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Research Article

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Mapping the Cocoyam Value Chain in Nkhata Bay in Order to Identify Activities of the Key Actors and their Relationships

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Abstract

Cocoyam (Colocasia esculenta) remains a grossly neglected and underutilized crop in Malawi despite its documented potential for addressing food insecurity, improving household income, and providing nutritional and helping in the community resilience to the adversary of climate change. This study assessed the cocoyam value chain in Nkhata Bay District, Malawi, examining key actors, their activities, relationships, and the chain's implications for household food security, livelihoods, and poverty reduction. Using a mixed-methods approach, data were collected from 390 farmers, 20 vendors, 15 transporters and 50 consumers as respondents across five Extension Planning Areas through structured questionnaires, focus group discussions, and key informant interviews. Findings reveal a small-scale, predominantly informal value chain composed of input suppliers, producers, wholesalers, retailers, transporters, traditional healers, and consumers, notably lacking processors and exporters and no value addition observed. Cocoyam is entirely absent from district crop databases, national agricultural statistics, and policy frameworks, creating governance and institutional vacuums that perpetuate the chain's subsistence orientation. Producers about 91% generate income. A governance vacuum, absent quality standards, FISP exclusion, and no producer cooperatives, systematically suppresses commercialization. The study recommends for need of coordinated interventions across institutional mainstreaming, producer protection, market infrastructure development, transport improvement, and value addition. Findings contribute to empirical evidence supporting Malawi Vision 2063's crop diversification agenda and the UN Sustainable Development Goals on zero hunger and poverty reduction.

Keywords: Cocoyam Value Chain, Neglected Crops, Food Security, Governance Vacuum, Smallholder Farmers, Agricultural Policy Nkhata Bay, Malawi Vision 2063, Un Sustainable Development Goals

1. Introduction

Food security entails consistent physical, social, and economic access to sufficient, safe and nutritious food, including resilience to supply disruptions from climate change and other risks [1-4]. This study defines food security as food availability and utilisation amid climate change, examining the cocoyam (Colocasia esculenta) value chain in Nkhata Bay. Despite its potential for addressing food insecurity and poverty, cocoyam remains neglected, with farmers disadvantaged by poor market information and limited bargaining power [5]. The study assessed cocoyam production's relationship with food security, livelihoods, and policy needs.

1.1. Background Information

Globally, approximately 783 million people faced hunger in 2022, with Africa accounting for 20% [6]. In Malawi, 15% of the population experienced food insecurity in 2023, with 2.6 million facing severe chronic food insecurity, driven by climatic shocks and poverty [7,8]. Government policies and international organisations promote crop diversification as a remedy among others, [9,10]. Cocoyam (Colocasia esculenta), despite its nutritional and income potential, remains neglected due to limited research and utilization [11]. This study examined the cocoyam value chain in Nkhata Bay, focusing on food security, poverty reduction, and climate change resilience.

1.2. Problem Statement

Despite its potential for addressing food insecurity, improving income, providing nutritional and medicinal value, cocoyam

(Colocasia esculenta) remains neglected in Malawi's agricultural policies. Research has focused on major crops, leaving significant value chain gaps for cocoyam. The few existing studies, notably Mwenye (2009) narrowly examined genetic diversity and utilisation without analysing the full value chain or its actors [11]. Limited empirical evidence links cocoyam production to household food security and livelihoods, perpetuating policy neglect. This study therefore assessed the cocoyam value chain in Nkhata Bay, exploring its relationship with food security, livelihoods, and evidence-based policy recommendations.

1.3. Rationale for the Study

Cocoyam falls within the 0.01% minority crop category in Nkhata Bay, yet remains neglected despite its potential for food security and livelihoods [11]. This study examined its value chain, aligning with Malawi Vision 2063 Pillar 1, SADC Food Security Strategy (2015–2025), and UN SDGs 1 and 2, offering policymakers empirical evidence to mainstream neglected crops into national agricultural frameworks.

1.4. Research Objectives

1.4.1. Main Objective

The main objective was to do a value chain analysis for cocoyam (Colocasia esculenta) cultivation in Nkhata Bay District with respect to food security, income and poverty reduction as a means of achieving sustainable food systems and community resilience.

1.4.2. Specific Objectives

To map the cocoyam value chain in Nkhata Bay in order to identify activities of the key actors and their relationships

1.5. Research Questions

The study was guided by the following questions:
What were the key actors and their activities in the cocoyam value chain in Nkhata Bay district?

2. Literature Review

2.1. Theoretical Framework

The study was guided by value chain and transaction cost theories, which complemented each other in analysing key themes within the cocoyam value chain.

2.1.1. Value Chain Theory

Michael Porter in 1985 introduced the value chain concept to analyse firm activities that create competitive advantage and increase profit margins. Saini and Kumar (2026) define value as the price buyers willingly pay for a product. Bair (2009) further described value chains as interconnected commodity chains involving labour and production practices [12,13]. Birhanu (2023) expanded this to encompass all activities from conception through production, delivery, and disposal [14]. In this study, all cocoyam value chain activities were analysed, examining value added at each stage.

2.1.2. Transaction Cost Theory

The Transaction Cost Theory, founded by Ronald Coase, Oliver Williamson, and Yochai Benkler, examines costs incurred at each supply chain phase and rewards accruing to every actor [15]. It informed the analysis of relationships between cocoyam farmers and vendors, and their influence on the cocoyam value chain in Nkhata Bay.

2.2. Key Themes and Debates

2.2.1. Actor Identification and Role Definition in the Value chain

Value chains encompass actors from production to consumption, including input suppliers, producers, processors, traders, and consumers, [16,17]. Malawian research favours major crops, leaving cocoyam chains informal, poorly documented, and institutionally invisible [18-21]. Unlike formalised West African chains, Nkhata Bay's cocoyam remains smallholder-dominated, necessitating governance analysis for inclusive upgrading aligned with Malawi Vision 2063 [22-24].

2.2.2. Value Chain Linkages and Coordination Among Cocoyam Value Chain Actors in Nkhata Bay and Malawi

Value chain linkages connect actors across input supply, production, processing, trading, and consumption. Weak coordination raises transaction costs and prevents smallholders from capturing fair value [25]. Malawi's chains are fragmented and informal, with price volatility discouraging value addition, a deficit replicated in cocoyam [18,20,26,27]. In Nkhata Bay, isolated growers sell at farmgate prices while traders capture downstream value [11,27]. Remedies include farmer organisations, contract farming, and formal inclusion of cocoyam in national agricultural statistics.

2.2.3. Climate Vulnerability Across the Cocoyam Value Chain: How Climate Change Affects Different Actors in Nkhata Bay and Malawi

Climate change affects all cocoyam value chain actors distinctly. Input suppliers face flooding and fungal rot vulnerabilities, worsened by absent formal seed systems and cyclone disruptions [5,28-31]. Farmers experience yield losses, disrupted planting calendars, and increased pest pressure Dong, 2021. Processors face raw material shortages and aflatoxin risks while traders encounter price volatility and infrastructure disruptions [11,32]. Consumers suffer reduced food availability and inflated prices, necessitating cocoyam's integration into national climate adaptation frameworks [6,19,34].

2.2.4. Governance and Institutional Support for the Cocoyam Value Chain in Nkhata Bay and Malawi

Agricultural value chain governance encompasses rules, standards, and power relations coordinating activities and distributing benefits [23,35,36]. Cocoyam governance remains informal, absent from national statistics, FISP, and investment plans, undermining Malawi Vision 2063's diversification agenda [31,37]. Absent quality standards create information asymmetries discouraging investment, while missing farmer organisations limit collective marketing unlike Nigeria's successful models [22,27,32]. Addressing these self-reinforcing failures requires formal policy inclusion, producer cooperatives, tailored financial products, and

minimum quality standards [38].

2.2.5. Cocoyam crop value chain map in Africa and the Pacific Islands

Cocoyam value chain actors span input suppliers, farmers, processors, traders, and consumers across Africa and Pacific islands [39]. Despite feeding over 400 million people globally, commercial viability remains contested, with production declining in East Africa and only 13% sold locally in Malawi, motivating this study to determine actual profit margins across Nkhata Bay's value chain [19,31,40-43].

2.3. Identified Gap in Knowledge

The existing literature reveals significant knowledge gaps on cocoyam in Malawi. Unlike major crops with comprehensive value chain analyses, no equivalent study exists for cocoyam [16-18]. Existing Malawian studies has addressed genetic diversity and utilisation without systematic value chain analysis [5,11,31]. Actor roles, relationships, and profit margins remain undocumented, with cocoyam absent from national statistics, FISP, and institutional frameworks [19-21]. Empirical evidence linking cocoyam to household food security, livelihoods, and climate resilience is similarly lacking [19,34,40]. This study addresses these interrelated gaps through comprehensive value chain analysis in Nkhata Bay District. Value chain analyses for major crops such as groundnuts, maize, and sweet-potato in Malawi have been well documented, yet cocoyam, despite feeding over 400 million people globally, remains institutionally invisible and largely excluded from Malawi's national agricultural statistics, FISP, and extension frameworks [19-21,27,28,31,37]. Governance structures, actor coordination, and profit margin distribution across the cocoyam chain remain undocumented [23,25,35]. Furthermore, the linkage between cocoyam and household food security, livelihoods, and climate resilience in Malawi has not been empirically established [19,34,38]. This study therefore fills these interrelated knowledge gaps through a comprehensive value chain analysis in Nkhata Bay District, contributing to Malawi Vision 2063's agricultural diversification agenda [24,31].

3. Methodology

3.1. Research Paradigm

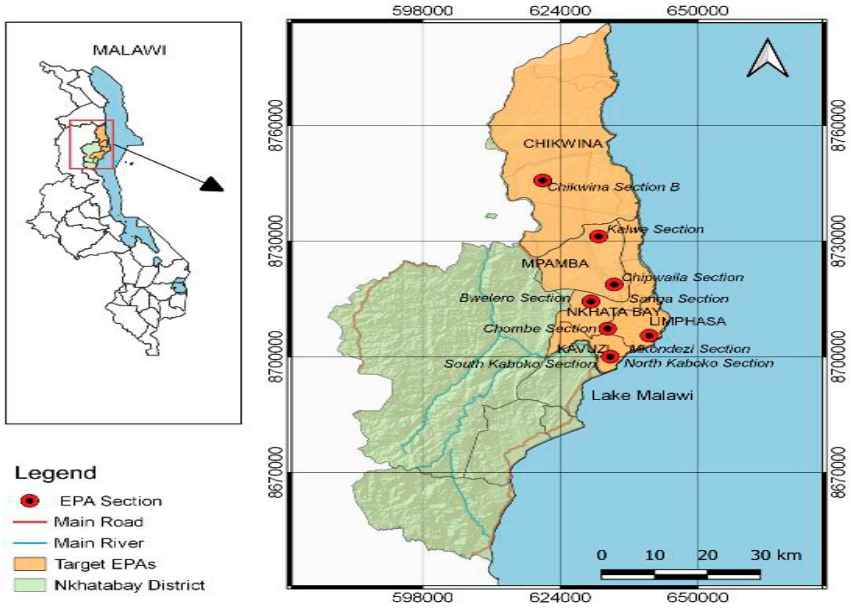
The Pragmatism is the most appropriate research paradigm for this study, rejecting the forced choice between positivism and interpretivism by prioritising what best answers the research question [44,45]. Since cocoyam value chain analysis requires both quantitative data and qualitative insights on actor relationships and governance, pragmatism effectively accommodates the mixed-methods approach needed to capture measurable economic transactions and complex social dynamics [16].

3.2. Research Design

An explanatory sequential mixed-methods design was adopted, collecting quantitative survey data first to establish broad value chain patterns, followed by qualitative interviews and focus group discussions to explain governance structures, power relations, and constraints [46]. This aligns with the Value Chain Analysis framework, capturing both tangible flows and governance structures, recommended for identifying intervention leverage points in African agricultural value chains [16,47,48].

3.3. Research Study Site

The study was conducted in Nkhata Bay District, a lakeshore district in Malawi's Northern Region with a population of 284,681, specifically targeting five cocoyam-growing Extension Planning Areas: Limphasa, Mpamba, Nkhata Bay Central, Chikwina, and Kavuzi [49].



Map 1. Nkhata-Bay District showing Cocoyam Growing Areas

3.4. Sampling and Data Collection

3.4.1. Study Population

The study population comprised cocoyam farmers, vendors, extension officers, consumers, transporters, and input suppliers. Convenience sampling, a non-probability method targeting easily accessible and willing participants within their geographical setting, was deployed to obtain valid data [50,51].

3.4.2. Sample Sizes

Basing on the formula below:

$$n = \frac{N}{(1 + Ne)^2}$$

Where n = sample size, N = population size, e is the margin of error The sample comprised 390 farmers, 20 vendors, 15 transporters, 50 consumers, and key informants including extension officers, food security officers, environmental officers, crop officers, and input suppliers, selected through purposive sampling [52].

3.4.3. Sampling Techniques

Purposive sampling (qualitative component) was used to select information-rich key informants with deep cocoyam value chain knowledge, ensuring authoritative responses to research questions [53,54]. Snowball sampling complemented purposive sampling to identify hard-to-reach informal value chain actors, particularly middlemen and traders, through participant referrals [55]. Systematic random sampling was used to select cocoyam-producing households from village registers, ensuring representativeness and reducing selection bias [56].

3.4.4. Method of Data Collection

Data collection employed five methods. Structured questionnaires captured quantitative data on production quantities, input costs, selling prices, and credit access from farmers and traders, enabling comparable analysis across large samples [57]. Key Informant Interviews with extension officers, NGO representatives, and district agricultural officers generated context-specific institutional insights [58]. Focus Group Discussions with farmer and trader groups, disaggregated by gender, surfaced collective experiences, power asymmetries, and governance perceptions [59,60]. Direct observation at market nodes reduced recall bias and documented actual trading practices [61]. Secondary data review of ADMARC records, MoAIWD statistics, and existing studies provided contextual triangulation [62].

3.5. Data Analysis

Data analysis employed five approaches and these are Value chain mapping visually represented product flows, actor functions, linkages, and geographic locations, forming the foundational analytical step, [16,63]. Gross margin analysis quantified value distribution and profit across chain actors, identifying equity and efficiency gaps [64,65]. Thematic content analysis inductively and deductively coded qualitative data from KIIs and FGDs around research objectives [66]. SWOT analysis synthesised findings into strategic recommendations for policymakers [67,68]. Finally, triangulation across all data sources ensured credibility, dependability, and confirmability [69].

3.6. Ethical Considerations

Ethical considerations were strictly observed throughout the study. Respondents were fully briefed, their confidentiality assured, and informed consent obtained through signed consent forms, maintaining their rights throughout [70]. Ethical clearance and approval certificates were obtained from Mzuzu University and relevant local authorities prior to data collection [71].

4. Findings

4.1. Demographic Profile of Respondents

Distribution of Respondents by Sex

Of 389 respondents, 209 (54%) were male and 180 (46%) females, see Table 1. Slight male dominance reflected volunteering patterns, though deliberate efforts ensured women's perspectives were captured across farming and vending roles.

Sex	Percentage
Male	54
Female	46

Table 1: Distribution of Respondents by Sex Distribution of Respondents by Role in the Value Chain

Table 2 presents that Farmers dominated respondents at 79% (n=389), followed by consumers 10% (n=50), vendors 4% (n=20), transporters 3% (n=15), extension officers 3% (n=13), and input suppliers 1% (n=5), reflecting cocoyam's subsistence-oriented production structure.

Actor	Number of Respondents
Cocoyam Farmers	389 (79%)
Consumers	50 (10%)
Vendors	20 (4%)
Extension Officers	13 (3%)
Transporters	15 (3%)

Input Suppliers	5 (1%)
Total	**492 (100%)**

Table 2: Distribution of Respondents by Key Role in the Cocoyam Value Chain

4.2. Mapping the Cocoyam Value Chain in Nkhata Bay

Focus group discussions across five EPAs identified eight cocoyam value chain actors in Nkhata Bay: extension officers, input suppliers, farmers, wholesalers, retailers, transporters, traditional healers, and consumers, each performing distinct yet interrelated functions. See Figure 1 below.

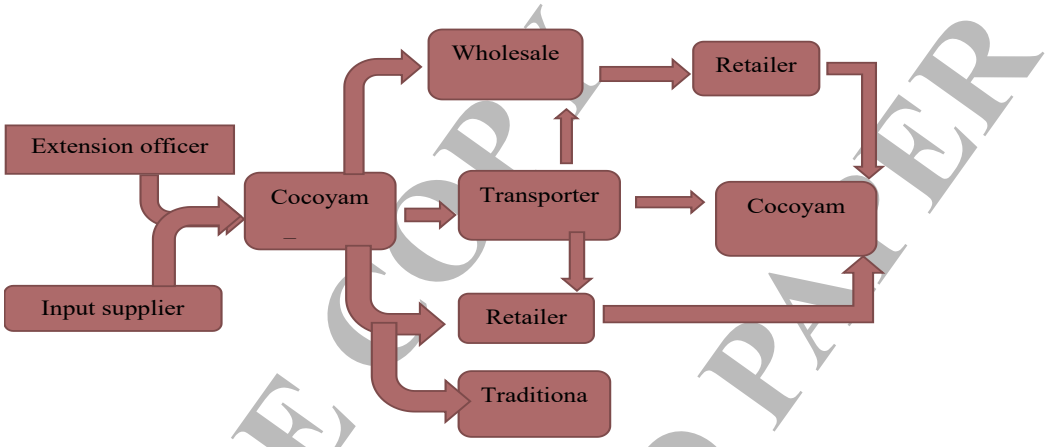


Figure 1: Cocoyam Value Chain Map in Nkhata Bay District

4.2.1. Cocoyam Farmers

Farmers, central to the value chain, handle all production stages. Across five EPAs, approximately 4,720 growers were identified, with Kavuzi and Chikwina recording highest concentrations, 389 farmers were surveyed on cocoyam cultivation as depicted in Table 3. Chintheche and Tukombo EPAs, being least productive, were excluded from the study.

EPA	Section	Approx. Cocoyam Growers	Farmers Reached
Limphasa	Mkondezi	350	45
	Chombe	400	54
Kavuzi	South Kaboko	320	32
	North Kaboko	1,600	84
Nkhata Bay	Bwelero	110	25
	Sanga	100	18
Mpamba	Kalwe	620	39
	Chipwaila	520	17
Chikwina	Chikwina B	700	75
Total		**4,720**	**389**

Source: Nkhata Bay Agricultural Section Officers, 2025

Table 3: Number of Cocoyam Growers per EPA Section

4.2.2. Extension Officers

Extension officers (4%), though lacking formal mandate for cocoyam, provided valuable institutional and field-level knowledge, confirming the crop's production reality despite its absence from national databases.

4.2.3. Input Suppliers

Input suppliers (1%) were minimal, farmers self-supply planting material through community networks, while chemical inputs sourced from agro-dealers, confirming cocoyam's informal, fragile input supply system.

4.2.4. Transporters

Transporters (3%) predominantly used head-loading (50%), bicycles (27%), and vehicles (17%), reflecting cocoyam's localised, small-scale trade, significantly constraining market reach and volume across Nkhata Bay. Table 4 below depicts the findings.

Transport Mode	Percentage	Interpretation	Implication for Value Chain
Walking on foot/ Head loading	50%	Dominant mode, reflecting subsistence-level, small-scale, and highly localised cocoyam trade	Severely limits trade volumes, market reach, and competitiveness. Reinforces farmgate selling and chain informality
Motor bike and bicycle	27%	Represents a semi-commercial transport layer serving short-distance intra-community trade	Insufficient for bulk movement or accessing distant urban markets and marginal commercial impact
Vehicle transport	17%	Suggests occasional rather than routine commercial movement and possibly linked to larger aggregators or seasonal surplus	Potential for scale but underutilised. Limited by poor rural road infrastructure and low trade volumes
Other means	6%	Likely includes lake-based transport relevant to Nkhata Bay's lakeshore geography	Weather-dependent and irregular and insufficient to bridge market access gaps consistently
Total	100%	Non-motorised transport dominates at 77% combined	Perpetuates post-harvest losses, weak price negotiation, suppressed incomes and chain informality

Table 4: Cocoyam Transport modes in Nkhata bay

4.2.5. Vendors

The vendors (4%) serve as critical intermediaries, purchasing cocoyam directly from farmers and reselling informally in local markets, without formal agreements or quality standards. However, they play a significant role in driving the cocoyam production and ensuring that it reaches the final consumers.

4.2.6. Cocoyam Simple Supply Chain

A simplified supply chain operates in Nkhata Bay, flowing directly from farmer to vendor to consumer, with minimal processing or value addition reinforcing subsistence-oriented production. See in figure 2.

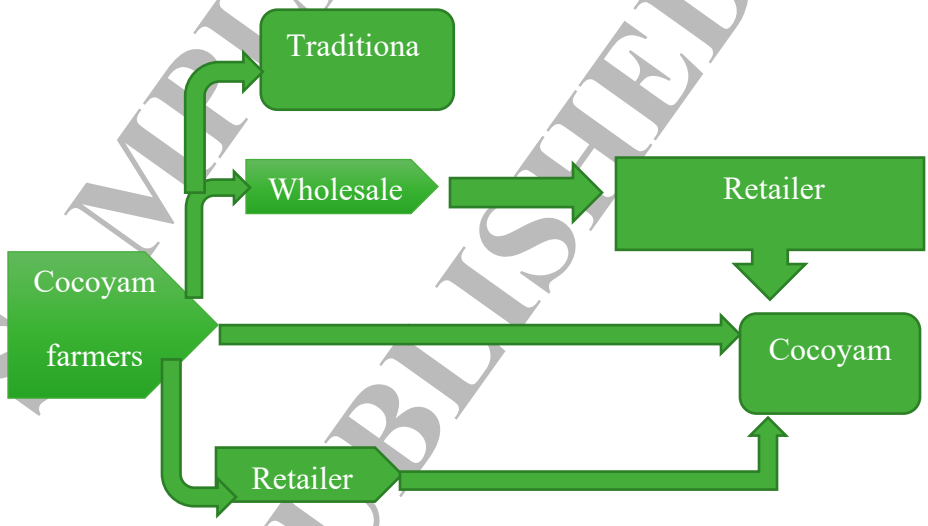


Figure 2: Cocoyam Simple Supply Chain in Nkhata Bay

4.3. Cocoyam Production in Nkhata Bay District

4.3.1. Land Size under Cocoyam Production

Table:5 shows that Cocoyam cultivation across Nkhata Bay's five EPAs is overwhelmingly subsistence-oriented, with 38.7% of farmers cultivating under a quarter acre and only 2.5% exceeding one acre. Kavuzi EPA leads participation (n=116), while Chikwina's Section B records highest single-section involvement (n=99) with strongest commercial potential. Nkhata Bay EPA remains most constrained (n=63), with zero farmers exceeding one acre, reflecting peri-urban land scarcity. Mpamba EPA exhibits notable intra-EPA variation, necessitating section-specific interventions. District-wide, large-scale commercial cocoyam cultivation is virtually absent, confirming that ecological contexts, land availability, and localised socioeconomic conditions collectively shape production patterns across EPAs.

Farm Size Category	LIMPHASA EPA			KAVUZI EPA			NKHATA BAY EPA			MPAMBA EPA			CHIKWINA EPA (Sec B)	DISTRICT TOTAL
	Mkondezi	Chombe	EPA Total	S. Kaboko	N. Kaboko	EPA Total	Bwerelo	Sanga	EPA Total	Kalwe	Chipwaila	EPA Total	Section B	n = 439
Less than 1/4 acre	21	24	**45**	10	27	**37**	10	16	**26**	14	5	**19**	43	**170**
1/4 acre	10	17	**27**	8	25	**33**	9	15	**24**	11	4	**15**	28	**127**
1/2 acre	8	7	**15**	7	20	**27**	7	3	**10**	8	2	**10**	14	**76**
Acre	5	6	**11**	5	9	**14**	1	2	**3**	6	10	**16**	11	**55**
More than an acre	0	1	**1**	2	3	**5**	0	0	**0**	0	2	**2**	3	**11**
TOTAL	**44**	**55**	**99**	**32**	**84**	**116**	**27**	**36**	**63**	**39**	**23**	**62**	**99**	**439**

Source: Primary data, 2024
Note: S. Kaboko = South Kaboko, N. Kaboko = North Kaboko. EPA = Extension Planning Area. District Total (n=439) represents all surveyed cocoyam farmers across Nkhata Bay District.

Table 5: Land size under Cocoyam production

4.3.2. Cocoyam Production Volume

Table: 6 indicate that Cocoyam production in Nkhata Bay remains overwhelmingly subsistence-scale, with 78% of farmers producing under 1,000kg.This is insufficient for meaningful market participation [20]. A critical structural barrier exists at 1,000kg, beyond which farmer numbers drop sharply by 63.9%, reflecting land, input, and market access constraints. Commercially viable production (2,000kg+) involves only 8.2% of farmers, confirming near-absent commercialisation. This inverse relationship between production volume and farmer participation reflects inadequate extension support and poor market linkages [31,40]. Transitioning farmers toward the 1,000 to 1,500kg threshold represents the highest-impact policy entry point, requiring coordinated input support and market linkage development aligned with Malawi Vision 2063 [72].

Production Category (kg)	No. of Farmers (n)	% of Total (%)	Cumulative Percentage (%)	Production Scale	Key Observation
Less than 500 kg	161	41.2%	41.2%	Micro-subsistence	Dominant category nearly half of all farmers produce at the lowest scale, confirming overwhelming subsistence-level cocoyam production
Less than 1,000 kg	144	36.8%	78.0%	Small subsistence	Second largest category combined with less than 500 kg, represents 78% of all farmers producing below 1,000 kg threshold
1,500 kg	52	13.3%	91.3%	Transitional	Sharp decline signalling a critical production barrier very few farmers transition beyond 1,000 kg to mid-level production
2,000 kg	23	5.9%	97.2%	Semi-commercial	Marginal presence fewer than 6% of farmers reach this level, indicating severely limited commercial cocoyam production capacity
More than 2,500 kg	9	2.3%	99.5%	Commercial	Near-absent, only 9 farmers across the entire district produce at potentially commercial scale, confirming cocoyam's minimal commercial viability
District Total	389	99.5%*			Over 78% of farmers produce below 1,000 kg, firmly establishing Nkhata Bay's cocoyam sector as predominantly subsistence-oriented
Source: Primary data, 2025					

Table 6: Showing Cocoyam production by volume

4.4. Factors Influencing Cocoyam Production in Nkhata Bay

Table 7 identifies key factors influencing cocoyam production in Nkhata Bay. Land availability was largely adequate, with 66% citing sufficient wetlands, though 28% noted fragmentation. Market unreliability concerned 40% of respondents, while 61% flagged pests and diseases, and 62% acknowledged agronomic knowledge gaps. Capital constraints and perishability were each cited by 70%, significantly limiting investment and post-harvest management. Most critically, 83% identified cocoyam's non-staple status as the dominant production-suppressing factor, as household food priorities favour maize and other staples over cocoyam cultivation.

FACTOR	DESCRIPTION & IMPLICATION	AGREE (%)	DISAGREE (%)	NEUTRAL / NO OPINION (%)
Non-staple food status Critical constraint	Cocoyam is not a priority household food hence production volumes suppressed as farmers favour maize and other staples for food security.	83%	17%	—
Capital constraints Critical constraint	Farmers lack sufficient capital to invest in inputs (seeds, fertilisers, tools) and expand production scale.	70%	30%	—
Perishability & poor storability Critical constraint	Fresh corms deteriorate rapidly post-harvest. Poor storage infrastructure leads to significant losses and limits market access windows.	70%	30%	—
Lack of agronomic knowledge High constraint	Farmers have insufficient knowledge of improved cultivation practices, limiting yields and overall production capacity.	62%	28%	10%
Pests & diseases High constraint	Crop losses due to pest and disease pressure discourage investment and reduce effective production levels.	61%	27%	7% (no opinion)
Market access High constraint	Absence of a reliable and predictable cocoyam market discourages large-scale production investment however, a majority acknowledge markets do exist.	40%	53%	7%
Land fragmentation Moderate constraint	Fragmented land parcels limit ability to consolidate production, though most respondents consider wetland areas adequate for larger-scale farming.	28%	66%	6%
Critical constraint ≥ 70% agreeHigh constraint 40–69% agreeModerate constraint <40% agree% disagreeing (not a constraint)				

Table 7: Factors influencing cocoyam production — Nkhata Bay District | n = respondents surveyed

4.3.4. Perceived Commercial Value of Cocoyam

Despite low production volumes, 81% of farmers perceive cocoyam as highly commercially valuable, revealing a critical profitability-access gap. Capital constraints, unreliable markets, and post-harvest losses prevent realisation of recognised potential, demanding targeted structural interventions to bridge perceived and actual market outcomes. Table 8 indicate farmers perception.

Perceived Value Return Rating	Estimated %
Very high value return	~48%
High value return	~33%
Average value return	~8%
No value return	~11%

Table 8: Perceived Cocoyam value by small holder farmers

4.3.5. Cocoyam as an Alternative Income Source

Table 9 reveals that 75% of respondents believe cocoyam can become a major income source, with only 10% disagreeing and 15% uncertain. This strong grassroots confidence reflects widespread recognition of the crop's latent economic potential. Uncertainty likely stems from unresolved structural barriers, inconsistent markets, post-harvest losses, and capital deficits. Critically, this optimism persists despite systemic constraints, suggesting that targeted interventions in market development, storage infrastructure, and credit access could effectively convert farmer confidence into measurable rural livelihood outcomes in Nkhata Bay.

Response	Percentage (%)
Agreed	75%
Disagreed	10%
Uncertain	15%

Table 9: Cocoyam as an alternative source of income

4.3.6. Contribution of Cocoyam to Annual Household Income

Among income-generating farmers (91%), cocoyam contributions vary markedly, 35% earn minimally (1–24%) while 33% depend on it for over 75% of household income. This bimodal distribution reveals supplementary and cocoyam-dependent farmer typologies, with the latter disproportionately vulnerable to production shocks, demanding prioritised policy attention toward income stabilisation. See table 10 below.

Cocoyam Contribution to Annual Household Income	Percentage of Farmers (%)
1–24% of annual income	35%
25–49% of annual income	16%
50–75% of annual income	16%
More than 75% of annual income	33%
Total income-generating farmers	**91% of all respondents**

Table 10: Cocoyam contribution to annual household income

4.4. Cocoyam Markets

Table 11, maps the cocoyam selling destinations by EPA. All EPAs have access to at least one local market outlet, with Mzuzu city serving as the primary urban market destination for Kavuzi, Limphasa, Mpamba, and Chikwina EPAs. Nkhata Bay town market serves farmers in the central EPA and Limphasa. Mpamba rural growth centre is also a significant outlet. This multi-tiered market geography reflects the diverse but largely informal market structure for cocoyam in the district.

EPA	Cocoyam Markets
Nkhata Bay	Sanga local market and Nkhata Bay main market
Kavuzi	Mzuzu main market and surrounding centres
Limphasa	Nkhata Bay market, Mpamba rural centre market and Mzuzu market
Mpamba	Mpamba rural centre market and Mzuzu market
Chikwina	Chigwere, Mzuzu market and Mpamba market

Table 11: Cocoyam Market Destinations by EPA

Table 12 shows that Cocoyam marketing is highly localised with 46% of farmers sell at local markets, 35% at farmgate, and 19% in town markets. This ~80% localised trade severely limits price negotiation power and value chain commercialisation [11,21].

Market Channel	Percentage (%)	Market Type	Key Characteristic	Implication for Value Chain
Nearest local market	~50%	Informal local market	Farmers transport cocoyam to the closest available market point	Dominates sales reflects localised trade, limited market reach and high transport burden on farmers
Direct to vendors on farm	~30%	Farmgate market	Vendors visit farms directly to purchase cocoyam from farmers	Convenient for farmers but weakens bargaining power as vendors capture downstream value margins
Town markets	~20%	Semi-formal urban market	Cocoyam sold at larger town market centres	Broader market access and potentially better prices but constrained by transport costs and infrastructure
Total	**100%**			Non-motorised and localised marketing dominates, limiting commercial scale and farmer income
Source: Primary data, 2025				

Table 12: Farmers Market for Cocoyam in Nkhata Bay

4.4.1. Price Setting and Factors Affecting Cocoyam Prices

Table: 13 indicate that although 86.4% of farmers self-determine cocoyam prices, the absence of formal market structures and collective bargaining mechanisms undermines genuine pricing competitiveness, with buyers controlling prices for 12.9% of farmers.

Who Sets the Price	Frequency	Percentage (%)
Buyer	48	12.9%
Seller (Farmer)	320	86.4%
Government	2	0.5%
Total	370	100%

Table 13: Who Sets the Cocoyam Price at the Market

Table:14 identifies Product quality (60%) and seasonality (38%) are the dominant cocoyam price determinants, underscoring the critical importance of post-harvest management and strategic market timing for optimising smallholder income in Nkhata Bay.

Factor	Percentage (%)
Quality of the crop	60%
Season/time of year	38%
Other factors	2%
Taste	0.2%

Table 14: Factors Affecting Cocoyam Market Price

4.4.2. Cocoyam Market Channels

Table:15 indicate that there are three types of cocoyam market channels operating in Nkhata Bay: direct farmer-to-consumer sales (Channel 1) maximise price retention but limit reach, farmer-to-retailer-to-consumer (Channel 2) balances accessibility, and the extended farmer-wholesaler-retailer-consumer chain (Channel 3) maximises market reach but progressively reduces farmers' price share, reflecting typical smallholder value chain power asymmetries [23,35].

Channel	Channel Type	Actor Linkages	Value Capture	Market Reach	Key Characteristic
Channel 1	Direct	Farmer → Consumer	Farmer captures full selling price	Limited localised subsistence-level transactions	No intermediaries and minimal transaction costs but restricted market access
Channel 2	Short	Farmer → Retailer → Consumer	Shared between farmer and retailer	Moderate extends beyond immediate farm community	Single intermediary introduces margin improves market reach at reduced farmer price
Channel 3	Long	Farmer → Wholesaler → Retailer → Consumer	Distributed across three actors before reaching consumer	Widest accesses broader and more distant markets	Most extended channel highest value dilution for farmer but greatest market penetration
Source: Primary data, 2025					

Table 15: Cocoyam market channels identified in Nkhata Bay district.

5. Discussion: Interpretation, Synthesis, and Implications of Findings

5.1.Interpreting the Findings in Light of Existing Literature

The findings of this study extend and empirically ground what has previously been theorised or assumed about neglected crop value chains in sub-Saharan Africa. The identification of eight distinct value chain actors, extension officers, input suppliers, farmers, wholesalers, retailers, transporters, traditional healers, and consumers, aligns broadly with Kaplinsky and Morris's (2008) foundational proposition that value chains encompass actors from production through to consumption. However, the nature of these actors in Nkhata Bay diverges significantly from formalised value chains documented in West Africa. Unlike Nigeria's cocoyam chains where commercial processing and coordinated marketing are more developed, Nkhata Bay's chain remains overwhelmingly informal, fragmented, and subsistence-oriented, confirming earlier observations by Mwenye (2009) and more recently by Glatzel et al. (2025) that cocoyam in Malawi is institutionally invisible and poorly documented [11,22].

The dominance of farmers (79% of respondents) and the near-absence of processors within the identified chain reinforces what

Nakhumwa (2015) and Chinsinga and Matita (2021) observed about Malawi's smallholder agricultural systems that says value addition is minimal, and the bulk of economic surplus is captured downstream by traders rather than producers [20,21,28]. The finding that 80% of cocoyam trade occurs through localised, informal farmgate and local market channels (Table 12) directly corroborates this argument and demonstrates that weak chain coordination is not merely structural but is actively reproduced through the absence of formal market institutions and collective farmer organisations [21,25].

5.2. Convergence and Divergence with Prior Work

Several findings converge with existing literature while others present novel or divergent insights. The identification of capital constraints (70%), perishability (70%), and non-staple food status (83%) as dominant production barriers aligns with Muthoni and Shimelis (2023) and Chipungu et al. (2022), who documented similar constraints limiting cocoyam expansion across East and Central Africa [40]. Likewise, the near-complete absence of a formal seed system, with farmers relying on community-based corm sharing, confirms Mazibuko and Changadeya's (2024) findings on the fragile and informal nature of cocoyam input supply in Malawi [5]. Where this study diverges from prior work is in revealing a profitability-access paradox that has not been explicitly articulated in the existing Malawian cocoyam literature. Despite 91% of farmers reporting income generation and 81% perceiving the crop as commercially highly valuable, production volumes remain overwhelmingly subsistence-level, 78% of farmers produce under 1,000kg per season (Table 6). This gap between perceived value and realised income is not captured in Mwenye (2009) or Chipungu (2022), whose studies focused primarily on genetic diversity and utilisation without engaging systematically with value chain economics [11,31]. The present findings therefore add new empirical content to what Gereffi and Fernandez-Stark (2011) describe as the governance dimensions of value chains, specifically, how power asymmetries and institutional gaps prevent smallholders from capturing the value they themselves recognise. Furthermore, the bimodal income distribution, with 35% of farmers earning minimal cocoyam income and 33% depending on it for over 75% of household income, reveals a structural heterogeneity within the Nkhata Bay farming population that previous aggregate analyses have obscured. This diverges from the homogeneous subsistence-producer portrayal in WFP (2018) and positions the study to offer more nuanced policy targeting [17].

5.3. Implications for Theory

Theoretically, the findings both confirm and refine the application of Global Value Chain (GVC) theory and the value chain governance framework to informal, neglected crop systems in low-income country contexts [17,35,36]. GVC theory, originally developed in the context of globally integrated industries, posits that governance structures determine how value is distributed among chain actors. Applied to cocoyam in Nkhata Bay, the findings demonstrate that the near-total absence of governance mechanisms, no formal quality standards, no producer cooperatives, no institutional price-setting, and no FISP integration, produces a market relational structure in which farmers nominally set prices (86.4%) but lack genuine bargaining power due to information asymmetries and market dependency [27,32]. This study contributes theoretically by demonstrating that GVC frameworks require adaptation when applied to institutionally invisible crops. The standard GVC assumption of identifiable lead firms coordinating chain governance does not hold for cocoyam in Malawi, instead, governance is effectively absent, producing what might be termed a governance vacuum, a theoretical condition in which chain actors operate without coordination, standards, or enforceable norms. This finding has implications beyond Malawi, offering a conceptual contribution applicable to other neglected and underutilised crops in similar institutional environments across sub-Saharan Africa.

5.4. Implications for Practice / Policy

The practical and policy implications of these findings are significant and directly relevant to multiple stakeholders, including the Malawian government, agricultural extension agencies, NGOs, and development partners. First, the exclusion of cocoyam from national agricultural statistics, FISP, and extension frameworks, confirmed by both the findings and identified knowledge gaps, represents a systemic policy failure that suppresses a crop with demonstrated livelihood importance for a substantial proportion of rural households in Nkhata Bay [21,31,37]. Formal institutional recognition of cocoyam is therefore the foundational prerequisite for any meaningful value chain development.

Second, the identification of 1,000kg as a critical structural production barrier, beyond which farmer participation drops sharply by 63.9%, provides a precise and actionable policy entry point. Targeted input support, subsidised storage infrastructure, and extension services aimed at transitioning farmers from sub-500kg to the 1,000–1,500kg threshold would yield the highest livelihood returns per unit of investment, consistent with Malawi Vision 2063's agricultural diversification agenda [24,72]. Third, the cocoyam-dependent household typology identified through the bimodal income distribution warrants prioritised social protection measures. For the 33% of farmers deriving over 75% of income from cocoyam, production shocks, market failures, and post-harvest losses represent acute livelihood risks requiring income stabilisation mechanisms alongside value chain development interventions. Finally, the strong grassroots confidence in cocoyam's commercial potential (75% agreeing it can become a major income source) provides a critical enabling condition for policy intervention, farmer motivation exists, and structural rather than attitudinal barriers are the primary constraint. Coordinated investment in market development, post-harvest technology, storage infrastructure, and producer collective action offers a realistic and evidence-based pathway for converting that confidence into measurable rural economic outcomes across Nkhata Bay District [32,38].

5.5. Limitations

Several limitations qualify this study's scope. Geographically, findings are restricted to five Nkhata Bay EPAs, limiting generalisation to other Malawian districts or East and Central

African systems [40,41]. Convenience and snowball sampling introduce selection bias, partially mitigated through gender-disaggregated focus groups and five-method triangulation [55,69]. Self-reported data carries recall bias, partially addressed through market observation and secondary data triangulation [62]. No ecological assessment was conducted, leaving sustainability empirically unverified amid climate change concerns [19,34]. The cross-sectional design limits longitudinal inference, however, rigorous mixed-methods triangulation strengthens findings' credibility within the defined scope [46].

6. Conclusion

This study produced the first comprehensive cocoyam (Colocasia esculenta) value chain map for Malawi, identifying eight distinct actors and their interrelationships in Nkhata Bay. Findings reveal a chain defined by informality, fragmentation, and a profitability-access paradox, 91% of farmers generate income yet 78% produce under 1,000kg seasonally, constrained by capital deficits, post-harvest losses, and governance vacuum characterised by absent quality standards, FISP exclusion, and no producer cooperatives. Theoretically, the study advances Global Value Chain theory by demonstrating that governance absence defines institutionally invisible crop chains across sub-Saharan Africa [19,23,35,40]. Practically, formal cocoyam inclusion in national statistics, FISP, and extension frameworks, targeting the 1,000kg threshold, provides the most evidence-based commercialisation pathway aligned with Malawi Vision 2063 and UN SDGs 1 and 2 [24,72].

Directions for Future Research

Several critical questions warrant future investigation. Longitudinal studies tracking farmer behaviour, production volumes, and market participation across multiple seasons are needed to determine whether identified constraints are structurally entrenched or intervention-responsive [73]. Formal ecological assessments of cocoyam population dynamics and climate vulnerability across producing districts are urgently required [19,34]. Comparative value chain studies in Rumphi, Karonga, and Kasungu would establish whether Nkhata Bay's governance vacuum is district-specific or nationally systemic [74-76]. Profit margin distribution analyses across identified market channels would quantify value capture inequity. Finally, research linking cocoyam-dependent households to nutritional and food security outcomes under climate stress scenarios would provide evidence justifying national policy integration [34,38].

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Ethical Clearance Reference

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Data Availability

Available from the corresponding author upon reasonable request

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