



Regulation and Economic Security Outcomes among Pineapple Growing Communities in Selected Districts in Central Uganda

Hilary Muheezangango, Charles Edaku, Peters Yiga
Nkumba University, Uganda
Email: h.muheeza14@gmail.com

Abstract: This study examines the relationship between regulatory frameworks and economic security outcomes among pineapple-growing communities in selected districts of Central Uganda. Drawing on institutional theory and value chain governance perspectives, the study explores how formal and informal rules, enforcement mechanisms, and compliance practices influence farmers' livelihoods, including income stability, asset accumulation, and resilience. A cross-sectional research design was employed, integrating both quantitative and qualitative approaches. Data were collected from 278 pineapple farmers using structured questionnaires, complemented by 9 key informant interviews and nine focus group discussions. Descriptive findings reveal that pineapple farming significantly contributes to household economic security, particularly in improving income, food security, access to healthcare, and education, although challenges such as price instability and limited risk mitigation persist. The results further show that regulatory frameworks are characterized by moderate awareness, weak enforcement, and uneven compliance. Correlation analysis indicates a strong and significant positive relationship between regulation mechanisms and economic security outcomes ($r = 0.752, p < 0.001$). Regression findings reveal that while overall regulation mechanisms significantly predicts economic security outcomes ($\beta = 0.511, p < 0.001$), compliance is the only statistically significant regulatory dimension ($\beta = 0.416, p < 0.001$). These findings suggest that regulation improves livelihoods primarily when farmers actively adhere to established standards and practices. The study concludes that strengthening enforcement systems, enhancing awareness, and promoting participatory compliance mechanisms are essential for translating regulatory frameworks into sustainable economic security outcomes among smallholder farmers.

Keywords: Regulation; Economic Security Outcomes, Pineapple Farming, Smallholder Farmers, Guidelines/rules, Compliance, Enforcement, Value Chain Governance, Institutional Theory, Central Uganda, Agricultural Policy, Livelihood Resilience

How to cite this work (APA):

Muheezangango, H. Edaku, C. & Yiga, P. (2026). Regulation and Economic Security Outcomes among Pineapple Growing Communities in Selected Districts in Central Uganda. *Journal of Research Innovation and Implications in Education*, 10(2), 996 – 1011. <https://doi.org/10.59765/psw5>

1. Introduction

Regulation of activities within agricultural communities is a critical component of governance that shapes production, exchange, and participation in value chains. Regulation refers to the formal and informal rules, standards, enforcement and compliance mechanisms that guide farmers' behavior in areas such as production

practices, quality control, pricing, and contractual relationships (North, 1990; Gereffi et al., 2005). Within pineapple growing communities, effective regulation enhances compliance, reduces uncertainty, and promotes trust among value chain actors, thereby facilitating more stable and predictable economic interactions. Institutional theory posits that well-defined and enforced rules reduce transaction costs and opportunistic behavior, while value chain governance theory

emphasizes that standards and regulatory mechanisms determine access to markets and the distribution of value among participants (North, 1990; Ponte & Sturgeon, 2020).

Despite its importance, regulation in many smallholder farming contexts remains weak, inconsistent, or inadequately enforced. In Central Uganda, pineapple farmers often operate in environments characterized by limited knowledge and adherence to quality standards, weak monitoring systems, and unequal power relations with intermediaries, which expose them to price volatility and market inefficiencies (Akankwasa, 2019; UBOS, 2022). Such regulatory gaps can constrain farmers' ability to access high-value markets, reduce income stability, and increase vulnerability to economic shocks. Empirical studies suggest that while governance structures exist, their effectiveness in improving household-level outcomes such as income security, asset accumulation, and resilience remains uncertain (Barrett et al., 2021; Adu et al., 2022).

Given these gaps, the study sought to examine the relationship between regulation of activities in pineapple growing communities and economic security outcomes. Understanding this relationship provided empirical evidence on whether regulatory mechanisms contribute to improved livelihoods, including income stability, reduced vulnerability, and enhanced resilience among smallholder farmers. This objective therefore seeks to bridge the gap between governance structures and their actual impact on farmers' economic well-being in Central Uganda.

1.1 Problem Statement

The Constitution of the Republic of Uganda (1995) and the National Agricultural Policy (2013) emphasize the importance of regulatory frameworks in promoting sustainable agricultural development, ensuring quality standards, and safeguarding farmers' participation in productive economic activities. These frameworks mandate institutions such as the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), the Local Government and regulatory bodies such as UNBS to enforce standards, supervise agricultural practices, and ensure coordination across the sector (Government of Uganda, 2013). Effective regulation is expected to enhance compliance with production and market standards, reduce exploitation, and create stable conditions that support farmers' income security and overall economic well-being (World Bank, 2021; Ponte & Sturgeon, 2020). Ideally, such regulatory mechanisms should facilitate reduction of fake farm inputs on markets, offer to farmers access to high-value markets, improve product quality, and promote equitable participation in agricultural value chains.

However, in practice, regulatory mechanisms within pineapple growing communities in Central Uganda

remain weak, fragmented, and inconsistently enforced. Evidence indicates that a significant proportion of agricultural inputs that do not meet certification standards continue to flood the markets, reflecting inadequate enforcement and weak coordination among regulatory agencies such as MAAIF, UNBS, and NEMA (Kuteesa, 2020; Mugagga et al., 2021; Okoboi & Barungi, 2023). In addition, limited monitoring of production and marketing practices exposes farmers to substandard inputs, price manipulation, and exclusion from formal markets. These regulatory gaps undermine compliance with quality standards, reduce market competitiveness, and weaken farmers' bargaining power within the value chain. Despite the existence of policy frameworks, the disconnect between regulation and implementation creates an environment where smallholder farmers operate under uncertain and often exploitative conditions.

These weaknesses in regulatory practices have direct implications for economic security outcomes among pineapple farmers. Smallholder households in Central Uganda continue to experience low and unstable incomes, limited asset accumulation, and high vulnerability to market and environmental shocks (UBOS, 2023; Mubiru et al., 2020). Poor enforcement of standards contributes to post-harvest losses, reduced product quality, and limited access to premium markets, further constraining income stability and livelihood resilience (FAO, 2022; World Bank, 2021). While existing studies have examined agricultural governance broadly, the study finds limited empirical evidence on how regulation of activities specifically influences household-level economic security outcomes in the context of pineapple growing communities. Therefore, this study seeks to examine the relationship between regulation of activities in pineapple growing communities and economic security outcomes in selected districts of Central Uganda. Understanding this relationship will provide evidence on whether strengthening regulatory mechanisms can enhance income stability, reduce vulnerability, and improve the overall economic well-being of smallholder farmers, pineapple farmers in particular.

1.2 Research Objectives

To examine the relationship between regulation of activities of pineapple growing communities in selected districts in Central Uganda and economic security outcomes.

2. Literature Review

The term regulation is defined in many different ways: (1) Regulation as "the promulgation of an authoritative set of rules, accompanied by some mechanism for monitoring and promoting compliance with these rules", (2) regulation as "all efforts of the state agencies to steer the economy", and (3) regulation as "all mechanisms of

social control – including unintentional and non-state processes” (Koop and Lodge, 2015; Jordana and Levi-Faur 2004; Baldwin et al. 2012). Regulation of activities within agricultural value chains refers to the formal and informal rules, standards, and enforcement mechanisms that guide production, processing, and marketing practices among farmers. According to institutional theory, such regulatory frameworks reduce uncertainty, minimize opportunistic behavior, and enhance market efficiency by establishing clear expectations and accountability among actors (North, 1990). In agricultural systems, regulation is operationalized through input certification, quality standards, inspection systems, and compliance monitoring, all of which influence farmers’ ability to participate effectively in markets and achieve stable economic outcomes (Saak, 2016; Opong & Bannor, 2022; FAO, 1999).

Empirical literature indicates that effective regulatory frameworks play a critical role in shaping economic security outcomes among smallholder farmers. Rugadya (2020) observes that weak regulatory enforcement in Uganda’s horticulture sector undermines adherence to standards, resulting in reduced market access and unstable incomes. Similarly, the National Agricultural Policy (MAAIF, 2013) emphasizes that regulatory institutions are essential for ensuring quality assurance, market competitiveness, and farmer protection; however, implementation gaps at the local level often limit their effectiveness. These gaps create inconsistencies in enforcement and weaken the link between regulatory structures and livelihood improvements.

Globally, evidence suggests that strong regulatory systems enhance economic outcomes by improving product quality, increasing market access, and stabilizing incomes. The Food and Agriculture Organization (FAO, 2020) highlights that traceability systems, inspection mechanisms, and compliance enforcement significantly improve farmers’ participation in high-value markets. In Ghana, weak pesticide regulation reduced smallholder incomes due to non-compliance with export standards, while in Kenya, hybrid regulatory models combining cooperative enforcement and private standards improved compliance and market participation (Amoah et al., 2021; Mwangi & Kariuki, 2020). These findings demonstrate that regulatory effectiveness directly influences farmers’ income stability, asset accumulation, and resilience.

In the Ugandan context, regulatory challenges remain widespread, particularly among smallholder farmers. Studies indicate that nearly 40% of agricultural inputs fail to meet certification standards, reflecting weak enforcement and limited coordination among regulatory bodies such as MAAIF, UNBS, and NEMA (Kuteesa, 2020; Mugagga et al., 2021). Additionally, only a small proportion of farmers meet formal quality standards required for high-value markets, limiting their ability to secure better prices and stable incomes (UBOS, 2022). Limited awareness of standards and inadequate

inspection coverage further constrain compliance, contributing to post-harvest losses estimated at 20–30% annually. These regulatory deficiencies weaken farmers’ bargaining power and reduce their participation in formal markets.

The relationship between regulation and economic security outcomes is also mediated by enforcement mechanisms and institutional coordination. Weak collaboration among regulatory agencies leads to fragmented oversight and inconsistent application of standards, undermining their effectiveness (Okoboi & Barungi, 2023). World Bank (2021) emphasizes that integrated regulatory systems enhance productivity and resilience by aligning standards with extension services, market access, and farmer support systems. However, most studies focus on national-level analyses, with limited attention to district-level dynamics within specific value chains such as pineapple farming.

Furthermore, poor regulatory practices have direct implications for household-level economic security outcomes. Weak enforcement of quality standards contributes to low product quality, reduced prices, and limited access to premium markets, thereby affecting income stability and asset accumulation. Empirical evidence from Central Uganda shows that low awareness of grading standards, limited inspection, and informal marketing systems reduce farmers’ ability to comply with market requirements and improve their economic position (Katungi et al., 2021; Ntanda, 2023). While global studies confirm that strong regulatory frameworks enhance resilience and reduce vulnerability, there is limited empirical evidence linking specific regulatory practices to multidimensional economic security outcomes such as income stability, asset accumulation, and resilience within pineapple growing communities.

Despite the growing body of literature, significant gaps remain. Most existing studies emphasize general agricultural governance or focus on export-oriented value chains, with limited attention to domestic horticultural systems such as pineapple farming in Central Uganda. Additionally, there is a lack of rigorous quantitative studies examining how specific dimensions of regulation such as clarity of rules, enforcement intensity, and compliance behavior affect household-level economic security outcomes. This gap limits the ability to draw context-specific conclusions on the effectiveness of regulatory mechanisms in improving farmer livelihoods.

Therefore, this study seeks to address these gaps by examining the relationship between regulation of activities and economic security outcomes among pineapple growing communities in selected districts of Central Uganda. By focusing on localized regulatory practices and their influence on income stability, asset accumulation, and resilience, the study contributes to a more nuanced understanding of how governance

mechanisms translate into tangible livelihood improvements.

3. Methodology

This study adopted a cross-sectional explanatory sequential mixed-methods design to examine the relationship between regulation of activities within pineapple-growing communities and economic security outcomes in selected districts in Central Uganda. The cross-sectional approach enabled the collection of data at a single point in time, which was appropriate for assessing how regulatory mechanisms such as rules, enforcement practices, and compliance requirements influence the economic well-being of actors within the pineapple value chain. The mixed-methods strategy allowed for the integration of both quantitative and qualitative evidence, thereby enhancing analytical rigor and providing a comprehensive understanding of regulatory dynamics and their implications for economic security.

The study population comprised pineapple farmers, cooperative leaders, traders, farm workers, and other stakeholders operating within the pineapple value chain in Luweero, Kayunga, and Mukono districts. These districts were purposively selected due to their significant involvement in pineapple production and the existence of formal and informal regulatory structures governing production and marketing activities. A stratified random sampling technique was employed to ensure proportional representation across different categories of respondents and geographical locations. The sample size was determined using Slovin's formula at a 5% margin of error, resulting in an initial target of 396 respondents. A total of 278 valid responses were obtained, yielding a response rate of 70.24%, and these were distributed across Luweero ($n = 97$), Kayunga ($n = 86$), and Mukono ($n = 95$).

Data were collected using both quantitative and qualitative methods. Quantitative data were obtained through structured questionnaires consisting primarily of closed-ended and Likert-scale items designed to capture information on regulatory practices, including licensing, market regulations, quality standards, and enforcement mechanisms, as well as indicators of economic security such as income stability, access to markets, and livelihood resilience. Qualitative data were collected through 22 key informant interviews and nine focus group discussions conducted with cooperative leaders, local government officials, and other value chain actors. In addition, non-participant observation was employed to document real-time practices and interactions within pineapple-growing communities. The data collection instruments were developed based on relevant theoretical frameworks and were pretested to ensure clarity, relevance, and contextual appropriateness.

The data collection process followed a systematic and structured procedure to ensure accuracy and reliability.

Approval to conduct the study was obtained from relevant institutional authorities and local government offices in the selected districts. Trained research assistants who were fluent in both English and Luganda administered the questionnaires through face-to-face interviews to enhance comprehension and accuracy of responses, particularly in rural settings. Qualitative data were collected using semi-structured interview and discussion guides, with sessions conducted in accessible locations and audio-recorded with participants' consent. Pretesting of the instruments was conducted prior to the main data collection exercise to refine question wording, sequencing, and clarity. This coordinated approach ensured high response rates, minimized errors, and improved the overall quality of the data collected.

Data analysis involved both quantitative and qualitative techniques. Quantitative data were analyzed using STATA version 18. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize regulatory practices and economic security indicators. Inferential statistical methods were applied to test relationships among variables, including Pearson's correlation analysis to assess the strength and direction of relationships, multiple regression analysis to determine the predictive influence of regulatory mechanisms on economic security outcomes, and Structural Equation Modeling to examine direct and indirect relationships within the study model. Qualitative data were analyzed using thematic content analysis, where interview and focus group transcripts were coded and organized into recurring themes related to regulatory enforcement, institutional effectiveness, compliance behavior, and their influence on livelihoods. These qualitative insights were used to enrich and contextualize the quantitative findings.

Measures were taken to ensure data quality, validity, and reliability. Instrument validity was achieved through expert review and pilot testing to confirm that the tools adequately captured the study constructs. Reliability was assessed using Cronbach's alpha coefficients, all of which exceeded the acceptable threshold of 0.70, indicating strong internal consistency. In addition, methodological triangulation through the use of multiple data sources and methods enhanced the credibility and robustness of the findings.

Ethical considerations were strictly observed throughout the study. Ethical approval was obtained from relevant institutional review bodies, and permission was secured from district authorities in the study areas. Participation in the study was voluntary, and informed consent was obtained from all respondents before data collection. Participants were informed about the purpose of the study, their rights, and their freedom to withdraw at any time without any consequences. Confidentiality and anonymity were ensured by not recording personal identifiers and by securely storing all data collected. The study was conducted in a manner that minimized any potential harm to participants, and all information

obtained was used strictly for academic purposes in accordance with established research ethics and standards.

4. Results and Discussion

This section presents findings on the relationship between regulatory mechanisms and economic security outcomes among pineapple-growing communities in selected districts of Central Uganda. It begins with respondents' demographic characteristics and then examines how formal rules, procedures, and enforcement practices influence income stability, market access, and livelihood resilience. Drawing on both quantitative and qualitative evidence, the analysis applies a many-to-one

framework to assess the direct and indirect effects of regulation, including the mediating role of the work environment.

4.1 Respondent Characteristics

This section presents the demographic characteristics of the respondents who participated in the study. The variables include age, sex, level of education, and district of residence. These characteristics provide important contextual information for understanding the composition of the sample and for interpreting variations in coordination structures and economic security outcomes among pineapple-growing households across the study districts.

Table 1: Respondent Characteristics (n=278)

Respondent Characteristic	Category	Freq	Percent
Age	18-25	10	3.60%
	26-35	39	14.03%
	36-45	105	37.77%
	46-55	81	29.14%
	56-Above	43	15.47%
Sex	Male	161	57.91%
	Female	117	42.09%
Level of education	None	7	2.52%
	Primary	98	35.25%
	Secondary	128	46.04%
	Tertiary	45	16.19%
District	Luweero	96	34.53%
	Kayunga	95	34.17%
	Mukono	87	31.29%

Source: Primary data, 2025

Table 1 presents the demographic characteristics of the 278 respondents who participated in the study. The age distribution indicates that the majority of respondents were within the economically active age groups. Most respondents were aged 36–45 years (37.77%), followed by those aged 46–55 years (29.14%). Together, these groups account for over two-thirds of the sample, suggesting that pineapple production in the study areas is largely undertaken by mature and experienced farmers. Younger respondents aged 18–25 years constituted a small proportion (3.60%), indicating limited participation of youth in pineapple farming.

In terms of sex, male respondents formed the majority (57.91%), while females accounted for 42.09% of the sample. Although men were more represented, the relatively high participation of women highlights their significant involvement in pineapple production and related value chain activities in the study districts.

Regarding educational attainment, most respondents had some formal education. Nearly half had attained secondary education (46.04%), followed by those with primary education (35.25%). A smaller proportion had tertiary education (16.19%), while only 2.52% reported having no formal education. This distribution suggests that most farmers possess basic literacy and numeracy skills, which are important for understanding extension messages, engaging in coordinated activities, and accessing market information.

The distribution of respondents across districts was fairly balanced. Luweero district accounted for 34.53% of respondents, Kayunga 34.17%, and Mukono 31.29%. This relatively even representation enhances the comparability of findings across districts and supports district-level analysis of coordination structures and economic security outcomes among pineapple-growing communities.

In summary, the demographic characteristics of the respondents indicate that pineapple farming in the study districts is largely undertaken by economically active and experienced individuals, with a substantial proportion possessing at least basic formal education. The relatively balanced participation of men and women highlights the importance of considering gender dynamics in coordination arrangements within the pineapple value chain. The low participation of the youth also indicates the importance of considering interesting the youth in pineapple growing, especially if the pineapple is to be prioritized and promoted as an economic security crop. Collectively, these characteristics provide an appropriate and robust foundation for examining the role of coordination structures in shaping economic security outcomes among pineapple-growing communities in Central Uganda.

4.2 Economic Security Outcomes

This section presents, interprets, and discusses findings on economic security outcomes (ESO), among pineapple

value chain communities in Luweero, Kayunga, and Mukono districts. As the dependent variable of this study, economic security outcomes provide a baseline understanding of the livelihood conditions within which governance practices operate. The unit of analysis is the individual pineapple farmer.

Economic security outcomes are conceptualized as multidimensional, encompassing income stability, asset accumulation, food security, access to education and health services, price stability, risk mitigation, climate resilience, and supply chain reliability (Narboy, et al., 2021). This conceptualization aligns with the Sustainable Livelihoods Framework (SLF), which emphasizes that households combine different assets and strategies to achieve sustainable livelihoods under varying vulnerability contexts (Scoones, 2019; Harvey et al., 2019). Understanding these outcomes establishes the foundation for analyzing how farmers' regulation mechanisms including knowledge of guidelines, enforcement and compliance of guidelines shape economic security in the subsequent analysis.

Table 2: Descriptive statistics on respondents Perception on Economic Security Outcomes

Economic Security	N	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean (SD)	Standard Deviation	Interpretation
Over the past 3 years, I have received regular & predictable income from pineapple farming.	278	12.59%	15.11%	0.72%	51.80%	19.78%	3.511	1.307	High
Pineapple farming has enabled me to acquire assets such as land, tools, livestock, build houses, & also plant other crops such as coffee etc.	277	4.33%	13.72%	0.36%	54.87%	26.71%	3.859	1.093	High
Money from pineapple farming has supported the education of my children.	277	2.89%	7.22%	0.36%	67.15%	22.38%	3.989	0.883	High
Pineapple farming has increased food security and improved my diet since I am able to integrate variety of crops in the farm and buy other foods that I cannot produce from my farm.	278	2.16%	4.68%	0.36%	71.22%	21.58%	4.054	0.775	High
Income from pineapple farming helps me pay for the medical bills of my family members and access improved sanitation and hygiene facilities.	277	2.17%	5.05%	0.00%	73.29%	19.49%	4.029	0.770	High
The prices I receive for pineapples are fair and stable.	278	12.59%	34.53%	0.36%	45.68%	6.83%	2.996	1.259	Moderate
I have ways of minimizing financial losses/risks in case of crop failure (eg: crop insurance, personal saving, farming groups, financial institutions).	278	9.35%	22.30%	0.36%	61.15%	6.83%	3.338	1.172	Moderate
Overall	278						3.737	0.778	High

Legend: Likert Mean: less 3- Disagreement and greater than 3- Agreement. Legend: Very high (4.24 – 5.00), High (3.43 – 4.23), Moderate (2.62 – 3.42), Low (1.81 – 2.61), Very Low (1.00 – 1.80).

Source: Primary data, 2025

Table 2 presents respondents' perceptions of economic security outcomes (ESO) resulting from pineapple farming over the past three years. The findings highlight the multidimensional benefits of pineapple farming on household livelihoods, while also pointing to areas of concern, such as price stability and risk management.

Regular and predictable income from pineapple farming is strongly supported by both quantitative and qualitative evidence. More than half of respondents reported receiving regular and predictable income from pineapple farming (51.80% agree; 19.78% strongly agree), with a mean score of 3.511 (SD = 1.307), indicating a generally high perception of income stability. This quantitative pattern is corroborated by qualitative findings, in which farmers and labourers consistently identified pineapple farming as a key source of household income and economic security. For instance, one labourer noted that "*workers earn income from selling pineapples*" (Key Informant Interview 09, 2025), while another explained that, "*many people generate income through collective efforts; both workers and farmers benefit*" (Key Informant Interview 06, 2025).

The convergence of these findings demonstrates that pineapple farming plays a central role in ensuring regular household income and sustaining livelihoods.

Acquisition of assets. Both quantitative and qualitative evidence indicate that pineapple farming plays a significant role in asset accumulation among households. A majority of respondents reported that pineapple farming enabled them to acquire assets such as land, tools, livestock, housing, and additional crops (54.87% agree; 26.71% strongly agree), with only a small proportion expressing disagreement. The high mean score (M = 3.859, SD = 1.093) reflects a strong perception of farming's contribution to asset building. This quantitative pattern is corroborated by qualitative findings, which show that income from pineapple farming is frequently reinvested in productive and non-productive assets. Respondents described using earnings to expand farms, purchase livestock, and improve housing. At the same time, qualitative accounts reveal structural constraints that moderate these gains, particularly limited access to credit due to high interest rates and inadequate land documentation. As one participant noted, "*Access to credit helps, but high interest rates and lack of documented land, limit loan access*" (Key Informant Interview 01, 2025).

The convergence of findings demonstrates that while pineapple farming significantly supports asset accumulation, institutional barriers shape the extent of investment.

Support for children's education. The contribution of pineapple farming to educational outcomes is strongly supported by both datasets. Quantitative results show

that most respondents acknowledged the role of pineapple income in supporting children's education (67.15% agree; 22.38% strongly agree), with a high mean score (M = 3.989, SD = 0.883). This perception is reinforced by qualitative evidence, in which respondents consistently identified income generation as the foundation for meeting household priorities, including school fees and related expenses. Although education was not always mentioned explicitly, participants repeatedly emphasized that pineapple farming provides the financial base for household investments. For instance, one participant stated that, "*Many people generate income through collective efforts; both workers and farmers benefit*" (Key Informant Interview 05, 2025)

The alignment between quantitative and qualitative findings confirms that pineapple-derived income is a key mechanism through which households enhance human capital development.

Food security and diet improvement. A strong convergence of evidence also emerges in relation to food security. A high proportion of respondents reported that pineapple farming improved household food security and diet diversity (71.22% agree; 21.58% strongly agree), with the highest mean score among all indicators (M = 4.054, SD = 0.775). Qualitative findings corroborate this result by illustrating both direct and indirect pathways through which pineapple farming enhances food access. Respondents explained that income from pineapple sales enables households to purchase diverse foods, while employment opportunities along the value chain support regular consumption. As one participant observed, "*work in pineapple farming creates jobs and teaches discipline*" (Key Informant Interview 07, 2025). Further during the field study, a number of respondents were overheard saying that pineapple growing allows integration with other crops especially bananas. Banana plants were also observed in almost all pineapple gardens in Luweero, Kayunga and Mukono districts. Together, these findings demonstrate that pineapple farming significantly strengthens household food security and dietary quality.

Access to healthcare and sanitation. Similarly, quantitative and qualitative findings converge on the role of pineapple farming in improving access to healthcare and sanitation. Most respondents agreed that income from pineapple farming helps cover medical expenses and supports sanitation improvements (73.29% agree; 19.49% strongly agree), reflected in a high mean score (M = 4.029, SD = 0.770). Qualitative evidence reinforces this perception, with respondents consistently describing pineapple-related earnings as a critical source of livelihood support that enables households to manage both routine and unexpected health-related costs. As one labourer noted, "*workers earn income from selling pineapples*" (Key Informant Interview 09, 2025). The integration of findings indicates that income from

pineapple farming reduces vulnerability to health shocks and enhances overall wellbeing.

Price stability. In contrast, both quantitative and qualitative evidence point to persistent challenges related to price stability. Only 45.68% of respondents perceived pineapple prices as fair and stable, while a substantial proportion expressed disagreement (34.53% disagree; 12.59% strongly disagree), resulting in a moderate mean score ($M = 2.996$, $SD = 1.259$). Qualitative findings corroborate these concerns, with respondents highlighting price volatility, weak bargaining power, and market saturation as key constraints. As one participant explained, “*Farmers suffer from price fluctuations and poor bargaining power, which affects their income stability*” (Key Informant Interview 03, 2025)

At the same time, some respondents noted that strategies such as bulk selling and quality differentiation can partially mitigate these challenges. The convergence of findings underscores price instability as a structural risk that limits the economic benefits of pineapple farming.

Financial risk mitigation. Evidence from both datasets suggests that financial risk mitigation mechanisms are present but unevenly accessible. Quantitative results show that while a majority of respondents acknowledged the use of strategies such as savings, cooperatives, and informal risk-sharing mechanisms (61.15% agree; 6.83% strongly agree), a sizeable proportion remained unconvinced (31.65% disagree), with a moderate mean score ($M = 3.338$, $SD = 1.172$). Qualitative findings validate this pattern by revealing that risk mitigation is largely informal and fragmented. Respondents emphasized that weak coordination and limited collective bargaining increase exposure to financial losses, with one informant noting that “*without bargaining power, many pineapples flood the market and households lose income*” (Key Informant Interview 020, 2025). These convergent findings highlight the need for more structured and inclusive risk management mechanisms.

Overall, the integrated findings indicate that pineapple farming significantly contributes to household economic security in Luweero, Kayunga, and Mukono districts, evidenced by high perceptions of improved food security, access to healthcare, support for education, income generation, and asset accumulation (mean score = 3.737, $SD = 0.778$). Both quantitative and qualitative data converge in highlighting these benefits while consistently identifying persistent challenges such as price volatility, limited access to formal financial mechanisms, weak bargaining power, and inadequate

risk-mitigation strategies. This convergence suggests that economic security outcomes are influenced less by production capacity and more by the governance, coordination, and market conditions surrounding pineapple production. While farming enables households to meet immediate needs and accumulate some assets, many remain vulnerable to market shocks and systemic uncertainties. Therefore, strengthening economic security requires interventions that go beyond increasing output, focusing on improving market stability, financial inclusion, and supportive coordination structures to enable households to transform short-term earnings into durable, resilient livelihoods.

4.3 Regulation Frameworks

Regulatory frameworks play a central role in shaping agricultural production systems by defining acceptable practices, safeguarding market standards, and protecting farmers’ welfare. These frameworks influence production decisions, environmental sustainability, and market participation by establishing rules and incentives that guide farmer behavior (Jena et al., 2022; Tambo et al., 2024). In pineapple farming in Central Uganda, regulation includes formal instruments such as laws, policies, guidelines, standards, and enforcement mechanisms governing production, pesticide use, post-harvest handling, marketing, and environmental sustainability, implemented by state agencies, certification bodies, development partners, and private sector actors. Such regulatory mechanisms particularly certification schemes, input regulation, and food safety standards have been shown to improve compliance with sustainable practices, enhance product quality, and facilitate access to high-value markets, thereby strengthening farmers’ economic outcomes and resilience (Zhang et al., 2024; Tambo et al., 2024; Omara et al., 2024; Sayekti & Prihandono, 2023). Therefore, the effectiveness of regulatory frameworks ultimately determines the extent to which pineapple farmers can achieve stable, predictable, and sustainable economic security outcomes within the value chain. In this paper, regulation was operationalized across four dimensions: awareness of legal frameworks, enforcement mechanisms, compliance with regulations, and the perceived contribution of regulatory bodies to economic security outcomes. Awareness reflects farmers’ knowledge of rules and access to information; enforcement captures institutional presence and activity; compliance measures adherence to regulations; and contribution assesses perceived effects on productivity, income, food security, health, climate resilience, and supply chain reliability.

Table 3: Descriptive statistics on respondents' views on Regulatory Mechanisms

REGULATION	N	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean (SD)	Standard Deviation	Interpretation
AWARENESS OF THE LEGAL FRAMEWORKS (Guidelines, Rules, Regulations, Policies, and Procedures)									
I am aware of the legal frameworks that govern pineapple growing, pesticide use, post-harvest handling and marketing in my area.	278	16.19%	38.85%	0.36%	42.81%	1.80%	2.752	1.216	Moderate
I have access to written guidelines or policies related to pineapple farming, pesticide use, post-harvest handling and marketing.	275	17.09%	38.91%	0.00%	42.55%	1.45%	2.724	1.219	Moderate
I have received training or sensitization on the procedures for pineapple farming, pesticide use, post-harvest handling and marketing.	275	15.64%	31.27%	0.00%	50.18%	2.91%	2.935	1.248	Moderate
There are effective systems such as: certification systems, Fair Trade, pesticides restrictions, environmental regulations, fertilizer regulations in place that enforce pineapple farming.	277	18.05%	39.35%	0.00%	39.35%	3.25%	2.704	1.248	Moderate
Violations of pineapple-related guidelines are consistently penalized. Enforcement mechanisms	276	18.84%	50.36%	0.36%	27.17%	3.26%	2.457	1.170	Low
Enforcement bodies such as: MAAIF, NAADS, Global GAP, UNBS, UFDA, FAO, WTO, NGOs, and Private Business Companies are visible and active in our community.	278	19.42%	29.50%	0.36%	46.04%	4.68%	2.871	1.307	Moderate
Compliance									
I comply with rules and regulations on pineapple farming and I have records/documentation to prove compliance with relevant procedures.	278	16.91%	28.42%	0.36%	52.88%	1.44%	2.935	1.244	Moderate
I adjust my farming practices to align with any new rules or policy updates.	275	15.27%	15.64%	2.55%	62.91%	3.64%	3.240	1.221	Moderate
Compliance with regulations has positively influenced my pineapple business productivity and incomes. Contribution of regulatory bodies	277	15.88%	22.38%	0.72%	48.74%	12.27%	3.191	1.344	Moderate

REGULATION	N	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean (SD)	Standard Deviation	Interpretation
Regulatory frameworks have improved my productivity as a pineapple grower.	272	17.28%	22.79%	0.00%	46.32%	13.60%	3.162	1.381	Moderate
Regulatory bodies have helped increase my income from pineapple farming.	278	15.47%	21.58%	0.36%	50.00%	12.59%	3.227	1.339	Moderate
Regulations have contributed to improving my food security.	276	14.86%	21.74%	0.72%	44.20%	18.48%	3.297	1.383	Moderate
Regulatory systems have enabled better educational opportunities for my household.	278	14.75%	21.58%	0.00%	47.84%	15.83%	3.284	1.358	Moderate
Regulations have positively influenced my health outcomes.	277	13.36%	23.83%	0.36%	48.38%	14.08%	3.260	1.326	Moderate
Regulatory frameworks have helped ensure price stability for my pineapples.	277	14.08%	25.99%	0.00%	50.18%	9.75%	3.155	1.303	Moderate
Regulations have assisted me in mitigating risks associated with pineapple farming.	277	13.31%	37.77%	0.00%	38.13%	10.79%	2.953	1.314	Moderate
Regulatory bodies have supported my climate resilience efforts.	278	13.00%	28.16%	0.36%	50.90%	7.58%	3.119	1.267	Moderate
Regulations have improved the reliability of the supply chain for my pineapples.	277	12.95%	31.29%	0.00%	43.53%	12.23%	3.108	1.323	Moderate
Overall-Regulation	278						3.024	1.144	Moderate

Likert Mean: less 3- Disagreement and greater than 3- Agreement. Legend: Very high (4.24 – 5.00), High (3.43 – 4.23), Moderate (2.62 – 3.42), Low (1.81 – 2.61), Very Low (1.00 – 1.80)

Source: Primary data, 2025

Awareness and Access to Regulatory Frameworks- Quantitative and qualitative evidence converge in showing that awareness of legal frameworks governing pineapple production, pesticide use, post-harvest handling, and marketing is present but uneven among farmers. Just under half of respondents reported awareness of such frameworks (42.81% agree; 1.80% strongly agree), while a slightly larger proportion disagreed or strongly disagreed (55.04%), resulting in a moderate mean score ($M = 2.752$, $SD = 1.216$). This pattern is corroborated by qualitative findings, which reveal that regulatory knowledge is largely informal and transmitted through peer learning rather than formal legal instruments. Participants explained that farmers often learn acceptable practices through observation and imitation, reflecting the dominance of informal norms within the pineapple value chain. For instance, one implementor noted that “*rules are informal and largely learned from observing other farmers*” (Key Informant Interview 07, 2025), while another mentioned that “*there are no formal regulatory structures in key areas of production and marketing*” (Key Informant Interview

01). The convergence of findings indicates that while regulatory awareness exists, it is shaped more by informal practices than by formal legal frameworks. Uneven awareness of regulatory frameworks limits effective compliance, leading to unequal market participation and weakening the ability of regulation to improve farmers’ economic security outcomes.

A similar pattern emerges in access to written guidelines or policies. Quantitative results show that 44.00% of respondents reported access to written regulatory materials, whereas 56.00% did not, with a moderate mean score ($M = 2.724$, $SD = 1.219$). Qualitative evidence reinforces this finding by highlighting the scarcity and weak institutionalization of formal regulatory documents. An official emphasized the lack of a comprehensive legal framework, noting that, “*There are no serious regulations because there must be a mother law, which is not there*” –(Key Informant Interview 02, 2025).

Together, the findings demonstrate that limited dissemination of formal regulatory information constrains farmers' engagement with written rules.

Training, Enforcement, and Institutional Presence-Both datasets indicate that training and sensitization constitute the primary mechanisms through which regulatory practices are transmitted. Quantitatively, slightly over half of respondents reported receiving training on pineapple farming procedures and related standards (50.18% agree; 2.91% strongly agree), yielding a moderate mean score ($M = 2.935$, $SD = 1.248$). Qualitative accounts corroborate this pattern, showing that regulatory influence is exercised largely through extension services rather than formal enforcement. As one respondent explained, "*Regulation is promoted through training and sensitization at district, sub-county, and parish levels*" (Key Informant Interview 03,2025).

The convergence of findings suggests that education functions as a substitute for formal regulatory enforcement in the pineapple sector.

Perceptions of enforcement systems further reflect this hybrid regulatory environment. Quantitative results indicate that fewer than half of respondents perceived effective enforcement mechanisms ($M = 2.704$, $SD = 1.248$), while qualitative findings reveal fragmented and inconsistently applied enforcement. For example, respondents noted that government interventions often lack follow-up and monitoring, undermining regulatory impact. Similarly, perceptions of penalization were low, with only 30.43% of respondents believing that violations are consistently punished ($M = 2.457$, $SD = 1.170$). Qualitative narratives strongly corroborate this finding, with participants emphasizing the absence of national-level regulation and weak deterrence mechanisms. Together, the integrated evidence highlights a regulatory system characterized by partial enforcement and limited accountability.

Institutional visibility also reflects this moderate regulatory presence. Quantitatively, about half of respondents perceived enforcement bodies as visible and active ($M = 2.871$, $SD = 1.307$). Qualitative findings align with this perception, indicating that institutional presence is mainly associated with extension officers and local government actors rather than comprehensive regulatory oversight. This convergence suggests that while institutions are present, their engagement is uneven and largely advisory rather than coercive.

Compliance and Adaptive Behavior-with regulatory requirements. Quantitatively, slightly over half of respondents reported compliance with regulations and documentation practices ($M = 2.935$, $SD = 1.244$). Qualitative findings validate this pattern by showing that compliance is often driven by localized governance structures such as cooperatives, employers, and

extension systems rather than formal legal obligations. Similarly, farmers reported adjusting their practices in response to policy changes ($M = 3.240$, $SD = 1.221$), reflecting adaptive behavior within a loosely regulated environment. Qualitative narratives reinforce this interpretation, highlighting how localized coordination mechanisms shape compliance. The convergence of findings suggests that compliance is pragmatic and context-driven rather than strictly rule-based.

Regulatory Contributions to Economic Security-Across multiple indicators, quantitative and qualitative findings converge in showing that regulatory frameworks contribute to economic security, albeit in a limited and uneven manner. Respondents reported moderate positive effects of regulation on productivity ($M = 3.162$, $SD = 1.381$), income ($M = 3.227$, $SD = 1.339$), food security ($M = 3.297$, $SD = 1.383$), education ($M = 3.284$, $SD = 1.358$), health outcomes ($M = 3.260$, $SD = 1.326$), price stability ($M = 3.155$, $SD = 1.303$), climate resilience ($M = 3.119$, $SD = 1.267$), and supply chain reliability ($M = 3.108$, $SD = 1.323$). Qualitative accounts corroborate these perceptions by illustrating how regulatory engagement with institutions such as MAAIF, NAADS, UNBS, NGOs, and private buyers improves knowledge, market access, and production practices. At the same time, qualitative evidence highlights persistent constraints, including weak enforcement, compliance costs, and gaps in transport and logistics regulation. The alignment of findings indicates that regulation functions more as an enabling and guiding mechanism than as a strictly enforced governance system.

Overall, the combined quantitative and qualitative evidence reveals a regulatory environment characterized by moderate awareness, partial enforcement, pragmatic compliance, and incremental contributions to economic security. The overall mean score ($M = 3.024$, $SD = 1.144$) reflects this intermediate level of regulatory effectiveness. The convergence of findings demonstrates that regulation plays a substantive but constrained role in shaping pineapple farmers' economic security outcomes. Formal rules, institutional guidance, and informal practices operate simultaneously, creating a hybrid regulatory system in which governance is mediated by both official institutions and community-based norms. This integrated evidence suggests that regulatory frameworks influence economic security not only directly through rules and enforcement but also indirectly by shaping knowledge, behavior, and institutional support systems within the pineapple value chain.

In synthesis, regulation emerges not merely as a control mechanism but as a foundational governance practice that structures farming behavior, stabilizes incomes, and supports household well-being among pineapple growers. These findings provide a critical bridge to the next chapter on control mechanisms, as they demonstrate how formal regulatory frameworks set the conditions

under which monitoring, supervision, and accountability processes can further consolidate economic security gains.

4.4 Correlation and Regression Analyses

Table 4: Correlation between individual constructs of the regulatory variable systems against economic security outcomes among 278 pineapple farmers in selected districts of Uganda

Variables	Economic Security Outcomes	p-value
Overall Regulation	0.7519	0.000
Guidelines	0.6397	0.000
Enforcement Mechanisms	0.6170	0.000
Compliance	0.7311	0.000

Source: Primary data, 2025

Table 4 presents the correlation between key constructs of regulatory systems overall regulation, guidelines, enforcement mechanisms, and compliance and economic security outcomes among 278 pineapple farmers in selected districts of Uganda. The results indicate strong and statistically significant positive relationships across all constructs. Overall regulation shows the strongest association with economic security ($r = .752, p < .001$), suggesting that a well-functioning regulatory environment is closely linked to improved farmer livelihoods. Compliance also demonstrates a strong positive relationship ($r = .731, p < .001$), highlighting the importance of adherence to rules, record-keeping, and alignment with policy requirements in enhancing productivity, income, and household well-being. Guidelines exhibit a moderately strong correlation ($r = .640, p < .001$), while enforcement mechanisms, though slightly lower, remain significant ($r = .617, p < .001$), indicating that both access to regulatory information and

the presence of enforcement structures contribute positively to economic outcomes.

Overall, these findings underscore the critical role of regulatory systems in shaping economic security among pineapple farmers. The stronger relationships observed for overall regulation and compliance suggest that the effectiveness of regulatory frameworks largely depends on farmers' active engagement and adherence to established standards. While guidelines and enforcement mechanisms provide the necessary institutional foundation, their impact is less pronounced when not complemented by compliance. This implies that regulation yields the greatest benefits when clear policies, effective enforcement, and farmer participation are aligned, creating an enabling environment that enhances income stability, productivity, and sustainable livelihoods.

Table 5: Regression analysis examined the influence of regulatory systems (guidelines, enforcement mechanisms and compliance) on economic security

Predictor	B	SE	t	p	95% CI for B
Guidelines	0.040	0.086	0.46	.647	[-0.130, 0.209]
Enforcement Mechanisms	0.047	0.068	0.69	.491	[-0.087, 0.180]
Compliance	0.416	0.048	8.74	< .001	[0.323, 0.510]
Constant	2.194	0.093	23.61	< .001	[2.011, 2.377]

$F(3, 274) = 107.49, p < .001, R^2 = .541, \text{Adjusted } R^2 = .536, \text{RMSE} = 0.530.$

Source: Primary data, 2025

Table 5 presents the results of a multiple regression analysis examining the influence of regulatory systems guidelines, enforcement mechanisms, and compliance on economic security outcomes among 278 pineapple farmers in selected districts of Uganda. The overall model is statistically significant, $F(3, 274) = 107.49, p < .001$, indicating that the combined predictors explain a substantial proportion of the variation in economic security. The model explains approximately 54.1% of the

variance ($R^2 = .541$; Adjusted $R^2 = .536$), demonstrating strong explanatory power. Among the predictors, compliance emerges as the only statistically significant factor ($\beta = .416, t = 8.74, p < .001$), suggesting that farmers' adherence to regulations, proper record-keeping, and responsiveness to policy changes significantly enhance income stability, productivity, and household well-being.

In contrast, guidelines ($\beta = .040, p = .647$) and enforcement mechanisms ($\beta = .047, p = .491$) were not statistically significant predictors, indicating that the mere presence of policies or enforcement structures does not directly translate into improved economic security outcomes. Rather, their effectiveness depends on the extent to which farmers actively comply with regulatory requirements. The constant term ($\beta = 2.194, p < .001$) reflects a moderate baseline level of economic security

in the absence of regulatory influence. Overall, these findings highlight that while regulatory frameworks provide an essential institutional foundation, it is compliance that serves as the key driver through which regulation translates into tangible livelihood improvements, reinforcing the importance of farmer engagement in achieving sustainable economic outcomes.

Table 6: Regression analysis showing the relationship between Regulation and Economic security outcomes

Predictor	B	SE	t	p	95% CI for B
Regulation	0.511	0.027	18.95	< .001	[0.458, 0.564]
Constant	2.191	0.087	25.13	< .001	[2.020, 2.363]

$F(1, 276) = 359.06, p < .001, R^2 = .565, \text{Adjusted } R^2 = .564, \text{RMSE} = 0.514.$

Source: Primary data, 2025

The results of the simple linear regression demonstrate a significant and positive relationship between overall regulation and economic security outcomes among 278 pineapple farmers in selected districts of Uganda. The model is statistically significant, $F(1, 276) = 359.06, p < 0.001$, with an R-squared of 0.5654 and an adjusted R-squared of 0.5638, indicating that approximately 56% of the variation in economic security can be explained by differences in perceived regulatory effectiveness. The regression coefficient for regulation ($\beta = 0.511, t = 18.95, p < 0.001$) shows that higher levels of regulation are associated with higher economic security, with a one-unit increase in regulation corresponding to a 0.511-unit increase in economic security outcomes. The intercept (cons = 2.191, $p < 0.001$) reflects a moderate baseline level of economic security in the absence of regulatory influence.

These findings underscore the central role of regulation in shaping economic security among pineapple farmers. Effective regulatory systems including clear guidelines, functional enforcement, and supportive policies appear to enable farmers to stabilize incomes, manage risks, and improve household well-being. The results further highlight the importance of compliance, suggesting that farmers' active engagement with regulatory frameworks is critical to translating formal rules into tangible economic benefits. Overall, the study emphasizes that sustainable livelihoods are fostered not only through the presence of rules and enforcement mechanisms but also through participatory governance structures that ensure alignment between policy objectives and farmers' practices.

4.5 Hypothesis Testing

Hypothesis posited that regulation has no significant relationship with economic security outcomes among pineapple-growing communities in selected districts of Central Uganda. The findings, however, led to the rejection of this hypothesis, indicating that regulation especially when coupled with farmer compliance is vital

in promoting income stability, productivity, and overall household well-being. A multiple regression analysis using regulatory constructs (guidelines awareness, enforcement mechanisms, and compliance) as predictors of economic security among 278 farmers revealed a statistically significant model ($F(3, 274) = 107.49, p < 0.001; R^2 = 0.5406$). Compliance emerged as the only significant predictor ($\beta = 0.416, p < 0.001$), while guidelines and enforcement mechanisms were not significant, suggesting that adherence to rules, proper record-keeping, and alignment with policy updates directly enhance economic security.

A complementary simple linear regression of overall regulation further confirmed a strong positive relationship with economic security ($\beta = 0.511, t = 18.95, p < 0.001; R^2 = 0.5654$). These results collectively demonstrate that regulatory effectiveness significantly shapes economic security among pineapple farmers. Qualitative evidence reinforces this, with farmers emphasizing that following best practices and guidance from regulatory bodies improves their livelihoods. As one key informant noted: "*Engagement with institutions such as MAAIF, NAADS, UNBS, NGOs and private buyers improve knowledge, market access, and production practices*" (Key Informants 08, 2025), highlighting the importance of multi-stakeholder engagement in enhancing farmers' capacities and translating regulatory frameworks into tangible economic benefits.

4.6 Discussion: Regulation and Economic Security Outcomes

The findings of this study demonstrate that regulatory frameworks play a significant role in shaping economic security outcomes among pineapple-growing communities, but their effectiveness is conditional on enforcement, compliance, and institutional context. Grounded in Institutional Theory, the results confirm that formal rules, standards, and procedures influence

farmers' behavior and livelihood outcomes when supported by credible enforcement and monitoring systems (North, 1990; Scott, 2014). While correlation and regression results show a strong positive relationship between regulation and economic security, the evidence highlights that compliance is the most critical pathway through which regulation translates into tangible benefits such as income stability, improved productivity, and enhanced market participation. However, qualitative findings reveal that the mere existence of regulatory frameworks is insufficient; their impact depends on enforcement capacity, contextual relevance, and social legitimacy. In settings where enforcement is weak or where informal practices dominate, regulatory awareness does not consistently lead to improved outcomes, underscoring that institutions shape incentives only when effectively operationalized within local socio-economic conditions.

From a broader governance perspective, the findings align with Stakeholder Network Governance, the Sustainable Livelihoods Framework (SLF), and Value Chain Governance Theory (VCGT), which emphasize the interconnected roles of institutions, relationships, and resource access in shaping livelihood outcomes. Regulation operates within networks of producers, traders, and regulatory actors, where trust, coordination, and information flows facilitate compliance and enhance effectiveness. The study further shows that regulatory mechanisms influence economic security outcomes both directly and indirectly through the work environment by improving access to training, certification systems, financial services, and market linkages. However, important trade-offs emerge: weak enforcement limits impact, while high compliance costs may exclude resource-constrained farmers. This highlights that regulation is not inherently transformative but functions as a governance catalyst whose success depends on complementary support systems, including capacity building, inclusive policies, and institutional coordination. Overall, the study advances theory by demonstrating that the relationship between regulation and economic security outcomes is mediated, context-specific, and dependent on the alignment between formal rules, enforcement capacity, and enabling environments.

5. Conclusion and Recommendations

5.1 Conclusion

The strong, statistically significant relationship between regulatory systems and economic security outcomes highlights the critical role of effective governance in shaping farmers' livelihoods. These findings indicate that pineapple-growing communities benefit most when regulatory frameworks are not only present but actively complied with, as compliance demonstrates the strongest positive influence on income stability, productivity, and overall livelihood resilience. While guidelines and

enforcement mechanisms provide the foundation for regulation, their impact is realized primarily through farmers' adherence to established rules and standards. Effective regulation enhances market participation, ensures quality standards, and promotes sustainable production practices, underscoring its importance as a key determinant of economic security. Therefore, strengthening compliance mechanisms and fostering participatory, enforceable regulatory systems should be central to strategies aimed at improving household economic outcomes and sustaining the pineapple value chain in Central Uganda.

5.2 Recommendations

1. **Strengthen and Harmonize Regulatory Frameworks:** The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) should review and streamline agricultural certification, licensing, and quality assurance regulations to make compliance more accessible, cost-effective, and aligned with the needs of smallholder pineapple farmers.
2. **Enhance Farmer Sensitization and Enforcement Support:** District Local Governments should implement regular sensitization and extension programs to improve farmers' understanding of regulatory requirements, quality standards, and certification processes, while strengthening supportive enforcement mechanisms.
3. **Promote Farmer Compliance and Best Practices:** Farmers and farmer organizations should actively participate in regulatory training, adhere to recommended production and quality standards, and maintain proper production and marketing records to improve compliance and market competitiveness.
4. **Leverage Civil Society for Regulatory Capacity Building:** Civil society organizations should support advocacy for fair and inclusive regulatory policies and provide targeted training on compliance, certification, and quality assurance systems to enhance farmers' participation in formal markets and improve economic security outcomes.
5. **Institutionalize informal structures within pineapple value chain communities** specifically farmer groups, farmer labour associations, trader groups, and transporter groups by integrating their norms, coordination practices, and peer-monitoring mechanisms into formal regulatory and extension systems to strengthen awareness, improve compliance with production and marketing standards, enhance local enforcement of regulations, and improve farmers' market participation and economic security outcomes. This is justified by evidence of uneven awareness of regulatory frameworks, which limits compliance and weakens regulatory effectiveness, and by the fact that these structures already function as low-cost, context-relevant governance mechanisms that can be

leveraged to improve coordination, regulation, and control within the value chain.

Uganda Journal of Agricultural Sciences, 24(1), 55–70.

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