotheses and generalize findings across the target population of smallholder cocoa farmers. At the same time, the design was suitable for collecting data at a single point in time, which aligns with the study's aim of capturing farmers' current experiences and perceptions regarding cocoa income, farm size, off-farm earnings, and payment systems.

Population and Sample Size

The study population consisted of 162 Agricultural Marketing Co-operative Societies (AMCOS) operating in Kilombero District, encompassing a total of 20,198 smallholder cocoa farmers. From this population, 810 questionnaires were administered, with five farmers selected based on convenient sampling technique from each AMCOS to ensure representativeness. Data analysis was conducted using 501 duly completed questionnaires, yielding a response rate of 61.85%. The questionnaires were filled in person by farmers and where necessary the enumerators who distributed them assisted in clarifying the questions.

Measurement of Variables

Different scales of measurements were adopted from previous studies as presented in table 1 below.

Table 1. Measurement of Variables

Name of Variable	Variable measurement	Studies
Market Price	Amount of money (expressed in USD) paid by a buyer in exchange of 1Kg of cocoa quantity	Musselli et al. (2025); Ahmad (2025)
Payment Waiting Time	A number of days where a cocoa farmer waits to get paid after an auction	Tuffour et al. (2023)
Cocoa Off-farm Income	Income generated by a cocoa farmer from other activities other than cocoa agribusiness	Mutsami et al. (2025); Mapunda (2024)
Cocoa Farm Size	The size of cocoa farm owned/ rented by cocoa farmer expressed in acres	Temba & Njau, 2025
Cocoa Farm Income	Income generated from cocoa agribusiness per se expressed in Tanzanian Shillings	Temba & Njau, 2025
Farmer's	An attitude of a farmer towards the expected benefits out of investment in crop diversification measured based on 5-point likert scale (1=Strongly disagree, 5=Srongly agree)	Molela (2024); Vernooy (2022)
Crop	Engaging in multiple crops farming	Hufnagel et al. (2020)

Source: Own elaboration.

Data Collection

Primary data were collected from cocoa farmers through self-administered questionnaires. A total of 501 duly completed questionnaires were returned and used for analysis.

Data Analysis

To examine the hypothesized relationships among the study variables, Covariance-Based Structural Equation Modeling (CB-SEM) was employed. The analysis was done using Analysis of Variance Structures (AMOS) software. The employment of CB-SEM model was important because of the availability of latent variable "perceived uselessness" as the intervening variable. The equation below summarizes the relationships between the variables.

$$CD = \beta_0 + \beta_1 MP_i + \beta_2 PT_i + \beta_3 OI_i + \beta_4 FS_i + \beta_5 FI_i + \text{Ь} FP_i + \varepsilon_i$$

RESULTS AND DISCUSSION

Descriptive Statistics

Table 2 presents a summary of the demographic characteristics of cocoa farmers, highlighting gender distribution, family status, education level, and farming experience. The findings reveal notable patterns that shed light on the socio-economic structure of cocoa farming communities. The data indicate a significant gender imbalance, with male respondents outnumbering females where males were 76% while females were 24%. This suggests that cocoa farming remains a male dominated activity, possibly due to cultural norms, land ownership patterns, or labor demands that favor men's participation. However, the presence of women, though smaller, underscores their important but often under-recognized role in agricultural production. A large majority (81%) of respondents were married, while only 19% were single. This distribution implies that cocoa farming is largely a family enterprise, with household labor and decision-making playing a central role in sustaining farm operations. The predominance of married farmers also points to the intergenerational nature of cocoa farming, where family members contribute to both labor and knowledge transfer.

Table 2. Descriptive Characteristics of Respondents

	Gender		Marital Status		Education Level	
Description	Male	Female	Married	Un-married	Basic Level	Illiterate
Frequency	381	130	406	95	461	40
Percentage (%)	74	26	81	19	92	8

Source: Own elaboration

Table 3. Descriptive Characteristics of Respondents

Constructs	Items	FL	Cronbach Alpha	Alpha	CR	AVE
	MP.1	0.632	.822	.914	0.805	0.672
Market Price	MP.2	0.603	.990			
	MP.3	0.667	.904			
	PT.1	0.699	.976	.902	0.718	0.567
	PT.2	0.716	.938			
	PT.3	0.688	.989			
Payment Time	PT.4	0.786	.901			
	PT.5	0.700	.967			
	PT.6	0.765	.991			
	OI.1	0.724	.810	.921	0.721	0.508
Off-farm Income	OI.2	0.699	.898			
	OI.3	0.711	.971			
	FS.1	0.607	.911	.894	0.698	0.667
	FS.2	0.669	.996			
Farm Size	FS.3	0.688	.905			
	FS.4	0.701	.942			
	FS.5	0.604	.921			
	FI.1	0.654	.892	.907	0.704	0.609
	FI.2	0.711	.988			
	FI.3	0.734	.724			
Farm Income	FI.4	0.705	.917			
	FI.5	0.718	.999			
	FI.6	0.726	.917			
	FI.7	0.802	.999			
	FP.1	0.521	.991	.987	0.699	0.575
	FP.2	0.899	.906			
Farmer's Perception	FP.3	0.735	.982			
	FP.4	0.728	.912			
	FP.5	0.908	.941			

Source: Own elaboration, model test results

Education was measured against the basic standard seven benchmark. An impressive 92% of respondents had attained this level, while only 8% were illiterate. This relatively high literacy rate is significant, as it enhances farmers' ability to adopt new technologies, access extension services, and engage with market information. The small proportion of illiterate farmers highlights the need for targeted interventions to ensure inclusivity in training and capacity-building programs.

Validity of Research Tools and Data Reliability

The factor loading test conducted through Confirmatory Factor Analysis (CFA) established a strong association between the observed variables and their respective latent constructs, with all items loading above the recommended threshold of 0.5. This outcome provides clear evidence of construct validity, as summarized in Table 3. Furthermore, the internal consistency of the measurement items was confirmed to be acceptable, as indicated by the Composite Reliability (CR) and Average Variance Extracted (AVE) values for each construct. Together, these results demonstrate that the measurement model is both reliable and valid, thereby supporting its suitability for subsequent analysis.

With respect to discriminant validity, the test results demonstrated that the values of each construct, when compared against itself, were consistently higher than the values obtained when the same construct was correlated with other constructs. This outcome, as summarized in Table 4, provides clear evidence that the constructs are distinct from one another, thereby confirming the adequacy of discriminant validity within the measurement model.

Table 4. Discriminant Validity Test

Construct	MP	PT	OI	FS	FI	FP
MP	**0.704*****					
PT	0.611	**0.712****				
OI	0.500	0.561	**0.794*****			
FS	0.396	0.341	0.476	**0.700****		
FI	0.327	0.562	0.394	0.567	**0.767***	
FP	0.441	0.350	0.406	0.339	0.423	**0.711**

Source: Own elaboration, Discriminant Validity Test Results

Model Fit Test

A total of six (6) statistical tests were conducted to verify the robustness of the SEM model in measuring inferential results. These model fit assessments formed an integral part of the second stage of the overall estimation process, namely the structural model evaluation. As summarized in Table 5, the indices included the Normed Fit Index (NFI = 2.861), which confirmed the overall fit of the sample by assessing data discrepancy, along with the Comparative Fit Index (CFI = 0.988), Tucker–Lewis Index (TLI = 0.987), Incremental Fit Index (IFI = 0.971), Goodness-of-Fit Index (GFI = 0.924), and the Root Mean Square Error of Approximation (RMSEA = 0.049). Collectively, these indices demonstrated that the model achieved an acceptable fit to the data, as all values met or exceeded the recommended thresholds, thereby confirming the authenticity and adequacy of the SEM model for subsequent inferential analysis.

Table 5. Model Fit Test Results

Model	Threshold	Results	Model	Threshold	Results
NFI	≤3.000	2.861	GFI	≥0.900	0.924
CFI	≥0.900	0.988	IFI	≥0.900	0.971
TLI	≥0.900	0.987	RMSEA	≤0.060	0.049

Source: Own elaboration, model test results

Hypotheses Test Results

The study formulated five (5) hypotheses to examine the indirect effects of cocoa-related factors on the marginal propensity to invest in crop diversification in Kilombero, Tanzania. The results of these hypotheses testing are presented in Table 6, which summarizes the inferential statistics derived from the structural model analysis. This analysis constituted the second phase of the SEM procedure, focusing on the structural relationships among the latent constructs and their implications for investment behavior in crop diversification.

Inferential statistics revealed that cocoa farmers' decision to invest in crop diversification was explained by 52.4% of their perception of financial strength derived from the premium market prices offered by potential cocoa buyers. This relationship was statistically supported by two key parameters: the coefficient ($\beta = 0.303$), which was positive, and the p-value ($p < 0.001$), which was well below the 0.05 threshold, indicating strong significance. The observed indirect effect aligned with the direct effect findings previously reported by Ahmad (2025) and Boysen et al. (2023). From this, it was deduced that farmers' perceptions enhanced the causal relationship between market price and marginal propensity to invest by 25.30%. In practical terms, higher cocoa prices enabled farmers to generate revenue beyond production overheads, thereby creating financial capacity for diversification. Conversely, when revenues fail

Table 6. Inferential Statistical Results

Market Price	Path	Coefficient "β"	*p*-value	*Adjusted* R^2	Decision
Direct Effect	MP-->CD	0.412	0.031	0.271	Accepted
Indirect Effect	MP-->FP-->CD	0.303	<0.001	0.524	Accepted
Payment Time					
Direct Effect	PT-->CD	0.432	0.049	0.310	Accepted
Indirect Effect	PT-->FP-->CD	0.263	0.007	0.566	Accepted
Off-farm Income					
Direct Effect	OI-->CD	0.540	0.011	0.303	Accepted
Indirect Effect	OI-->FP-->CD	-0.387	0.349	0.231	Not Accepted
Farm Size					
Direct Effect	FS-->CD	0.309	0.025	0.192	Accepted
Indirect Effect	FS-->FP-->CD	0.483	<0.001	0.397	Accepted
Farm Income					
Direct Effect	FI-->CD	0.212	0.034	0.357	Accepted
Indirect Effect	FI-->FP-->CD	0.389	<0.001	0.611	Accepted

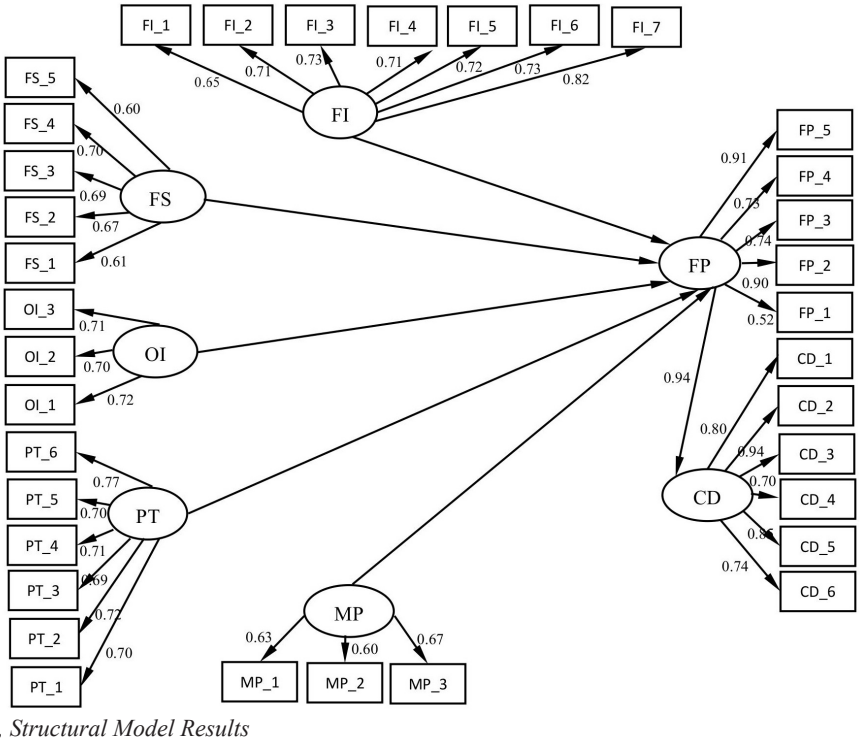
Source: Own elaboration, Structural Model Results

to cover production costs, the likelihood of farmers engaging in crop diversification schemes becomes minimal.

The indirect effect of farmers' perception on the causal relationship between payment waiting time and the marginal propensity to invest was found to be statistically significant (β = 0.303, p = 0.007). As highlighted earlier by Tuffour et al. (2023), Kimbi et al. (2021), and Belair (2021), the direct effect was further strengthened by 25.6% through the mediating role of farmers' perception. Overall, 56.60% of the decision by cocoa farmers to invest in crop diversification was explained by their perception of the importance of receiving payments promptly after auctions. Delays in payment often overlapped with the farm preparation period for other crops, rendering the proceeds less useful once received. Conversely, earlier payments, as emphasized in the sub-sector's marketing policy, increased the likelihood that farmers would allocate part of their cocoa earnings toward the production of other crops.

In contrast, although previous studies including Mtaturu (2024) identified off-farm income as a significant determinant of farmers' investment in crop diversification, the introduction of farmers' perception as a mediating variable produced different results. The statistical parameters (β = -0.387, p = 0.349) indicated that the mediating effect of perception on the relationship between off-farm income and investment decisions was not statistically significant. This outcome reflects the reality that cocoa farmers in Kilombero generated relatively low income from cocoa activities, limiting their capacity to accumulate sufficient off-farm capital. Consequently, expectations of financing diversification through off-farm income remained constrained.

Figure 2. Path Diagram



Source: Own elaboration, Structural Model Results

The structural model results revealed both direct and indirect effects of cocoa farm size on the marginal propensity to invest in crop diversification. These findings were consistent with those of Adesiyan and Kehinde (2024) and Tennhardt et al. (2024), who emphasized the significant role of farm size in shaping farmers' decisions to invest in crops beyond cocoa. Farmers' perception of the importance of farm size, particularly in relation to production capacity, accounted for 39.7% of their decision to diversify. The indirect effect of farm size ($\beta = 0.483$, $p < 0.001$) was 20.5% greater than the direct effect, which stood at 19.2%. Practically, cocoa farmers believed that larger farms guaranteed higher yields and, consequently, greater revenue. Notably, farmers in Kilombero actively sought to expand their farm sizes by planting new cocoa seedlings, a trend that contrasted with practices in other production areas of Tanzania, such as Kyela and Rungwe.

The final variable considered in this study was cocoa farm income, measured as the average revenue generated per acre of land. Results from the structural model analysis were consistent with the findings of Dogeje et al. (2024), which established a direct correlation between farm income and farmers' decisions to invest in crop diversification. The indirect effect analysis further revealed that 61.1% of farmers' decisions to diversify were explained by their perception of the usefulness of cocoa income. This contribution was 25.4% higher than the direct effect, which accounted for 35.7%. In practical terms, cocoa farmers require surplus income to finance investments in crops beyond cocoa agribusiness. Since income is determined by both production volume and market price, these factors are directly proportional to farmers' propensity to channel resources into other agribusiness ventures.

CONCLUSION

The study demonstrates that cocoa farmers' decisions to invest in crop diversification in Kilombero, Tanzania are shaped by a complex interplay of demographic characteristics, perceptions, and economic factors. Demographic analysis revealed that cocoa farming is predominantly male-driven, family-centered, and supported by relatively high literacy levels, providing a strong foundation for adoption of new practices.Structural model results confirmed the validity and reliability of the measurement model, with both direct and indirect effects highlighting the critical role of farmers' perceptions in mediating relationships between cocoa-related factors and diversification decisions. Specifically, perceptions of premium market prices, timely payments, farm size, and farm income significantly enhanced the causal pathways, often amplifying indirect effects beyond direct ones. These findings underscore that farmers' subjective evaluations of financial strength, payment timeliness, and production capacity are decisive in shaping their investment behavior.

Conversely, the mediating role of perception in the relationship between off-farm income and diversification was not statistically significant, reflecting the limited contribution of off-farm earnings in Kilombero. This suggests that diversification is primarily driven by cocoa-related revenues rather than external income streams.

Overall, the results highlight that strengthening market mechanisms such as ensuring premium prices, timely payments, and supporting farm expansion can substantially increase farmers' capacity and willingness to diversify. Policy interventions should therefore prioritize improving cocoa market structures and enhancing farmers' perceptions of income security, as these are pivotal in promoting sustainable crop diversification and resilience within cocoa farming communities.

Recommendations

It is important for government authorities to strengthen market mechanisms by ensuring consistent access to premium cocoa prices through transparent and competitive marketing systems. Cooperatives should be enhanced to guarantee fair pricing and reduce market uncertainty. Likewise, the payment systems should be improved by introducing policies that shorten the waiting time for cocoa payments after auctions. Furthermore, it is important to promote the digital payment platforms or mobile money services to enable faster transactions and reduce delays that overlap with preparation periods for other crops. Cocoa farmers should be facilitated to access land and inputs which will ensure both production and productivity per area. The training programs should be provided that emphasize the link between farm income, market opportunities, and diversification potential. This is essential for enhancing the farmer's perceptions and financial literacy. Government should strengthen extension services to build farmers' confidence in using cocoa revenues for investment in other agribusiness ventures. Policy-makers and stakeholders should design policies that integrate cocoa marketing reforms with crop diversification strategies. This will encourage farmer cooperatives and associations to act as intermediaries in negotiating better prices and faster payments.

Further researches may be conducted to explore contributions of crop diversification to personal finance of smallholder cocoa farmers in Tanzania. This will provide more insights on the importance of crop diversification not only to cocoa farmers but also to other smallholder farmers in the country.

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