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# To Examine the Status and Determinants of Household Food Security, Resilience and Poverty in the Cocoyam Value Chain in Nkhata Bay, Malawi

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***Abstract***
*Cocoyam (Colocasia esculenta) remains a neglected and underutilized crop in Malawi despite its documented potential for food security and poverty reduction. This study examined the status and determinants of household food security, resilience, and poverty in the cocoyam value chain in Nkhata Bay District. Guided by the Sustainable Livelihoods Framework and situated within a critical realist paradigm, the study employed a convergent mixed-methods design. 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. Descriptive statistics, bivariate analysis, and thematic analysis were used to analyze the data. The findings reveal that 90% of respondents affirm cocoyam's contribution to food security, with 38.1% consuming it daily and 81% relying on it as an alternative during food shortages.*

*Wetland access emerged as a critical determinant, with wetland cultivators reporting significantly higher daily consumption (48.4%) compared to upland producers (24.5%). However, value addition remains minimal, with 90% consuming cocoyam only in boiled form, and only 28% generating income from sales, indicating unrealized poverty reduction potential. The study concludes that while cocoyam plays a significant role in household food security and resilience, its contribution to poverty reduction is constrained by weak value chains and institutional neglect. Addressing these constraints through targeted extension, value addition interventions, and policy reorientation could enhance the crop's contribution to sustainable livelihoods in Malawi. Providing cocoyam food recipe for local communities by NGOs and government nutritional agencies in order to inculcate food diversification mentality other than relying on cassava, maize as staple foods*

**Keywords:** Cocoyam, Food Security, Resilience, Poverty Reduction, Value Chain, Underutilized Crops, Sustainable Livelihoods Framework, Malawi Vision 2063, UN SDGs

## 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 status and determinants of household food security, resilience and poverty in the cocoyam (*Colocasia esculenta*) value chain in Nkhata Bay. Despite its potential for addressing food insecurity climate change shocks and poverty, cocoyam remains neglected, with farmers disadvantaged by poor market information and limited bargaining power [5-11]. 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% [12]. 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, Climate change and chronic food insecurity as such Government policies and international organisations promote crop diversification as a remedy Ali and Bhattacharjee, 2023 [6-11,13,16]. Cocoyam (*Colocasia esculenta*), despite its nutritional and income potential, remains neglected in government policies due to limited research and utilization [1].

### 1.2. Problem Statement

Malawi's 2.6 million chronically food-insecure people face compounding threats from climate-induced agricultural disruptions [13]. Although cocoyam (*Colocasia esculenta*) offers promising potential for food security diversification and poverty reduction smallholder farmers remain constrained by poor market information and weak bargaining power [5-11,13,16]. With limited evidence on cocoyam's contribution to household food security, resilience, and poverty reduction this study examined these dimensions within Nkhata Bay's cocoyam value chain [7,15].

### 1.3. Research Objectives

#### 1.3.1. Main Objective

To analyse the cocoyam (*Colocasia esculenta*) value chain in Nkhata Bay, Malawi, examining its contribution to food security, income, poverty reduction, and sustainable community resilience.

#### 1.3.2. Specific Objectives

a) To examine the status and determinants of household food security, resilience and poverty in the cocoyam value chain

#### 1.3.3. Research Questions

a) What were the status and determinants of household food security, resilience and poverty in the cocoyam value chain?

## 2. Literature Review

### 2.1. Theoretical Framework

#### 2.1.1. The Sustainable Livelihoods Framework

This study adopts the **Sustainable Livelihoods Framework (SLF)** to analyse how households utilize human, natural, financial, social, and physical assets to achieve food security and climate resilience [17,18]. The SLF is justified by its holistic approach, linking asset access (e.g., wetlands and extension services) to institutional contexts, specifically addressing Malawi's maize-centric policy bias [19]. By mapping variables like consumption frequency and seasonal scarcity to the framework's components, the study identifies that cocoyam's potential is constrained by gaps in physical capital and institutional support. Consequently, the SLF situates cocoyam's contribution within the broader structural constraints of Nkhata Bay [5,15,20,21].

### 2.2. Thematic Synthesis, Scholarly Debates and Identified Gaps in the Literature

**Neglected Crops and Household Food Security**

Scholarship is divided on whether neglected crops like cocoyam are strategic food security assets or indicators of vulnerability. Proponents argue their resilience, soil tolerance, and year-round availability enhance dietary diversity and income smoothing during lean seasons [8-10]. Conversely, critics suggest reliance on cocoyam may mask structural deprivation, serving as a "fallback" rather than a path to security [8,22-24]. This study addresses the unresolved tension between cocoyam as a genuine asset versus a symptom of livelihood insecurity [25].

#### 2.2.1. Value Chain Constraints and Smallholder Benefit Capture

Value chain literature highlights how infrastructure deficits, perishability, and information unevenness expose cocoyam farmers to exploitation [26-29]. However, scholars debate the primary drivers of this marginalization. The "upgrading" school emphasizes supply-side improvements like post-harvest handling and market linkages [30,31]. Conversely, political economy proponents argue that land rights, credit, and gendered labor dynamics are more critical [32,33]. This debate is vital in Malawi, where mixed empirical results suggest that upgrading can unintentionally marginalize women while benefiting resource-rich actors [34].

#### 2.2.2. Resilience, Climate Adaptation, and Poverty Reduction

The third theme bridges food security and livelihoods scholarship with a growing body of work on climate resilience. Scholars have consistently argued that crop diversification, and specifically the inclusion of drought-tolerant, waterlogging-tolerant species such as cocoyam, constitutes a low-cost adaptive strategy for smallholders facing increasing climate variability [35,36]. The broader resilience literature conceptualizes this as a form of 'absorptive capacity', whereby households draw on diverse asset portfolios, including natural capital such as wetland access, to buffer against shocks without resorting to destructive coping strategies such as asset liquidation or child school dropout [37,3].

Debate intensifies, however, around the question of whether resilience-enhancing strategies translate into durable poverty reduction, or whether they simply stabilise households at low welfare levels without generating upward mobility. Chambers and Conway's (1992) foundational work on sustainable livelihoods stressed that resilience without transformative change in structural conditions may perpetuate poverty traps [39]. More recent scholarship echoes this concern, arguing that the poverty-reduction potential of NUC-based livelihoods is contingent on simultaneous improvements in market integration, social protection, and governance of natural resources [40,41]. Critically, the mechanisms through which cocoyam value chains might contribute to reducing monetary and multidimensional poverty have not been rigorously tested in the Malawian context, where production zones differ substantially in agroecological character, market access, and livelihood asset bases [42].

#### 2.2.3. Points of Scholarly Agreement and Persistent Contradictions

Across these three thematic domains, a degree of consensus exists on several descriptive points: cocoyam is nutritionally dense and culturally significant value chain inefficiencies are prevalent and harm smallholders [21,26,27,43-46]. Climate variability is increasing the vulnerability of rain-fed agricultural systems in southern Africa [47-49]. Scholars also broadly agree that gender is a cross-cutting determinant of outcomes across food security, value chain participation, and resilience [32,50-52].

The contradictions, however, are equally significant. First, while some studies document cocoyam's positive contribution to dietary diversity and consumption frequency, others find no statistically robust relationship between cocoyam consumption patterns and improved food security status once confounding variables are controlled for [8,53-56]. Second, the literature disagrees on whether production zone, including access to wetlands, is primarily an asset or a source of market exclusion, since wetland-dependent farmers may be geographically remote from markets even as they enjoy yield advantages [15,52]. Third, the poverty-reduction potential of value chain upgrading is contested, with evidence of both transformative and regressive outcomes depending on institutional context [57-59]. These contradictions reveal that aggregate analyses obscure heterogeneous realities across production zones, household types, and market structures, and point toward the necessity of context-specific empirical inquiry [22,25,41].

#### 2.2.4. Identified Gap in Knowledge

Despite broad agreement that cocoyam is nutritionally dense, culturally embedded, and potentially adaptive under climate stress the literature has not produced a rigorous, context-specific account of how cocoyam value chains function in Malawi or what they actually deliver to smallholders [21,35,43]. Studies disagree on whether cocoyam consumption meaningfully improves food security once confounders are controlled, whether wetland access is an asset or a source of market exclusion, and whether value chain upgrading reduces poverty or entrenches existing inequalities along gender lines [8,14,32,34,56]. As Chinsinga and Matita (2021) note, the mechanisms linking NUC-based livelihoods to poverty reduction remain untested in Malawi, where agroecological conditions, market access, and household asset bases vary considerably across production zones [42].

## 3. Methodology

### 3.1. Research Paradigm

### Critical Realism

This study adopts the critical realist paradigm, positioning itself between positivism and interpretivism to explore how objective realities are mediated by social structures [60,61]. By distinguishing between the empirical, actual, and real, this approach moves beyond observable data to uncover underlying mechanisms, such as policy biases and market constraints, that determine food security [62]. Ultimately, critical realism balances farmer agency with the structural material constraints shaping livelihoods in Nkhata Bay [63].

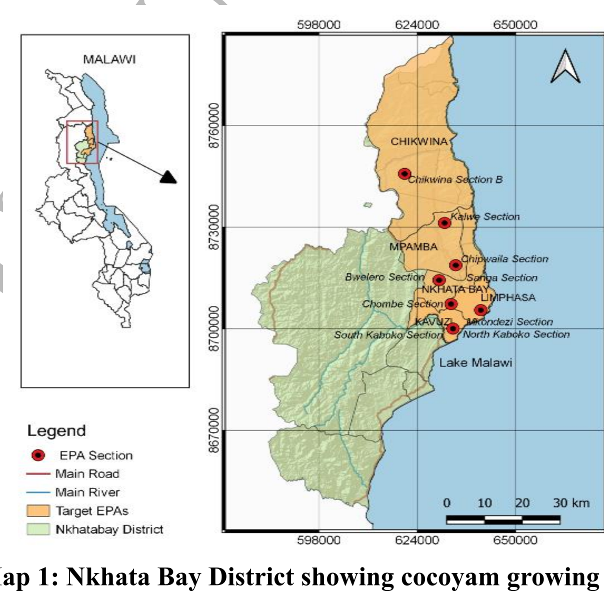
### 3.2. Research Design

This study employs a convergent mixed-methods design, integrating a quantitative survey of 390 households with qualitative focus group discussions (FGDs) [64]. This approach aligns with critical realism by documenting empirical patterns, such as consumption frequency, while using FGDs to uncover the underlying mechanisms and structural "whys" [60,61]. Through retroduction, the study identifies how natural capital and institutional gaps shape food security outcomes [62]. Methodological triangulation and reflexivity further ensure findings are contextually grounded and robust, bridging the gap between observable data and real-world structural determinants [65].

### 3.3. Research Study Site

Situated in Northern Malawi, this study targeted Nkhata Bay District's population of 284,681 [66]. Limphasa, Mpamba, Central, Chikwina, and Kavuzi EPAs were purposively selected due to prevalent cocoyam cultivation.






**Map 1: Nkhata Bay District showing cocoyam growing areas**

### 3.4. Sampling and Data Collection

#### 3.4.1. Study Population and Sample sizes

A sample of 390 farmers, 50 vendors, 10 transporters, and 50 consumers was surveyed. Key informants included 10 extension officers, food security officers, environmental officers, and crop officers, selected through purposive sampling [67,68]. The sample was calculated based on the formula below:

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

Where $n$ = sample size, $N$ = population size, e is the margin of error

#### 3.4.2. Sampling Techniques

The study employed a multi-stage stratified sampling strategy to ensure district-wide representation [69]. First, all five Extension Planning Areas (EPAs) were purposively selected. Second, households were stratified by wetland (dambo) and upland rain-fed production zones to capture varying resilience levels [70]. Finally, villages and households were randomly selected to minimize bias [71]. While the strategy balances consistency with feasibility, limitations include the exclusion of non-producers and potential accessibility bias [72]. These were mitigated through cross-validating village rosters with multiple informants and utilizing FGDs to capture broader community perspectives [73].

#### 3.4.3. Data collection tools

##### 3.4.3.1. Focus Group Discussion Participants

FGDs (8–12 participants each) were conducted across five EPAs, purposively selecting cocoyam farmers, women, youth, vendors, and community leaders to capture diverse perspectives, facilitated in Chichewa as a national language and Tumbuka and Tonga spoken in Nkhata Bay district [72,74]. The multi-stage stratified sampling strategy, combining purposive EPA-level selection, production zone stratification, and random household selection, provides a robust foundation for analysing food security, resilience, and poverty. The 390-household sample ensures statistical power, while FGDs offer qualitative depth, with triangulation mitigating limitations and ensuring rigorous, contextually grounded findings.

### 3.5. Data Analysis

The study employed an integrated analytic approach combining quantitative and qualitative methods, consistent with the convergent mixed-methods design and critical realist paradigm outlined previously. Quantitative data were analyzed using descriptive and inferential statistical techniques, while qualitative data were analyzed using thematic analysis. The integration of these approaches enabled a comprehensive examination of both the status and determinants of food security, resilience, and poverty within the cocoyam value chain.

#### 3.5.1. Quantitative Data management and Analysis

Quantitative data were entered into Microsoft Excel for cleaning and verification, then analysed using IBM SPSS (Version 26) for its robust survey data capabilities with less than 2% missing cases excluded listwise [75-77]. Descriptive statistics, including frequencies, percentages, central tendency, and dispersion, documented food security patterns, including 38.1% daily cocoyam consumption and 90% affirmation of its household livelihood contribution [78].

#### 3.5.2. Qualitative Data Management and analysis

FGD audio recordings were transcribed verbatim, translated into English, and imported into NVivo (Version 12) for systematic coding and theme development. Thematic analysis followed six-phase framework: data familiarization, initial coding, theme searching, theme reviewing, theme defining, and report writing [12]. Coding was both inductive and deductive, informed by the Sustainable Livelihoods Framework with participant quotes integrated to ground findings in lived experience and capture diverse perspectives [17,18,72].

#### 3.5.3. Strategies for Consistency

Trustworthiness was ensured through credibility via triangulation, prolonged fieldwork, and member checking, dependability through audit trails, confirmability through researcher reflexivity and participant quotes; and transferability through thick contextual description [72,79,80]. Consistent with the convergent mixed-methods design, quantitative and qualitative findings were integrated using a weaving approach, presenting findings together by theme to demonstrate convergence, divergence, and complementarity [64,81]. This integration, aligned with critical realist principles, enabled comprehensive understanding of food security determinants, resilience, and poverty within the cocoyam value chain [60,61].

#### 3.5.4. Ethical Consideration

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 [82]. Ethical clearance and approval certificates were obtained from Mzuzu University and relevant local authorities prior to data collection [83].

## 4. Findings

### 4.1. Demographic Profile of Respondents

#### 4.1.1. Overview of the Respondent's Area

A total of 390 households were stratified across five EPAs, with each getting an average of 78 households, reflecting its heterogeneous production landscape. Wetland producers constituted 58.1% (n=215) and upland 41.9% (n=155). The zonal composition necessitates zone-disaggregated analysis to reveal meaningful differences in food security, value chain participation and resilience across production zones [84].

#### 4.1.2. Profile and Interpretation

The sample is predominantly working-age, with the 31–45 (38.0%) and 46–60 (34.0%). The cohorts comprising 72.0% of respondents experienced farmers with established market relationships. Youth (18–30 years) are underrepresented at 13.0%, raising intergenerational sustainability concerns, while elderly respondents (60+, 15.0%) represent a vulnerable subgroup warranting age-disaggregated analysis [85]. The combined 18–60 cohort (85.0%) confirms an active farming population consistent with rural smallholder surveys across sub-Saharan Africa, capable of reflecting meaningfully on production, market participation and coping strategies. Refer Table 1 below.

| Age Group | Percentage |
|---|---|
| 18–30 years | 13.0% |
| 31–45 years | 38.0% |
| 46–60 years | 34.0% |
| 60+ years | 15.0% |
| Total | 100% |

**Table 1: Age Distribution of Respondents**

### 4.1.3. Literacy and Educational Attainment

Primary education dominates the sample, with 65.0% completing primary level and 18.0% having no formal education, totaling 83.0% with primary education or below. Only 15.0% attained secondary and 2.0% tertiary education. This low educational profile is a typical of rural Malawi smallholders [86]. The rural is associated with constrains market participation, technology adoption and extension service access due to limited literacy and numeracy. Consequently, extension strategies should prioritize non-text-based formats, while the small tertiary-educated cohort (2.0%) may introduce slight upward bias in market participation estimates if uncontrolled in regression models. Refer **Table: 2 below.**

| Education Level | Percentage |
|---|---|
| No formal education | 18.0% |
| Primary education | 65.0% |
| Secondary education | 15.0% |
| Tertiary education | 2.0% |
| Total | 100% |

**Table 2: Education Level of Respondents**

### 4.1.4. Gender and Occupational Profile

The sample achieved near-equal gender representation (51.1% male, 48.9% female), reflecting deliberate gender-disaggregated sampling acknowledging women's significant roles in cocoyam production and processing. Farming dominated occupations at 92.4%, positioning cocoyam as central to household livelihoods. The high marriage rate (81.4%) implies dual-adult labour availability for cultivation, while the remaining 18.6% unmarried, widowed, or female-headed households may represent vulnerable subgroups facing distinct labour access and food security constraints [87].

### 4.1.5. Overall Assessment and Analytical Implications

The sample reflects a coherent rural Malawian smallholder profile, farming-dependent, low-educated, working-aged and married, across five EPAs. Key analytical implications include zone-level disaggregation (58.1% wetland vs. 41.9% upland), age and education as regression controls, gender-sensitive analysis [88]. The demographic profile's consistency with national agricultural surveys supports external validity, providing a solid empirical foundation for assessing food security, resilience, and poverty reduction within the cocoyam value chain.

## 4.2. Status of Household Food Security in the Cocoyam Value Chain

### 4.2.1. Perceived Contribution of Cocoyam to Food Security

Respondents were asked whether cocoyam can help improve household food security based on their experience of growing and consuming the crop. The overwhelming majority affirmed its contribution. Refer Table: 3 below.

| Response | Frequency | Percentage |
|---|---|---|
| Agree | 333 | 90.0% |
| Disagree | 26 | 7.0% |
| Not Sure | 11 | 3.0% |
| Total | 370 | 100% |

**Table 3: Perceived Contribution of Cocoyam to Food Security**

### 4.2.2. Frequency of Cocoyam Consumption

The frequency of cocoyam consumption during the harvest season provides an indicator of its role in household diets. Respondents reported the number of meals containing cocoyam consumed per week. The data show that **38.1%** of households consume cocoyam daily (seven times per week), while a further **20.2%** consume it four times per week. Combined, **58.3%** of households consume cocoyam at least four times weekly, indicating its significance as a dietary staple for a substantial portion of the population. Refer Table:4 below.

| Meals per Week | Frequency | Percentage |
|---|---|---|
| **1 meal** | 36 | 9.7% |
| **2 meals** | 25 | 6.7% |
| **3 meals** | 66 | 17.8% |
| **4 meals** | 75 | 20.2% |
| **5 meals** | 23 | 6.2% |
| **6 meals** | 4 | 1.0% |
| **7 meals** | 141 | 38.1% |
| **Total** | 370 | 100% |

**Table 4: Number of Cocoyam Meals per Week**

### 4.2.3. Types of Cocoyam Meals Prepared

Respondents were asked to identify the meal occasions at which cocoyam is consumed within their households. The majority of households (61%) use cocoyam primarily for breakfast, reflecting its role as a readily available morning meal. However, nearly one-third (30%) incorporate cocoyam into all three main meals, indicating that for these households, cocoyam functions as a staple food rather than merely a supplementary crop. Refer Table: 5 below.

| Meal Type | Percentage |
|---|---|
| **Breakfast only** | 61% |
| **Breakfast, lunch, and supper** | 30% |
| **Supper and lunch only** | 7% |
| **Lunch and breakfast only** | 2% |
| **Total** | 100% |

**Table 5: Types of Cocoyam Meals Prepared**

### 4.3. Cocoyam Food Products Consumed

The study explored the specific forms in which cocoyam is prepared and consumed, as this has implications for value addition and market potential. The findings reveal that boiled cocoyam is the overwhelmingly dominant form of consumption (90%), with minimal value addition. Cocoyam soup is consumed by 20% of households, while chips are consumed by only 3%. Notably, no households reported consuming cocoyam as nsima (the traditional maize-based staple), fried, or as porridge. This pattern suggests significant untapped potential for value addition and product diversification.

Focus group discussions illuminated the reasons for this pattern. Participants explained that boiling is the simplest and most traditional preparation method, requiring no specialized equipment or ingredients. One participant from Chikwina EPA noted: *"We have always eaten cocoyam this way, since our grandparents. You just wash it, boil it, and it is ready. We have never thought to make anything else from it."* (female farmer, Chikwina)

| Product Type | Percentage of Households |
|---|---|
| **Boiled cocoyam** | 90% |
| **Cocoyam soup** | 20% |
| **Cocoyam chips** | 3% |
| **Cocoyam nsima** | 0% |
| **Fried cocoyam** | 0% |
| **Cocoyam porridge** | 0% |

**Table 6: Cocoyam Food Products Consumed**

### 4.4. Cocoyam as an Alternative Food Source During Shortages

A key dimension of resilience is the ability of households to access food during periods when staple crops are scarce. Respondents were asked whether cocoyam serves as an alternative source of food when other food sources are unavailable. The majority (82%) of respondents affirmed that cocoyam serves as an alternative food source during periods of shortage. This finding is consistent with the consumption frequency data and underscores cocoyam's role as a safety net. Focus group discussions provided qualitative depth to this finding. Participants described the seasonal pattern of food scarcity in Nkhata Bay, which typically peaks from October to March. During this "hunger gap," cocoyam, particularly that grown in wetlands, becomes a critical food source. A female farmer from Mpamba EPA explained:

*"When the maize is finished and we are waiting for the new harvest, we turn to cocoyam. Those of us with gardens in the dambo [wetland] can still harvest even when the rains have not come. Without cocoyam, many families would go hungry."* (Female farmer, Mpamba)

Participants also noted that cocoyam's flexibility in growing seasons, with wetland cultivation possible during dry periods, provides a distinct advantage over maize, which is strictly rain-fed. This characteristic emerged as a key determinant of household resilience.

| Response | Frequency | Percentage |
|---|---|---|
| **Agree** | 320 | 82% |
| **Disagree** | 30 | 8% |
| **Not Sure** | 40 | 10% |
| **Total** | 390 | 100% |

**Table 7: Cocoyam as an Alternative Food Source**

### 4.5. Determinants of Food Security, Resilience, and Poverty

#### 4.5.1. Production Zone as a Determinant

Bivariate analysis revealed significant differences in food security outcomes based on production zone. Households engaged in wetland (dambo) cultivation reported higher consumption frequency and greater reliance on cocoyam during shortages compared to upland producers. Focus group participants explained that wetland cultivation enables year-round production, providing a more reliable food source during dry spells. A participant from Kavuzi EPA elaborated:

*"Those of us with dambo gardens can harvest cocoyam even in October when the maize is finished. The upland cocoyam is harvested once a year, but we harvest from the dambo many times. This is why we never go without food."* (Male farmer, Kavuzi)

| Production Zone | Daily Consumption (7 meals/week) | Agree Cocoyam is Alternative |
|---|---|---|
| **Wetland (Dambo)** | 48.4% | 87.9% |
| **Upland Rain-Fed** | 24.5% | 71.6% |
| *Chi-square test: $p < 0.01$* | | |

**Table 8: Consumption Patterns by Production Zone**

#### 4.5.2. Access to Wetlands as Natural Capital

The Sustainable Livelihoods Framework emphasizes natural capital as a key determinant of livelihood outcomes. Access to wetlands emerged as a critical asset differentiating households in terms of food security and resilience.

| Indicator | With Wetland Access | Without Wetland Access |
|---|---|---|
| **Cocoyam as alternative food** | 87.9% | 71.6% |
| **Daily consumption** | 48.4% | 24.5% |
| **Perceive food secure** | 78.6% | 58.2% |

**Table 9: Indicators of Resilience by Access to Wetlands**

#### 4.5.3. Value Chain Constraints

Despite cocoyam's contributions to food security, the study identified significant constraints limiting its potential for poverty reduction. The near-exclusive reliance on boiled consumption (90%) with minimal processing represents a missed opportunity for value addition.

Focus group discussions revealed that most households do not sell cocoyam in formal markets. A market vendor from Mpamba EPA noted:

*"We sell cocoyam in the village, but it is cheap. People do not think of it as something to sell in town. If we could make chips or flour, maybe we could get better prices, but we do not have the equipment or the knowledge."* (Female vendor, Mpamba)

This finding aligns with the literature on value chain constraints for underutilized crops, which identifies limited processing capacity and weak market linkages as persistent barrier [42]

| Practice | Percentage |
|---|---|
| **No processing (boiled only)** | 90% |
| **Basic processing (chips)** | 3% |

**Table 10: Value Addition Practices**

### 4.6. Resilience and Climate Adaptation

The study explored cocoyam's role in building household resilience to climate variability. Focus group discussions provided rich insights into the crop's adaptive characteristics. Participants consistently noted that cocoyam's ability to grow in wetlands during the dry season provides a critical buffer against the seasonal food scarcity that affects many households. A participant from Limphasa EPA explained:

*"Cocoyam is our insurance. When the rains fail and the maize dries, we still have cocoyam in the dambo. It does not need much care, and it is there when we need it."* (Male farmer, Limphasa)
Additionally, participants in four EPAs mentioned cocoyam's role in controlling soil erosion, noting that its dense foliage and root system help stabilize soil in wetland areas. This environmental co-benefit was identified as an important consideration for climate adaptation strategies.

| Attribute | Mentioned in FGDs |
|---|---|
| **Thrives in wetlands during dry season** | 5/5 EPAs |
| **Tolerates waterlogging** | 5/5 EPAs |
| **Controls soil erosion** | 4/5 EPAs |
| **Can be grown with minimal inputs** | 5/5 EPAs |
| **Harvestable during hunger gap** | 5/5 EPAs |

**Table 11: Perceived Resilience Attributes of Cocoyam**

### 4.7. Poverty Reduction Potential

The 90% of households rely on cocoyam for food self-sufficiency, only 28% sell cocoyam and 12% participate in vending, indicating largely untapped income-generating potential. Focus group discussions identified key constraints including low market prices reflecting cocoyam's stigmatization as a "poor person's food," poor road infrastructure limiting urban market access, lack of value-addition processing equipment, and seasonal supply limitations. A Chikwina EPA farmer summarized: "We eat most of it and sell only a little in the village" due to prohibitive transport costs.

| Pathway | Percentage of Households | Key Finding |
|---|---|---|
| **Food self-sufficiency** | 90% | Agree cocoyam contributes to food security |
| **Income from sales** | 28% | Sell cocoyam in local markets |
| **Income from vending** | 12% | Engage in cocoyam trading |

**Table 12: Economic Contributions of Cocoyam**

### 4.8. Summary of Key Findings

| Theme | Key Finding |
|---|---|
| **Food Security** | 90% of respondents affirm cocoyam contributes to food security and 38.1% consume it daily |
| **Resilience** | 81% report cocoyam serves as alternative during food shortages. Wetland cultivation enables dry-season harvest |
| **Poverty Reduction** | 90% achieve food self-sufficiency. Only 28% generate income from sales. Value addition is minimal (90% boiled only) |
| **Determinants** | Wetland access is key determinant. There is significant differences between wetland and upland producers |

| | |
|---|---|
| **Value Chain Constraints** | Minimal processing, weak market linkages, low prices, and limited infrastructure constrain poverty reduction potential |
| **Climate Adaptation** | Cocoyam thrives in wetlands during dry season, tolerates waterlogging and helps control soil erosion |

**Table 13: Summary of Key Findings by Theme**

### 4.9. Integration of Findings

Cocoyam substantially contributes to household food security and resilience in Nkhata Bay, particularly for wetland households. However, poverty reduction potential remains constrained by limited value addition, weak market linkages, and poor infrastructure. The gap between high consumption (38.1% daily) and low market participation (28%) highlights a critical value chain opportunity, underscoring the importance of integrating neglected crops into agricultural development strategies.

## 5. Discussion

This chapter interprets and synthesises the findings presented in Chapter Four in light of the existing scholarly literature, assesses their theoretical and practical significance, and reflects on the study's limitations. The discussion is organized around the three interlocking themes of food security, resilience, and poverty reduction within the cocoyam value chain in Nkhata Bay, Malawi.

### 5.1. Interpreting and Synthesizing the Findings

The finding indicates that 90% of respondents affirm cocoyam's food security contribution, with 38.1% consuming it daily, strongly corroborates the established view that neglected and underutilised crops (NUCs) perform critical food-provisioning roles beyond caloric sufficiency [21,44,43]. With 58.3% of households consuming cocoyam at least four times weekly during the harvest season, the data position it as a true dietary staple rather than a supplementary crop, consistent with who document comparable centrality in agroecological zones marked by marginal soils and seasonal food stress [11,53]. The finding that 81.1% of households rely on cocoyam during food shortages does not, however, resolve the tension identified in the literature, between cocoyam as a genuine food security asset and as a marker of livelihood riskiness [8].

The figure is consistent with both interpretations namely adaptive capacity on one reading and insufficient dietary diversification on another. Focus group discussions partially resolve this vagueness. Households described cocoyam as a strategically managed safety net rather than a last resort, particularly wetland producers who harvest continuously through the dry season, a pattern consistent with Béné et al.'s (2014) concept of absorptive capacity within livelihood resilience frameworks. Production zone division sharpens the interpretation further [37]. Wetland (dambo) households reported daily consumption rates of 48.4% against 24.5% for upland producers, and 87.9% versus 71.6% affirmed cocoyam's role during shortages (Chi-square, $p < 0.01$). These differences confirm the Sustainable Livelihoods Framework's proposition that natural capital access is a primary livelihood determinant. While the literature remains unsure about whether wetland access is a net advantage or a form of geographic market exclusion, the Nkhata Bay evidence is explicit. Wetland access is a food security asset [15,39]. Yet with 72% of households making no market sales, its benefits remain confined largely to the subsistence level.

The near-exclusive reliance on boiled cocoyam (90%), with chips consumed by only 3% and no households reporting any flour, nsima, or porridge preparation, confirms the value chain literature's characterisation of NUC sectors as trapped in low-value subsistence [26,27,46]. Cultural apathy, captured in one participant's remark that "we have always eaten cocoyam this way, since our grandparents", compounds the absence of processing infrastructure and market incentives, consistent with and Reardon and Minten (2021), who identify the interaction of supply-side constraints and weak demand signals as the principal barrier to NUC commercialization [34].

### 5.2. Convergence and Divergence with Established Knowledge

The findings align with the literature on key fronts. Cocoyam's dietary centrality and hunger-gap role corroborate West and Central African evidence, now extended to southern Africa [21,43]. The primacy of production zone confirms calls for agroecological disaggregation, and minimal processing echoes findings from Ghana and Nigeria [8,46,52,54]. Three divergences are notable. First, despite scholarly scepticism about NUC consumption producing measurable food security gains this study finds strong perceived and behavioural evidence, attributable to wetland cultivation's ecological advantage [8,56]. Second, the resilience versus insecurity doubt is partially resolved. Households frame cocoyam as a proactive insurance mechanism [22]. Third, the 62-percentage-point gap between food self-sufficiency (90%) and market participation (28%) exceeds West African comparators indicating a substantially longer commercialisation pathway to poverty reduction in Malawi [22,57].

### 5.3. Implications for Theory

This study makes several theoretical contributions. First, it advances the application of the Sustainable Livelihoods Framework to NUC-based farming systems by providing empirical substance to the proposition that natural capital, specifically wetland access, operates as a primary livelihood asset differentiating household food security and resilience outcomes [37-39]. Prior applications of the framework to smallholder agriculture in southern Africa have emphasised financial and social capital as the dominant differentiators this study re-centres natural capital and demonstrates its statistical primacy across multiple food security indicators.
Second, the findings challenge the binary framing of NUCs as either genuine food security assets or signs of insecurity that

recurs in the theoretical literature [8,42]. The evidence from Nkhata Bay supports a more refined theoretical position. cocoyam simultaneously constitutes an absorptive resilience mechanism and a symptom of structural constraints that prevent value chain upgrading.

This dual character is not adequately captured by either the optimistic NUC advocacy literatureor the structurally pessimistic food insecurity literature, and points toward a synthetic theoretical framework that accounts for zone-differentiated asset portfolios, cultural embeddedness and market integration simultaneously [8,21,22,44]. Third, the study refines understanding of value chain upgrading theory (Gereffi et al., 2018 in the NUC context by demonstrating that the barrier to upgrading is not exclusively supply-side infrastructure, but also the social stigma of cocoyam as a "poor person's food," which depresses demand-side incentives and perpetuates low farm-gate prices. This cultural dimension of market constraint is under-theorised in the mainstream value chain upgrading literature, which tends to privilege technical and institutional explanations over social and symbolic ones [26].

### 5.4. Implications for Practice and Policy

The findings carry clear implications for agricultural development practitioners, government policymakers, and NGOs operating in Malawi's food systems. For the Ministry of Agriculture, the evidence that wetland access is the single most powerful determinant of food security and resilience outcomes argues for protecting and equitably governing dambo wetland areas, including preventing land encroachment, and for facilitating access to wetland plots among upland-dependent. The 13.3 percentage-point gap in perceived food security between wetland (78.6%) and non-wetland (58.2%) households quantifies the potential return on targeted land access interventions.

For extension services and agricultural NGOs, the near-total absence of value addition (90% boiled only) despite high consumption rates identifies a tractable intervention point. Piloting low-cost processing technologies, such as manual chippers and solar driers, and accompanying market linkage programmes aligned with the value chain upgrading literature's recommendations (Reardon and Minten, 2021; could convert cocoyam's subsistence contribution into an income-generation pathway, potentially addressing the 62-percentage-point gap between food self-sufficiency and market participation [27]. Extension messaging should prioritise non-text-based formats given the finding that 83% of respondents have primary education or below.

For food security and resilience programmers operating under frameworks such as the Malawi Growth and Development Strategy and the National Agriculture Policy, the study's evidence that cocoyam functions as a seasonal food security buffer during the October–March hunger gap recommends its explicit inclusion in food security monitoring systems and social protection targeting criteria. Currently, cocoyam is largely invisible in official agricultural statistics and food security assessments, a policy gaps this study helps to address.

### 5.5. Limitations of the Study

Several limitations warrant acknowledgement. First, the cross-sectional design precludes causal inference; the bivariate associations documented are consistent with causal mechanisms but require longitudinal panel data for confirmation. Triangulation with focus group discussions across all five EPAs partially mitigated this constraint. Second, self-reported consumption frequencies and food security perceptions introduce social desirability bias. The absence of validated instruments such as the Household Food Insecurity Access Scale (HFIAS) or 24-hour dietary recall limits inferential precision, and future studies should incorporate these measures. Third, geographic concentration in Nkhata Bay, with its distinctive dambo wetland coverage and high rainfall, constrains transferability to drier or more landlocked cocoyam-producing districts. Findings should be read as contextually grounded evidence illuminating broader theoretical propositions rather than nationally generalisable statistics.

Fourth, youth underrepresentation (13% aged 18–30) likely introduces downward bias in market orientation and technology adoption estimates. Fifth, although gender-disaggregated sampling was achieved, gender was not fully exploited as a multivariate analytical variable, an omission future studies should address through gendered regression models, given the literature's consistent identification of gender as a primary determinant of value chain outcomes [32,50,51]. Notwithstanding these limitations, the mixed-methods design, stratified sampling, and zone-disaggregated analysis strengthen the findings' credibility and delineate a productive agenda for future research.

### 5.6. Recommendations

#### 5.6.1. Policy Recommendations

The evidence generated by this study points toward several actionable policy and programmatic recommendations directed at three principal audiences namely government ministries, agricultural development organisations, and research institutions. These recommendations are grounded in the empirical findings and the theoretical frameworks applied throughout the study, particularly the Sustainable Livelihoods Framework and value chain upgrading theory (Gereffi et al., 2018; [17,26,39].

#### 5.6.2. For Government: Protect Wetland Access and Reform Agricultural Policy

The Ministry of Agriculture and Land Resources should formally recognise dambo wetland access as a critical food security asset and enact legal protections against land encroachment in wetland cultivation zones. Given that wetland producers recorded daily cocoyam consumption rates of 48.4% against 24.5% for upland households, and that 87.9% of wetland producers affirmed cocoyam's role in household food security compared to 71.6% of upland producers (Chi-square, $p < 0.01$), differential access to natural capital is the single most powerful determinant of food security outcomes in Nkhata Bay. This finding is consistent with the Sustainable Livelihoods Framework's assertion that natural capital constitutes a primary livelihood asset [17,37]. The Ministry should further revise the Malawi Agriculture Sector Wide Approach to include cocoyam explicitly in food security monitoring, seed multiplication programmes, and extension curricula, addressing the maize-centric policy bias that has rendered this crop invisible in official agricultural development agendas [19]. Equity in wetland plot allocation, prioritising female-headed households and upland-dependent producers, would directly translate the 13.3-percentage-point food security gap between wetland and non-wetland households into a policy intervention target.

#### 5.6.3. For Agricultural Development Organisations: Invest in Processing Infrastructure and Market Linkages

NGOs and development partners operating in Nkhata Bay's food systems should prioritise closing the gap between cocoyam's demonstrated food security contribution and its near-zero market participation rate. With 90% of households relying exclusively on boiled cocoyam and only 28% making any market sales, the value chain is trapped in a low-value subsistence mode [26,27]. Targeted investment in low-cost, village-level processing equipment, including manual chippers, solar driers, and flour milling capacity, would reduce post-harvest losses and open product differentiation pathways consistent with value chain upgrading theory (Reardon and Minten, 2021; Gereffi et al., 2018). Critically, upgrading interventions must be designed with explicit gender safeguards to prevent the well-documented pattern whereby processing commercialisation displaces women from value chains they historically control [32,34,50].

Demand-side interventions are equally necessary: the social stigma of cocoyam as a "poor person's food" depresses market prices and suppresses consumer demand, requiring behavioural change campaigns that reframe cocoyam as a nutritionally dense, culturally valued food commodity [21,43,44]. Extension workers should deliver training in non-text-based formats, radio, visual demonstrations, and community theatre, given that 83% of surveyed respondents have primary education or below.

#### 5.6.4. For Researchers: Address Evidence Gaps Through Longitudinal and Gendered Inquiry

The cross-sectional nature of this study precludes definitive conclusions about whether cocoyam-based livelihoods generate durable welfare improvements or merely stabilise households at low welfare levels, the resilience-trap question identified by Chambers and Conway (1992) and subsequently elaborated by Sumberg et al. (2022) and Cervantes-Godoy and Dewbre (2010) [39,40]. Longitudinal panel research tracking wetland and upland households over three to five agricultural seasons is recommended to resolve this question. Future studies should incorporate validated food security instruments such as the Household Food Insecurity Access Scale (HFIAS) or Food Consumption Score to move beyond self-reported perceptions toward measurable dietary status. Given the literature's consistent identification of gender as a primary determinant of value chain outcomes (Sraboni et al., 2014), a dedicated gendered value chain analysis deploying multivariate regression is warranted [32,50,51]. Comparative research extending to other cocoyam-producing districts, including drier, landlocked settings such as Kasungu or Ntchisi, would test the agroecological transferability of these findings and contribute to the broader NUC scholarship that remains heavily concentrated in West Africa [11,19,56].

## 6. Conclusion

### 6.1. Synthesis of the Study's Contribution

This study examined household food security within the cocoyam value chain in Nkhata Bay District, Malawi, identifying determinants of food security and resilience across production zones and assessing cocoyam's poverty-reduction potential. Using a mixed-methods design, a stratified survey of 370 households across five EPAs and focus group discussions, the study addresses all three objectives with original empirical evidence. The findings confirm cocoyam as a central food security asset. About 90% of households affirm its contribution, 38.1% consume it daily, and 81.1% rely on it during the October–March hunger gap. Wetland (dambo) access emerges as the primary determinant of food security and resilience outcomes, with wetland producers recording daily consumption rates double those of upland households, re-centring natural capital within the Sustainable Livelihoods Framework. However, a structural gap constrains poverty reduction: while 90% achieve food self-sufficiency through cocoyam, only 28% sell it, and value addition remains negligible. Theoretically, the study challenges the binary framing of cocoyam as either resilience asset or insecurity signs, and refines value chain upgrading theory by foregrounding social stigmatisation as an overlooked demand-side barrier. These contributions extend NUC scholarship, geographically concentrated in West Africa, into southern Africa, providing the first systematic, zone-disaggregated empirical account of cocoyam's food systems role in Malawi.

### 6.2. Directions for Future Research

Several questions remain for future inquiry. First, longitudinal panel research is needed to determine whether wetland access and cocoyam consumption generate durable welfare improvements or merely stabilise households at low welfare levels, the resilience-trap question this cross-sectional design cannot resolve. Second, a dedicated gendered value chain study deploying multivariate regression is warranted, given that women and men occupy structurally distinct positions in NUC value chains, and the present analysis did not fully exploit the gender variable [32,50]. Third, comparative research across other cocoyam-producing districts in Malawi and the broader southern African region, particularly drier, landlocked settings, would test the generalisability of these findings. Fourth, rigorously evaluated pilot programmes, including randomised or quasi-experimental designs, are needed to establish which processing and market linkage interventions generate welfare gains without eroding the dambo wetland assets on which resilience depends. Finally, future surveys should incorporate validated instruments such as the Household Food Insecurity Access Scale (HFIAS) or Food Consumption Score to move beyond perceived contributions toward measurable food security status. This study has demonstrated that cocoyam is simultaneously a proven food security buffer and an underleveraged economic resource. The task ahead is translating this evidence into policy attention for a crop that has sustained millions while remaining invisible to official agricultural development agendas.

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