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Article

Climate change-induced food system synergy discrepancies impacting the sustainability of youth agripreneurship

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Abstract: Globally, climate change continues to disrupt food systems. Determinants such as gradually rising temperatures and extreme weather patterns have a significant impact on these systems resulting in inconsistencies that ultimately impair their sustainability. This study focused on investigating climate-induced discrepancies in food system synergy and their impact on the sustainability of youth agripreneurs. The study was conducted in the Musina municipality of the Limpopo province. Simple random sampling was used to select the study participants, while structured questionnaires were administered during in-person interviews. The multinomial logistic regression model was used to investigate the influence of climate-induced discrepancies on the sustainability of agribusiness enterprises owned by young farmers. The study's findings revealed that climate-induced discrepancies had a severe impact on the collapse, survival, and sustainability of agribusiness enterprises. Subsequently, these discrepancies had both progressive and regressive influences on the sustainability of agribusiness enterprises at various stages of their life cycle. At a policy level, the study recommends joint collaborative investment efforts in localized input manufacturing facilities, as this will help mitigate fluctuations in input prices and sustain their availability. . Future studies could focus on integrating the economic viability of a commodity-tailored resilience approach, thereby providing insights into the coping mechanisms that are ideal and cost-effective for specific regions and agricultural enterprises.

Keywords: climate change; food system; agribusiness sustainability; young agripreneurs; discrepancies

1. Introduction

Climate change remains one of the most significant challenges worldwide, particularly in the agricultural food system, and it persists and manifests through extreme weather events, such as temperature fluctuations, heavy rainfall, and prolonged drought seasons [1]. The impacts of climate change reduce crop yields, leading to increased food prices [2]. Climate-related shocks are significant drivers of food price fluctuations, disproportionately affecting vulnerable populations with limited capacity to absorb higher costs [3]. Climate change also shapes consumer preferences, with growing demand for sustainable and locally sourced foods creating opportunities for some agripreneurs while marginalizing others who lack the resources to adapt [4]. Empirical evidence confirms that reduced productivity patterns are seasonal and closely linked to rainfall, with hunger trends declining significantly after the rainy seasons, making them highly vulnerable to changes in climatic conditions [5]. The agricultural food system is an economic activity that heavily depends on climate and specific weather conditions to produce food and other goods necessary to sustain human needs [6]. The study adopted the food system synergy to explore how climate-imposed disruption will logically affect the viability and sustainability of agribusiness enterprises across the three segments of agribusiness: industry, commerce, and trade. While within the context of the current study, sustainability was defined as an integrated system of plant and animal production times having a site-specific application that permits satisfying human needs and enhances the quality of the environment and natural resources while sustaining the economic viability of farm operations and improving quality of life for farmers and society [7]. According to Pörtner et al. [8], climate change projections indicate that its effects will adversely affect agricultural yields, particularly in regions that rely on rainfall, among other environmental factors. Climate change poses a significant threat to the sustainability of food production among farmers, particularly those in regions that rely on rain-fed agriculture [9]. Consequently, agriculture remains the primary source of employment and income in such regions. Agriculture provides opportunities for youth, which is essential to securing the future of agriculture in Africa, while addressing some of the burning global challenges, such as unemployment [10]. Meanwhile, as the world's population continues to grow, there is a need to produce food more sustainably and efficiently, and to create a more resilient food system to ensure food security [11].

However, youth farmers, who possess technical knowledge and skills that make them crucial to the human resources within the agricultural sector for present and future sustainability, face vulnerabilities to climate-induced disruptions, such as prolonged droughts, erratic rainfall, flooding, and rising temperatures [8]. Climate change affects the sustainability of agribusinesses, including those owned and operated by emerging agripreneurs [12,13]. The impacts of climate-induced disruption on the sustainability of youth agripreneurs are lucid. According to Deconinck et al. [14], climate-induced disruptions strain food systems, leading to high and volatile prices and other distributional issues. Consequently, the influence of these discrepancies raises concerns about the sustainability of the food system. Similarly, a study by Fanzo and Miachon [15] highlighted that low and unstable yields drive prices, thereby threatening food security and the sustainability of farmers. There are numerous demands placed on food systems, necessitating practical approaches to achieve sustainability within them [16]. Furthermore, Khatri et al. [17] argues that creating a sustainable and resilient food system is essential because it helps alleviate hunger and makes significant progress toward achieving SDG 2, which aims to eradicate hunger. Disruptions within the food system's synergy negatively affect its sustainability, leading to agribusiness failure [18]. Agribusinesses have adopted various measures in response to climate risk to ensure the sustainability of their production and profitability [19]. To move toward sustainability in any sector, we must know the current sustainability status within that particular sector or activity [20]. At the operational level, the sustainability of food system synergy is determined by the coping mechanisms employed to navigate the challenges it faces.

Based on this background, the study aimed to investigate the impact of climate-induced discrepancies in food system synergy on the sustainability of youth agripreneurship. While most studies investigate climate change adaptation trends among farmers, particularly scrutinizing the production phase, the current study adopts a holistic approach to investigating the food system sequentially. The integration of youth agripreneurs is pivotal in exploring insights that would shape the adaptive capacity of the future food producers. Moreover, young agripreneurs are increasingly recognized as key players in driving innovation and sustainability within agricultural food systems, making this study a baseline for streamlining climate finance and investment to enhance climate resilience among youth and emerging agripreneurs, particularly in emerging economies. Moreover, it was essential to conduct a study of this nature, as it provides thorough insights into how disruption within a specific phase of the food system can cripple the resilience of food producers, potentially impairing market competitiveness and ultimately their sustainability.

2. Materials and methods

2.1. Study area and research design

The study was conducted in the Musina municipality, situated within the Vhembe District. **Figure 1** below shows the map of the study area for ease of reference. Vhembe District is one of the five districts in the Limpopo Province of South Africa. Musina is the northernmost town in South Africa, with an estimated population of 68,359 people, and covers an area of approximately 42.23 km² [21]. Musina municipality is situated close to the Beit Bridge border post between South Africa and Zimbabwe; it is the main entry point into the country from countries north of South Africa. The study area was suitable for the study focus due to its susceptibility to climate change variability, characterized by high temperatures, reduced rainfall, and prolonged droughts. Musina municipality is in one of the emerging economic regions of the Limpopo province. It is highly vulnerable to the impacts of climate change, particularly due to its exposure to extreme weather events, including high temperatures and prolonged dry spells [22]. The study was conducted during the winter of 2025. The Musina municipality covers a predominantly rural geographical area, catalyzing agricultural development. It is in one of South Africa's developing provinces, which is also vulnerable to climate change impacts, particularly due to its exposure to extreme weather events. While the potential contribution of youth agripreneurs towards the alleviation of unemployment and the promotion of economic growth and innovation is being increasingly recognized, youth agripreneurs in Musina municipality face various challenges [23]. The study employed a quantitative research design, as it quantifies data and generalizes the findings from a sample to various perspectives based on logical methods, with a focus on testing theory, influenced by empiricist and positivist ideologies [24].

2.2. Population, sampling technique, data collection, and ethical considerations

The study population consisted of 116 youth agripreneurs. A simple random sampling technique was employed to select the participants. Simple random sampling was ideal because it ensured that every person in the population had an equal probability of being selected as a respondent [25]. A sample size of 92 was selected from a population of 115 young agripreneurs registered with the local authorities. Structured questionnaires were administered to the participants during face-to-face interviews. Face-to-face interaction was preferred because it reduces misunderstandings and minimizes errors, while ensuring clarity [26]. The study obtained signed consent from all the participants. While the ethical protocols were observed during the study, ethical approval was granted by the University of Venda Research Ethics Committee, with reference number FSEA/24/AECA/09.

Figure 1: A map showing Musina Municipality. Sourced from: www.statssa.gov.za (retrieved on May 10, 2026).

2.3. Empirical model

The Multinomial Regression model (MNR) was employed to investigate the impact of climate change-induced discrepancies on the sustainability of agribusiness enterprises owned by young agripreneurs. The MNR is a fundamental extension of binary logistic regression, designed to predict a nominal dependent variable based on one or more independent variables. Like other regression methods, MNR can use both nominal and continuous independent variables, as well as interactions between independent factors, to predict the dependent variable. The MNR model was appropriate because its dependent variable was polychotomous and was selected for its strength in analyzing nominal outcomes with more than two categories [27].

The econometrics model for the analysis was expressed as:

$$Y=a+B_1X_1+B_2X_2+B_3X_3+B_4X_4+\ldots\ldots\ldots\ldots u. \quad (1)$$

Y denotes a dependent variable, where its measurement is 0 = non-sustainable, 1 = short-term, 2 = medium-term, and 3 = long-term sustainability. In the analysis, the non-sustainable was used as the category base. Youth agripreneurs' sustainability in the study is analyzed across three dimensions: short-term, medium-term, and long-term. Short-term sustainability in this study refers to agripreneurs' ability to maintain production and operations in the face of climate uncertainties within a 12-month period. Medium sustainability refers to a farmer's ability to retain production and profits and maintain operational efficiency over a period of 2 to 5 years. Long-term sustainability demonstrates a farmer's capacity to remain resilient, market-competitive, and productive over an extended period, typically spanning 5 years or more. The dimensions used in the study provide insight into how climate-induced discrepancies influence the continuity and resilience of youth agripreneurs. Furthermore, the study adopted the common agribusiness sustainability dimensions, particularly by integrating the assets' lifespans and short-, medium-, and long-term financial borrowing periods. Furthermore, a = constant; B = coefficient of predictor variables; X_s denotes explanatory variables that were the climate-induced discrepancies within the food system, and u = disturbance term. The model adequacy test was performed, and the model-fitting information indicated that the model was suitable for the analysis. The study used the Cox & Snell R^2 and the Nagelkerke R^2 to determine the model's accuracy. The diagnostic statistical analysis reveals that the Cox & Snell R^2 and Nagelkerke R^2 scores were 0.761 and 0.834, respectively, indicating that between 76% and 83% of the variability in the dependent variable is explained by the set of explanatory variables. Furthermore, the explanatory variables used in the multinomial logistic regression analysis are listed in **Table 1**, along with their anticipated influence on the sustainability of agribusiness ventures owned by young farmers.

Table 1. Description of explanatory variables used in the multinomial logistic regression.

Variables names	Type of measure	Expected signs
Maintenance costs	Low = 0; moderate = 1; high = 2	+/-
Input price fluctuation	Low = 0; moderate = 1; high = 2	+/-
Delayed supply	Rare = 0; casually = 1 regularly = 2	+/-
Irregular input supply	Rare = 0; casually = 1 regularly = 2	+/-
Production inconsistency	Low inconsistency = 0; moderate inconsistency = 1, high inconsistency = 2	+/-
Reduced supply quality	Yes = 1; no = 0	+/-
Lack of storage facilities	Yes = 1; no = 0	+/-
Perishability rate	Low perishability = 0; moderate perishability = 1; high perishability = 2	+/-
Transport cost fluctuation	Low = 0; moderate = 1; high = 2	+/-
Increase lead time	Short turnover = 0; long turnover = 1	+/-
Market price fluctuation	Low = 0; moderate = 1; high = 2	+/-
Change in consumer demand	Rare = 0; casually = 1 regularly = 2	+/-
Supply competition	Low = 0; moderate = 1; high = 2	+/-
Market product flooding	Yes = 1; no = 0	+/-
Market access	Has access = 1; no access = 0	+/-

Source: Author's computation (2025).

The variables in **Table 1** were used in the analysis because they were identified as predictors of young agripreneurs' sustainability, through their direct influence on economic viability and market competitiveness, which, in turn, affected their sustainability. Moreover, their selection was based on their identification of persistent discrepancies arising from the impacts of climate change within the agribusiness-based approach, which incorporates industry, commerce, and trade segments.

Ultimately, such discrepancies were further investigated to determine how they influence the sustainability of agribusiness enterprises owned by young agripreneurs, following a common agribusiness segments approach that addresses the food system value chain. Furthermore, the study didn't use the common operational indicators for sustainability; rather, it adopted an agribusiness segment approach and further scrutinized persistent climate change-induced discrepancies that had influenced the economic viability, market performance, and market competitiveness of young agripreneurs, potentially impacting the sustainability of their business ventures.

3. Results and discussion

3.1. Discussion on the distribution of socio-economic characteristics of participants

The results in **Table 2** present the gender and age distribution, as well as the farming experience, of youth agripreneurs. The study findings regarding gender revealed that most youth agripreneurs were females, accounting for 56.5 %, while males accounted for 43.3 %. The gender composition within the study sample reveals that female youths are more involved in agricultural entrepreneurship than their male counterparts. Regarding the age aspect, the findings also revealed that most youth agripreneurs within the study sample were aged between 30 and 35, accounting for 56.5 %, followed by those between the ages of 25 and 29 with an aggregate of 29.3 %, and the minority were between 18 and 24 years old, with 14.7 %. The study findings pertaining to farming experience revealed that most youth agripreneurs had farming experience ranging between 1 and 3 years, followed by 30.4% with 4 to 6 years farming experience, followed by those with farming experience between 7 and 10 years with 14.1 %, and only 6.5 % had farming experience that was between 11 years and above. Farmers' experience plays a pivotal role in motivating and sustaining youth farmers' engagement in agriculture. This section may be divided by subheadings.

Table 2. Distribution of the Socio-economic characteristics among participants.

Variable	Frequency	Percentage
Gender		
Male	40	43.5
Female	52	56.5
Age group		
Between 18 and 24 years	13	14.7
Between 25 and 29 years	27	29.3
Between 30 and 35 years	52	56.5
Farming experience		
Between 1 and 3 years	45	48.9
Between 4 and 6 years	28	30.4
Between 7 and 10 years	13	14.1
Between 11 years and above	6	6.5
Total	92	100

Source: Field Survey (2025).

3.2. Discussion on the climate-induced discrepancies within the food system

The study findings, as shown in **Table 3**, highlight climate-induced discrepancies caused by climate change across the agribusiness landscape, comprising the industry, commerce, and trade segments. The discrepancies are categorized into three agribusiness segments: industry, distribution, and trade. The industry segment comprises discrepancies in input acquisition and production, while the distribution segment encompasses the transfer and distribution of products from production units to the market. Trade is where the change of ownership occurs during the actual transaction. In this section, discrepancies are ranked from most persistent to least persistent. The study ranked food system discrepancies by their mean values.

According to the study findings, the most persistent discrepancy across the industry segment is maintenance costs, with a mean value of 1.7609. The study's findings suggest that climate change disruptions significantly affect the maintenance required for production. An increase in severe climatic conditions increases the burden of utilizing more fertilizers, pesticides, and maintaining soil quality through soil rehabilitation, which affects farmers' income [28]. The second most experienced discrepancy is input price fluctuation, with a mean value of 1.6957. According to FAO [29], climate change leads to an increase in input prices, such as drought, which reduces fertilizer production that relies on water, driving up prices. Within the commerce segment, the most significant discrepancy is reduced supply quality, highlighting the agricultural food system's sensitivity to extreme weather events. Reduced supply quality had a mean value of 1.7391. Climate change determinants, such as temperature fluctuations, irregular rainfall patterns, and droughts, often lead to a decline in the quality of perishable products, including fruits and vegetables. As FAO [30] eluded, quality-related losses have a more immediate effect on revenue and marketability and are more common than volume reductions.

Across the trade segment, the most persistent discrepancy is the fluctuation in market prices. Unpredictable climatic conditions curate market price instability. The study's findings were consistent with those of Kotz et al. [31], which identified climate change as a key driver of reduced market selling prices. The second most significant discrepancy is a change in consumer demand, with a mean value of 1.7609, and a shift in crop availability, which alters consumers' demand due to seasonality. According to Ndiritu et al. [32], climate variability influences both the type and timing of products reaching the market, prompting customers to substitute or change their preferences based on price and availability. The persistence of these discrepancies highlights the interconnectedness of climate change disruptions across industry, commerce, and trade, where industry disruptions persist into commerce shortcomings, cascading into trade inefficiencies and instability, which ultimately hinder youth agripreneurs' profitability, sustainability, and overall resilience.

From the study findings, it can be noted that young agripreneurs have been facing various climate chance-induced discrepancies within the food system synergy as shown by how such discrepancies within the industry segments would potentially influence the operation of agribusiness enterprises within the commerce segment and subsequently the trade segments. From the study findings above, it can be noted that when farmers experience high maintenance costs, it ultimately contributes to the reduced supply quality within the commerce segment and could potentially impact the trade segments through market price fluctuations, change in consumer demand and supply competition.

Table 3. Discrepancies within the food system caused by climate change.

Industry segment		Commerce segment		Trade segment		Rank
Maintenance costs	1.7609	Reduced supply quality	1.7391	Market price fluctuation	1.7717	1
Input price fluctuation	1.6957	Lack of storage facilities	1.4348	Change in consumer demand	1.7609	2
Delayed supply	1.3370	Perishability rate	1.2391	Supply competition	1.3478	3
Irregular input supply	1.3043	Transport cost fluctuation	0.9130	Market product flooding	1.3261	4
Production inconsistency	1.2717	Increase lead time	0.8370	Market access	1.1413	5

Source: Survey results 2025.

3.3. Discussion on the influence of climate change-induced discrepancies on the sustainability of young agripreneurs

This section discusses the results on climate change-induced discrepancies that significantly impact the sustainability of the agribusiness enterprises. The results outline the impact of climate change-induced discrepancies on the various levels of sustainability within agribusiness enterprises. The discussion on the multinomial logistic regression analysis is based on the results presented in **Table 4** below.

3.3.1. Discussion on climate change-induced discrepancies impacting short-term sustainability

Fluctuation of input prices

The study's findings in **Table 4** revealed that fluctuations in input prices negatively affect youth agripreneurs' short-term sustainability. The input price fluctuation was statistically significant at the 5% significance level. The negative coefficient of -4.198 implies that when youth agripreneurs encounter market input price fluctuations, the probability of achieving short-term sustainability decreases by 4 units. The study findings suggest that frequent recurrence of input price fluctuations hinders the short-term sustainability of farmers. As noted by Janet [33], the volatility of agricultural input prices, often influenced by economic factors such as inflation and climatic conditions, undermines the sustainability of short-term operations. This suggests that unpredictable changes in input costs, such as the prices of seeds, fertilizers, pesticides, and fuel, destabilize farmers' income stability. Price fluctuations make effective planning difficult, increasing production uncertainties and cost variability. Most young agripreneurs operate on limited budgets and have limited access to credit, which further limits their ability to absorb sudden cost increases. The study findings align with those of Bogale [34], who emphasized that input price volatility reduces farmers' ability to sustain their agricultural businesses. Uncertainties in input prices can reduce profit margins, making agriculture appear less appealing than non-farm jobs, especially to young agripreneurs. The high cost of fertilizers and other essential inputs during peak planting seasons frequently discourages investment in subsequent cycles, resulting in lower productivity and sustainability. The current study shows that fluctuations in input prices have a regressive influence on young agripreneurs' efforts to maintain their operational sustainability.

Table 4. Parameter estimates of the multinomial logistic regression of youth agripreneurs' sustainability.

Variables	How long have you been in continuous production without interruption?					
	Short-term sustainability		Medium-term sustainability		Long-term sustainability	
	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.
Fluctuation of input prices	-4,198	0,005***	-2,133	0,220	-2,424	0,125
Irregular input supply	1,008	0,053*	0,670	0,333	0,452	0,426
Delayed supply	0,121	0,801	1,686	0,081*	0,336	0,522
Unavailability of tailored climate resistance inputs	-1,493	0,090*	-1,572	0,176	-1,794	0,089*
Reduced seeds quality	0,124	0,891	23,315	0,988	-0,570	0,570
Reduced quality of produce	-0,655	0,719	-0,101	0,972	-18,893	0.222
Production inconsistency	-1,378	0,082*	-3,339	0,007***	0,038	0,965
Maintenance costs	0,416	0,486	-0,740	0,554	0,531	0,514
Change in growing seasons	0,408	0,420	0,707	0,305	0,981	0,084*
Labour skills	-0,378	0,384	-0,172	0,772	-0,067	0,894
Limited adaptive capacities	-0,316	0,577	-0,627	0,474	-0,273	0,683
Fluctuation of transportation costs	1,428	0,049**	2,744	0,011**	0,017	0,982
Perishability rate	0,611	0,219	-1,142	0,134	-0,866	0,173
Reduced supply quality	-1,126	0,287	-5,527	0,001***	-0,920	0,480
Increased lead time	-1,278	0,284	-3,141	0,112	0,395	0,802
Lack of storage facilities	0,979	0,402	-1,808	0,332	-0,173	0,899
Market product flooding	0,344	0,800	1,332	0,466	1,919	0,152
Supply competition	-0,115	0,844	0,545	0,561	0,048	0,941
Fluctuation in market price	1,566	0,080*	1,613	0,109	-0,260	0,730
Market access	-0,212	0,808	1,391	0,222	0,315	0,769
Change in consumer demand	0,040	0,937	0,971	0,188	0,272	0,676
Profit loss	-0,206	0,827	-0,684	0,599	-0,043	0,969
Diagnostic statistics						
Base category: Non-sustainable						
Number of observations: 92						
LR Chi-Square: 99,780						
-2 Log Likelihood: 150,1608						

Source: survey results (2025). Note: ***, **, *Significant at 1%, 5%, and 10% probability level, respectively. Coeff.- coefficient; Sig.- Significance.

Irregular input supply

Another climate-induced discrepancy that affects the short-term sustainability of youth agripreneurs is irregularity in input supply, as shown in **Table 4**. The irregular input supply was statistically significant at 5% significance level. The positive coefficient value indicates that irregular input supply has a positive influence on the short-term sustainability of youth agripreneurs. The study finds that irregular input supply has a positive influence on the short-term sustainability of youth agripreneurs, which is counterintuitive, as irregularities typically disrupt farmers' production and increase costs. When inputs such as fertilizers, seeds, pesticides, or animal feed are not consistently available, farmers typically experience delayed planting, reduced yields, and increased production costs [35]. Inconsistent input supply across locations disrupts production plans, as many agricultural activities depend on distinct seasonal conditions. Some commodities may incur significant maintenance costs if produced outside their environmentally acceptable seasons. However, the positive coefficient observed in the study could imply that irregular input supply may have triggered adaptive strategies of young agripreneurs in the study area [36].

Unavailability of tailored climate-resistant inputs

The study's findings revealed that the unavailability of tailored, climate-resistant inputs significantly affects the short-term sustainability of youth agripreneurs, with a statistically significant negative coefficient of -1.572 at the 10% significance level. This indicates that when youth agripreneurs face persistent shortages of climate-adaptive inputs such as drought-tolerant seeds, pest-resistant varieties, and heat-tolerant cultivars, their ability to sustain production and profitability deteriorates. The short-term period is a crucial stage for agripreneurs, often representing the consolidation phase of farm investments and expansion. During this phase, a lack of access to appropriate inputs limits reinvestment capacity, lowers resilience to climate shocks, and hinders production. A study by Olarewaju et al. [37] found that the absence of adaptive agricultural inputs, such as resilient seed systems, significantly lowers productivity and compromises farm income stability. Similarly, Tofu et al. [38] demonstrated that in regions where climate-resilient seed varieties are unavailable or unaffordable, farmers experience yield stagnation, declining soil fertility, and increased susceptibility to pest outbreaks, all of which weaken short-term sustainability.

Production inconsistency

Another discrepancy influencing short-term sustainability was production inconsistency. Production inconsistency was found to be statistically significant at the 10% level. The negative coefficient of -1.378 indicates that when youth agripreneurs experience production inconsistency, their short-term sustainability declines by 1 unit. Climate shocks, pest infestations, disease outbreaks, or variability in input availability contribute to production inconsistency. Such variations hinder agripreneurs' ability to consistently meet market demand, plan financial and operational resources, and maintain customer relationships. Amede et al. [39] found that smallholder farmers with unpredictable production are more exposed to income fluctuation, limiting their ability to sustain business operations. Similarly, Mokone and Ndhlovu [40] stated that irregular production directly limits market participation, reduces profitability, and discourages investments in farm activities, endangering short-term viability. Furthermore, production inconsistencies increase the risk of post-harvest losses and inefficiencies in resource allocation.

Fluctuation of transportation costs

The study's findings in **Table 4** also revealed that fluctuations in transport costs have a progressive effect on short-term sustainability. Transportation costs were found to be statistically significant at a 5 % significance level. The study findings suggest that transport price fluctuations have a positive influence on short-term sustainability. However, this finding appears counterintuitive, as transport cost volatility is typically expected to negatively affect agricultural production and marketing. In most cases, fluctuations in transport costs increase the overall cost of delivering inputs and outputs, thereby reducing farmers' profit margins and market competitiveness. According to Austine et al. [41], high and volatile transportation costs often limit farmers' access to more profitable markets, resulting in lower income and weaker production incentives. Similarly, Baraka et al. [42] also highlighted that transport cost variability affects the profits of smallholder farmers and hinders their participation in high-value markets. Transport cost fluctuations can potentially delay the delivery of perishable items, increase post-harvest losses, and discourage consistent market participation. Furthermore, fluctuating fuel prices are one of the primary drivers of transportation cost fluctuations, increasing unpredictability in agricultural supply chains and making it harder for farmers to plan logistics effectively.

Fluctuation in market price

The study further highlighted that short-term sustainability is also positively influenced by fluctuations in market prices. A fluctuation in market price was found to be statistically significant at the 10 % level. The study findings imply that when farmers experience market price fluctuations, they increase their chances of short-term sustainability. The study's findings appear to contradict the existing literature, as market price fluctuations for most farmers increase income instability and uncertainty. As elucidated by Tshikororo [43], market price fluctuations give farmers less control over prices and often result in them selling their produce at a very low price. Furthermore, the study indicated that market price fluctuation negatively impacts farmers' sustainability. Similarly, Keubeng et al. [44] found that volatility in agricultural markets exposes farmers to significant income fluctuations, discourages investment in productivity-enhancing technologies, and increases their sensitivity to financial shocks. Furthermore, Vargas [45] demonstrated that volatile market prices impede the preparation and allocation of resources, as farmers are unable to estimate returns or budget for inputs and labor efficiently. This volatility often erodes confidence among young agripreneurs, prompting some to leave the market altogether.

3.3.2. Discussion on climate change-induced discrepancies impacting medium-term sustainability

Delayed supply

The study findings reveal that, under medium-term sustainability, delayed supply was found to be statistically significant at the 10% level. The delayed supply had a positive coefficient of 1.686, indicating that when youth agripreneurs experience a delay in supply, they are more likely to achieve medium-term sustainability. The study's findings suggest a positive relationship between delayed supply and medium-term sustainability. However, the relationship is paradoxical and contradictory to expectations, as most studies indicate delays in the supply of inputs or raw materials interrupt agricultural operations and diminish sustainability. In the agricultural sector, the delayed supply of seeds, fertilisers, or equipment can lead to planting delays, reduce production efficiency, and lower overall yield, ultimately undermining medium-term profitability [46]. The study's findings could be largely influenced by the fact that most agripreneurs report experiencing delays in input supply, yet they still manage to sustain their production, achieving medium-term success. Supply chain delays are a source of operational risk. According to Wang et al. [47], supply chain interruptions cause uncertainty, increase costs, and reduce farmers' ability to consistently meet market demand. Delays in deliveries reduce business agility, impair responsiveness to changing market conditions, and may undermine consumer trust. Delays in perishable agricultural products can also lead to post-harvest losses and reduced product quality, putting medium-term sustainability at risk [48].

Production inconsistency

The study findings in **Table 4** indicate that production inconsistency has a significant yet regressive impact on the sustainability of agripreneurship. The production inconsistency was found to statistically and negatively impact the medium-term sustainability of agribusiness enterprises at a 1 % significance level. The study findings further reveal that a coefficient of -3.339 implies that every time a farmer is inconsistent in production, sustaining such production would regress by three chances. The 1 % significance level indicates that production inconsistency is one of the most significant predictors of sustainable production within the study sample. Furthermore, the study's findings imply that when farmers lose their production rhythm, their chances of improving sustainability decline. With the sample study impaired by the unavailability and delayed provision of climate change-tailored inputs, inconsistent production may primarily emanate from these supplementary challenges, which prompt farmers to adopt unprecedented production breaks, thereby compromising their sustainability. Logically, suppose farmers are not securing medium-term success. In that case, their capacity to achieve long-term success is unlikely, which explains why production inconsistency is one of the most influential predictors for farmers' failure to ensure their agricultural sustainability. Moreover, the inconsistency in farmers' production driven by climate change-induced dynamics has led to the unsustainability of their production and, ultimately, their agribusiness ventures. A study by Tofu et al. [38] emphasized that farmers' ability to plan effectively is diminished mainly by economic shocks, which exacerbate their vulnerability. Additionally, production inconsistencies create cash flow uncertainty and limit the capacity to expand agribusinesses through practices or technologies that improve sustainability and productivity.

Fluctuation of transportation costs

The study findings also revealed surprising results at the 1 % significance level and, with a coefficient of 2.744, indicating that fluctuations in transportation costs have a positive influence on medium-term sustainability. This suggests that young agribusiness owners may be able to adjust to, or even profit from, fluctuations in transportation costs, thereby improving their medium-term sustainability. Given that changes in transportation costs are generally associated with lower profitability, increased logistical uncertainty, and a decline in competitiveness in agricultural supply chains, the study's findings contradict existing literature. The distribution of agricultural commodity price fluctuations affects farmers, especially in rural areas with inadequate infrastructure. This restricts farmers' access to markets, reduces their profit margins, and deters their participation in agricultural markets [48]. These disparities hinder youth agripreneurs' success rather than boosting their profit margins, particularly in areas where lower farm incomes and decreased market participation have been linked to transportation costs and rural logistics constraints.

Reduced supply quality

Medium-term sustainability is also significantly and adversely affected by lower supply quality, with a coefficient of -5.527 and a statistical significance level of 1 %. This outcome highlights the importance of adhering to market and quality standards. The study's findings imply that young agripreneurs' medium-term sustainability is hindered by 5 units when they experience reduced supply quality. The ability of young agripreneurs to survive in the agricultural sector is directly threatened by declining supply quality, which also affects productivity and profitability. A in a decline in supply quality, leading to a loss of market competitiveness and a decline in consumer trust. According to Bureth [49], inconsistencies in the quality of agricultural outputs also impair production efficiency and erode buyer-seller relationships, especially in value chains where market access depends on quality assurance.

3.3.3. Discussion on climate change-induced discrepancies impacting long-term sustainability

The unavailability of tailored climate-resistant inputs

The study's findings revealed that the unavailability of climate-resistant inputs is statistically significant at the 10% level for farmers' long-term sustainability, with a negative coefficient of -1.794. This means that when youth agripreneurs lack access to tailored inputs such as drought-tolerant seeds, pest-resistant crops, and heat-tolerant varieties, their long-term sustainability declines by two units. This outcome aligns with the study of Owusu-Kwarteng et al. [50], which emphasized that the availability of climate-resistant varieties enhances agricultural resilience and productivity, especially under fluctuating climatic conditions. The study further highlighted that access to such inputs improves resource efficiency and secures long-term farm profitability. Similarly, Olarewaju et al. [37] found that limited access to adaptive agricultural technologies and resources significantly constrains the resilience and sustainability of smallholder farmers across Sub-Saharan Africa. The study further highlighted that when farmers rely on traditional crop varieties susceptible to heat and water stress, yields decline, resulting in lower income stability and reduced farm longevity. Climate-resilient inputs, including drought-resistant seeds and pest-tolerant crops, play a crucial role in maintaining consistent yields and reducing vulnerability to extreme weather events. Consequently, the lack of such input perpetuates unsustainable practices and increases exposure to production risks.

Change in growing season

The other influential discrepancy impacting the long-term sustainability of agribusiness enterprises was changes in growing seasons, at the 10% significance level, as shown in **Table 4**. The study findings suggest that continuous changes in the growing season enhance youth farmers' long-term sustainable agricultural production. The positive coefficient of 0.981 implies that, as the growing season changes, the probability that youth agripreneurs sustain their production increases by almost a unit.

Furthermore, the results suggest that versatile farmers with a grounded knowledge of changing growing seasons are better positioned to produce sustainably than their counterparts. The positive coefficient suggests that farmers who effectively adapt to altered growing periods, such as adjusting planting dates, adopting short-maturity varieties, or diversifying cropping cycles, tend to become more resilient and sustainable in the long run. Moreover, the study findings reveal that changing growing seasons have a positive impact on the sustainability of agricultural production, particularly for farmers with a solid understanding of the commodity production season approach. The findings also imply that changing growing seasons need specific adaptive mechanisms, which tailored inputs could complement. The study findings could be primarily influenced by the study area's high temperatures, which prompt farmers to identify the ideal commodity to produce under varying growing seasons. According to a study by Kabata [51] on adaptive agricultural management, youth agripreneurs who recalibrate production calendars in response to unpredictable rainy seasons improve yield stability and resource-use efficiency, thereby strengthening long-term farm viability. Similarly, Vilakazi et al. [52] also highlighted that flexibility in planting schedules and diversification of crop types enhance long-term sustainability among smallholders and youth farmers in Southern Africa.

Consequently, the study findings indicate that the sustainability of agribusiness enterprises is closely linked to the discrepancies encountered along food value chains. This pinpoints the influence of discrepancies experienced in the industry segments potentially influencing the sustainability of agribusiness ventures in the commerce and trade segments, and is thus integrated.

4. Conclusion

Climate-induced discrepancies have a severe influence on the collapse, survival, and sustainability of agribusiness enterprises. The study revealed that persistent climate-induced discrepancies, including fluctuations in input prices, irregular input supply, reduced produce quality, production inconsistencies, and market volatility, impaired the sustainability of agribusiness enterprises. Subsequently, these discrepancies had both progressive and regressive influences on the sustainability of agribusiness enterprises at various stages of their life cycle. It can be concluded that discrepancies faced within the various agribusiness segments which form part of the food system synergy have sequential implications along the food value chain within the food systems. It can be concluded that production inconsistency, input price fluctuations, and the non-availability of climate-tailored inputs primarily impaired short-term sustainability. While the medium-term sustainability was hindered mainly by poor produce quality, these young agripreneurs supply the market. Noticing and adjusting growing seasons contributed to young agripreneurs' long-term sustainability.

For practical implications, based on the study's findings, the study recommends capacitating potential and emerging young agripreneurs to identify a set of discrepancies within their regions linked to the commodities of interest and to align their efforts with an ideal combination of coping mechanisms that enhances their adaptive capacity. The study recommends that youth agripreneurs be capacitated to interpret patterns in input price fluctuations, changes in growing seasons, and production inconsistencies, thereby enhancing their strategic planning and ultimately strengthening their short-, medium-, and long-term sustainability. The study also recommends exploring a commodity-environment adaptive approach to identify potential resource-friendly coping mechanisms that enhance their sustainability. Capacitating young agripreneurs to develop change-tailored inputs and to scrutinize different coping mechanisms to ensure low adaptive-cost responses. The study further recommends that key stakeholders within the food system invest in localized input manufacturing facilities, as this will positively enhance the resilience of agribusiness enterprises and ultimately sustain their continuity. Policy intervention to prioritize input price stabilization and the output market by establishing input manufacturing hubs, thereby mitigating input price fluctuations and availability issues. Moreover, there should be a policy within the agricultural landscape to improve the governance of the food system, potentially reducing market forces that contribute to unfair competition and price volatility, particularly in informal markets.

The limitations of the study include its cross-sectional nature, which may have captured the impacts of climate change discrepancies on the sustainability of agribusiness enterprises at that point in time, without gathering additional information on the potential for agripreneurs to enhance their operations, particularly given the study's primary focus on sustainability. Moreover, the study relied on self-reported data, which may be subject to response bias.

Future research prospects should be conducted on institutional constraints' influence on climate-induced discrepancies impacting youth agripreneurs' sustainability. Moreover, future research could focus on integrating the economic viability of a commodity with a livestock-tailored resilience approach, as this would provide insights into the coping mechanisms that are ideal and cost-effective for specific regions and agricultural enterprises.

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