

**TRADITIONAL USE, VALUE ADDITION AND CONSERVATION OF
PUPWE (*Zanthoxylum Chalybeum*) IN CHITIPA DISTRICT**

MSc THESIS IN TRANSFORMATIVE COMMUNITY DEVELOPMENT

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MZUZU UNIVERSITY

JANUARY, 2026.

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BSc TRANSFORMATIVE COMMUNITY DEVELOPMENT

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**A THESIS SUBMITTED TO FACULTY OF ENVIRONMENTAL SCIENCES,
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REQUIREMENTS FOR THE AWARD OF THE MASTER OF SCIENCE
DEGREE IN TRANSFORMATIVE COMMUNITY DEVELOPMENT**

MZUZU UNIVERSITY

JANUARY, 2026.

DECLARATION

I hereby declare that this thesis, titled “Traditional Use, Value Addition and Conservation of Pupwe (*Zanthoxylum Chalybeum*)” has been written by me and constitutes a record of my research work. All citations, references and borrowed ideas have been duly acknowledged. It is being submitted in fulfilment of the requirements for the award of the degree of MSc in Transformative Community Development of Mzuzu University. None of the work presented here has been submitted previously for any degree or examination in any other University.



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CERTIFICATE OF APPROVAL

This thesis, Traditional Use, Value Addition and Conservation of Pupwe (*Zanthoxylum Chalybeum*) In Chitipa District by Milcah Mlazarirwa Kalinga, is submitted with our approval as university supervisors for the MSc in Transformative Community Development.

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DEDICATION

I dedicate this work to my dear parents Payih Kalinga and Ngani Silungwe, whose sacrifices and guidance have shaped my path, my supportive sister, Twisile Kalinga and my husband Blessings Mbonekela for his patience, understanding and constant belief in me.

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ABBREVIATIONS AND ACRONYMS

ACENUB: African Centre of Neglected and Underutilized Biodiversity

ANOVA: Analysis of Variance

CPR: Common Property Resource

FAO: Food and Agriculture Organization

FGD: Focus Group Discussions

GVH: Group Village Headman

HIS: Health Information System

KII: Key Informant Interviews

SDG: Sustainable Development Goals

SPSS: Statistical Package for Social Science

TA: Traditional Authority

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ABSTRACT

Pupwe (*Zanthoxylum chalybeum*) is an indigenous tree with significant nutritional, medicinal, and economic potential. However, limited awareness and research in Malawi hinder its full utilization. Recognizing its potential to improve rural livelihoods, health outcomes, and economic resilience, this study was undertaken to address these gaps and support the sustainable use of Pupwe. Specifically, the objectives of the study were: (i) to assess the traditional use of Pupwe in Chitipa District, (ii) to evaluate value addition opportunities and market development innovations, and (iii) to examine conservation practices. Research was conducted in Traditional Authorities (TAs) Mwabulambya and Nthalire in Chitipa District, Northern Malawi. A mixed-methods approach was used, combining qualitative and quantitative techniques. A total of 306 respondents were surveyed for quantitative data, while qualitative insights were gathered through eight focus group discussions and 12 key informant interviews. Quantitative data were analyzed using SPSS for descriptive and inferential statistics, while qualitative data were transcribed and thematically analyzed using NVivo. Findings indicate that Pupwe's most common traditional uses include culinary (54.7%) and medicinal (42.1%), with ritual use being least common (3.2%). The main value-added products identified were Pupwe culinary leaf powder (66.7%) and herbal rootbark powder (25.9%). However, only 5% of respondents are engaged in commercial activities. Value addition opportunities exist through improved processing technologies and innovations, notably processing machines (19.6%), product diversification (15.2%), and marketing strategies (13.1%), which can enhance profitability and market development. Despite its value, 77.1% of respondents reported a lack of community-led conservation initiatives. The study concludes that Pupwe is a multipurpose indigenous plant with significant potential for improving health, food security, and household income in rural Malawi. It recommends strengthening value addition technologies, supporting market development strategies and promoting community-led conservation initiatives to ensure sustainable utilization. This study is the first to comprehensively document Pupwe's traditional uses, value addition, and conservation in Malawi, filling a critical gap in literature.

Keywords: *conservation, Pupwe (Zanthoxylum chalybeum), traditional use value addition,*

CHAPTER ONE: INTRODUCTION

Chapter Introduction

This chapter introduces the study by presenting the background, focusing on the nutritional, medicinal, and economic potential of *Zanthoxylum chalybeum* (Pupwe) as a neglected and underutilized plant species. It then provides a detailed problem statement, highlighting gaps in traditional knowledge documentation, value addition opportunities, and conservation practices in Malawi. The chapter further outlines the main objective and three specific objectives of the study, followed by the key research questions. It concludes by presenting the justification of the study, emphasizing the importance of exploring Pupwe's potential in improving health, enhancing livelihoods, and contributing to sustainable development in Chitipa District and Malawi at large.

1.1 Introduction

Neglected and underutilized wild species have gathered increased attention as potential solutions for agricultural sustainability and community development in regions facing challenges like water scarcity and poor soil fertility (Padulosi 2013). Despite their potential, many NUCs remain under-researched and undervalued, often regarded as “poor man’s food,” which undermines their economic and nutritional importance and contributes to their marginalization in research, policy and markets.

Among these species, *Zanthoxylum chalybeum* (Pupwe) has shown exceptional promise due to its unique attributes and diverse applications. Pupwe scientifically identified as *Zanthoxylum chalybeum*, is an indigenous deciduous tree found across several African countries, including Burundi, Congo, Tanzania, Uganda, Zambia,

Malawi, Kenya and South Africa (Mbinile *et al.*2020). *Zanthoxylum chalybeum* is known to be distributed in several districts in Malawi, including Mzimba and Kasungu. Field observations and preliminary data indicate that it is particularly abundant and mostly utilised in Chitipa. This tree's notable characteristics include dark scales, prickles, and scattered thorns on its branches and leaves.

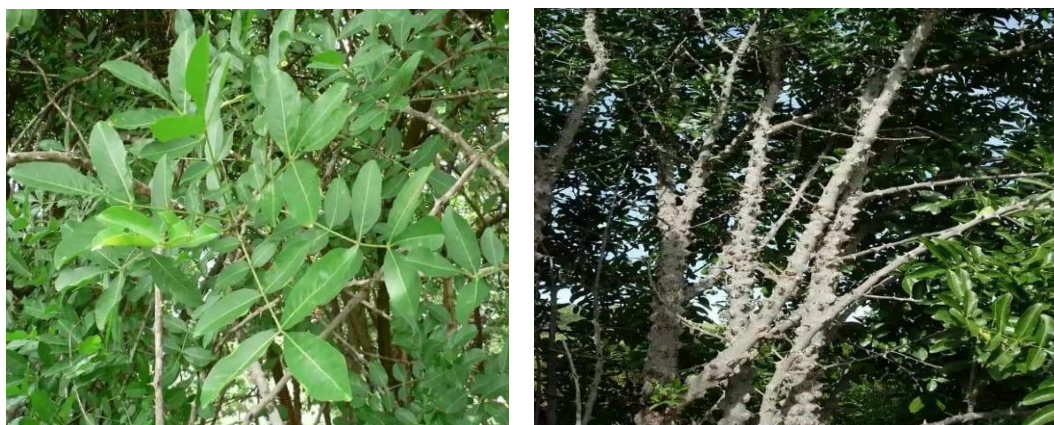


Plate 1: Pupwe (*Zanthoxylum chalybeum*) leaves and branches.

Pupwe holds significant importance both nutritionally and medicinally. It is widely used in traditional medicine for humans and animals. Studies from Kenya show overexploitation of *Zanthoxylum chalybeum* due to high demand for its medicinal properties (Mguni *et al.* 2023). A study done in local communities of Tanzania revealed a wide range of *Zanthoxylum chalybeum* applications in treating women's health systems (e.g., blood loss after labor, menstrual pain, and early pregnancy complications), body ache, fever, pneumonia, dizziness, chest pain, body immunity, malaria, abdominal pain ,intestinal problems including diarrhoea, cancer, skin diseases and Tuberculosis (Mbinile *et al.* 2020). According to Mbinile, the growing demand for Pupwe for medicinal purposes, combined with unsustainable harvesting of its roots and bark, threatens its long-term availability and usefulness.

Despite the heavy reliance on traditional medicine in Malawi Pupwe is not extensively utilized, although the prevailing trends underscores that 80 % of the Malawian population depends on traditional medicine (Chisamile et al. 2023).

In Tanzanian communities dried leaves of *Z. Chalybeum* are considered valuable sources of carbohydrates, vitamins and micronutrients, particularly during dry seasons when dietary resources are scarce (Grivetti 2000). A scientific analysis of leaves of *Z. chalybeum* revealed that they contain appreciable nutritional components, including 10.3% crude protein, 19.3% crude fiber, 3.3% fat (ether extract), 6.8% ash, and 18.2 MJ/kg gross energy, as well as minerals such as calcium (17 g/kg) and phosphorus (4.7 g/kg) (Dougall et al.1958) (Balama 2015). This nutritional richness could be of particular importance to Malawi, where a significant portion of Malawi's population falls below the poverty line hence to diversify sources of readily available plant-based mineral sources, in the face of high cost. Malawi is also associated with subsistence-oriented agriculture and it remains a primary livelihood, leaving many vulnerable to chronic food insecurity and nutritional deficiencies (Aberman *et al.* 2015).

Z. Chalybeum not only enriches local diets but also contributes to commercial ventures. Vendors in Iringa, Tanzania, have successfully marketed *Z. Chalybeum* powder locally and internationally, exporting to regions including Europe, the United States of America, Asia, and the Middle East (Mbinile *et al.* 2020a). Thus, the availability of Pupwe in Chitipa can help in alleviating poverty through commercialisation of Pupwe. This can go a long way to contribute to economic life of people in Chitipa where the poverty incidences stand at 36% (very poor), 47% (poor) and 15% (average) and the percentage of very poor in 2011 was at 24% according to HIS 4, 2016-2017.

Three million representing 15% of the total population in Malawi are grappling with the dual challenges of acute food security and healthcare accessibility and approximately 80% of the Malawian national population relies on traditional medicine for primary health care (Chisamile et al. 2023). Pupwe emerges as a multifaceted resource offering transformative opportunities for community development. By leveraging Pupwe, the populations in Chitipa can contribute towards Malawi's achieving Sustainable Development Goals (SDGs), particularly SDG1: No Poverty, SDG2: Zero Hunger, and SDG3: Good Health.

The study assumes that respondents in Chitipa District possess sufficient knowledge about Pupwe (*Zanthoxylum chalybeum*), will provide accurate and reliable information, and that the plant's nutritional and medicinal properties are relatively consistent across different locations. It is also assumed that local communities will cooperate during data collection and that processed Pupwe products have potential for local and broader markets. Nevertheless, the study acknowledges certain limitations, including reliance on primary data due to limited prior research, the focus on a single district which may limit generalizability and potential cultural sensitivities restricting access to indigenous knowledge.

1.2 Problem Statement

Neglected and underutilized crops (NUCs) contribute significantly to food security, nutrition and income diversification, yet remain overlooked in research and markets. *Zanthoxylum chalybeum*, an indigenous tree valued for its nutritional, medicinal and economic benefits, stands out as a promising crop for promoting sustainable livelihoods and rural development.

In countries such as Kenya and Tanzania, Pupwe's traditional use is well documented and integrated into community health and livelihood systems. However, in Malawi, knowledge about the plant's uses, benefits and management remains limited. There is a significant gap in both research and public awareness regarding its full potential.

While Pupwe is widely used in neighbouring countries to treat conditions such as malaria, fever and digestive problems (Jacqueline et al. 2007), its traditional use in Malawi has not been systematically documented. The limited existing knowledge relies mainly on personal experiences and oral transmission. The absence of scientific documentation raises concerns that valuable indigenous knowledge may be lost over time, thereby constraining opportunities to integrate Pupwe into local healthcare systems and community development initiatives.

Pupwe presents opportunities for value addition and innovation, including the processing of leaves and bark into herbal teas, powders and other products with market potential (Mbinile *et al.* 2020b). In Tanzania, it is already marketed locally and exported to regions such as Europe and the United States, yet in Malawi, structured value chain development remains limited, restricting community income and economic opportunities.

Across parts of East Africa, Pupwe populations are declining due to overharvesting and habitat degradation (Richardson 2011). Although the conservation status of Pupwe in Malawi has not been clearly established, the absence of community-led conservation. Without proactive efforts to ensure sustainable harvesting and regeneration, Pupwe's long-term availability and ecological benefits may be compromised.

Given the identified gaps, including insufficient documentation of traditional uses, limited efforts in value addition and unclear conservation practices, it is important to undertake a

comprehensive assessment of Pupwe (*Zanthoxylum chalybeum*). This will help uncover its full potential and inform strategies that promote its use in improving community health, supporting economic development and enhancing Pupwe sustainability.

1.3 Main Objective

To evaluate the potential of Pupwe (*Zanthoxylum chalybeum*) in Chitipa District, focusing on its traditional uses, economic value and sustainable practices

1.3.1 Specific Objectives

1. To assess the traditional use of Pupwe in the communities of Chitipa District
2. To evaluate the potential for value addition at each stage of the value chain and innovations for market development of Pupwe (*Zanthoxylum chalybeum*)
3. To examine the conservation practices of Pupwe in the communities of Chitipa district

1.3.2 Research Questions

1. What is the traditional use of Pupwe in the communities of Chitipa district
2. What is the potential for value addition at each stage of the value chain and innovation for the market development of pupwe
3. What are the conservation practices of Pupwe in communities of Chitipa district

1.4 Justification of the Study

The study will help bridge the existing knowledge gap, create awareness and contribute to a more comprehensive understanding of Pupwe's potential benefits in Malawi. In line with the first objective, which is to assess the traditional use of Pupwe, the research will document how communities in Chitipa utilize the plant for food, medicine and cultural practices. This will not only preserve indigenous knowledge but also support

improved health outcomes in rural communities. Highlighting these traditional uses will promote Pupwe as a valuable addition to local diets and traditional medicine, enhancing overall community well-being.

Aligned with the second objective, which focuses on evaluating the potential for value addition and innovations along the value chain, the study will contribute to the diversification of income sources for rural communities. It will explore ways Pupwe can be processed and marketed, reducing over-reliance on traditional crops and uncovering new economic opportunities and markets. This has the potential to support government revenue and community development, aligning with Sustainable Development Goal 1 (No Poverty) by providing alternative income streams for vulnerable populations.

Regarding the third objective, which seeks to assess the conservation practices of Pupwe, the study will generate insights into current harvesting methods, sustainability challenges and community knowledge gaps. Understanding the market dynamics and conservation context will inform the development of sustainable practices, encourage community engagement and support policy recommendations to ensure Pupwe is protected and responsibly utilized for future generations.

Additionally, the study addresses a critical research gap, as there is limited documentation on Pupwe in the Malawian context. By filling this void, the research contributes not only to academic literature but also to national planning and innovation around indigenous plants. The findings will serve as a foundation for future research and provide valuable guidance to policymakers and development practitioners aiming to tap into the potential of underutilized natural resources.

1.5 Chapter conclusion

Chapter One has provided a comprehensive foundation for the study by outlining the background, identifying the research problem, and stating the study's main and specific objectives along with key research questions. It highlighted the knowledge gaps surrounding the traditional use, value addition opportunities, and conservation status of Pupwe (*Zanthoxylum chalybeum*) in Malawi, thereby justifying the relevance of this research. The next chapter presents the literature review, including the theoretical and conceptual frameworks, and discusses previous studies related to traditional plant use, value chain development, and sustainable natural resource management.

CHAPTER TWO: LITERATURE REVIEW

Chapter Introduction

This chapter provides a review of literature relevant to the study on Pupwe (*Zanthoxylum chalybeum*). It begins by examining existing studies related to the traditional uses, nutritional and medicinal values, value-added opportunities, market potential, and conservation practices of Pupwe and other similar underutilized plant species. This is followed by the conceptual framework, which outlines the key variables and their relationships as they pertain to the study objectives. Finally, the chapter presents the theoretical framework that underpins the research, offering the lens through which the study is analyzed and interpreted.

2.1 Traditional Use of Pupwe

2.1.1 Medicinal use

The study done by Jacqueline in Kenya on the use of *Zanthoxylum chalybeum* as traditional medicine uncovered the utilization of leaf decoction for treating diarrhea, throat, stomach, and chest pain in parts of Kenya, Uganda, and Somalia (Jacqueline *et al.*2007). This finding resonates with Mbinile's research, which identifies *Zanthoxylum chalybeum* as having medicinal properties, particularly in Tanzania, where it's employed for treating malaria, fever, cough, headaches, chest pain, digestive issues, diabetes, and toothaches (Mbinile *et al.*2020b). However, both of these studies relied mainly on ethnobotanical surveys and self-reported community practices, without extensive pharmacological validation, which limits the generalizability of the findings. Further substantiates the plant's efficacy with scientific evidence of its alkaloid content, including tembetarine, nitidine, and skimmianine, known for their anti-malarial properties, as well as chelerythrine and nitidine exhibiting anti-inflammatory effects.

Similarly, (Masumbu *et al.* 2023) corroborates these findings, indicating the antioxidant properties of *Z. chalybeum* stem barks and its potential health benefits against cancer, cardiovascular diseases, diabetes, and obesity. Although these pharmacological studies are valuable, most were conducted under laboratory conditions, and their translation to rural community use has not been fully explored. Pharmacological studies of *Z. chalybeum* have reported promising results, highlighting its antibacterial, antifungal, antiplasmodial, antidiabetic, anticancer, and antisickling properties (Brouwer *et al.* 2021). Phytochemical analyses have revealed the presence of bioactive compounds including reducing sugars, alkaloids, anthracenosides, coumarin derivatives, flavonoids, steroid glycosides, triterpenes, anthocyanosides, saponins, and cardiac glycosides (Watson *et al.* 2016). This is supplemented by (Schemelezer 2008) whose study showcases the use of water extracts from the bark or root of *Z. chalybeum* in treating livestock diseases such as anaplasmosis, fever, liver disease, lumpy skin disease in cattle and diarrhoea in cattle, camels and goats. While this highlights the plant's versatility, the reliance on livestock case studies makes direct comparison with human use difficult. Given the breadth of its applications across human and veterinary medicine, *Z. chalybeum* stands out as a highly valuable medicinal plant.

A recent ethnomedicinal review by (Mguni *et al.* 2023) confirmed that *Z. chalybeum* is used across Eastern and Southern Africa to treat malaria, cancer, and diabetes, with pharmacological studies validating its antibacterial and antidiabetic activities. Furthermore, a recent study by (Kumwenda *et al.* 2025) conducted in Malawi revealed high concentrations of phenolics and flavonoids in *Z. chalybeum* root extracts, showing strong antibacterial activity, particularly against *Staphylococcus aureus*. This adds important local evidence supporting the plant's medicinal efficacy and aligns with community practices in using Pupwe for treating infections (Kumwenda *et al.* 2025).

However, this study was laboratory-based and did not capture local knowledge systems or conservation practices, which are crucial for sustainable utilization.

These findings are particularly relevant for Malawi, especially in districts like Chitipa where traditional medicine remains integral to rural health care. The plant's versatility in treating both human and animal diseases aligns well with local reliance on herbal remedies. However, despite its broad use across East Africa, limited documentation exists on how Malawian communities specifically use and manage Pupwe for medicinal purposes. This underscores the importance of the current study in filling this contextual gap and providing Malawi-specific insights into the medicinal role of *Z. chalybeum*.

2.1.2 Nutrition

In the context of traditional culinary practices in Kenya (Gladys 2023) the study reveals the multifaceted use of *Zanthoxylum chalybeum*. The leaves are consumed as a vegetable but are also dried, pounded, and sieved to create vegetable powder. This powder is then soaked in hot water to form a thick vegetable paste, often mixed with groundnut paste and served with staple foods like ugali. This study is in line with Mbinile's study which further explores the culinary applications of *Z. Chalybeum*, highlighting the strongly aromatic leaves used for flavoring tea, while the bark finds use in tea-making and as a soup flavouring agent (Mbinile *et al.* 2020a), Teas derived from *Z. Chalybeum* fruits or leaves are utilized to aid in childbirth. While these ethnographic accounts provide valuable cultural context, they lack quantitative data on the nutritional value of these preparations.

The leaves contain a moderate level of protein, which is essential for growth, tissue repair, and the maintenance of body functions, particularly in communities where access to animal protein may be limited. They contain moderate amounts of dietary fibre and fats, providing energy

and supporting growth and digestion. The leaves are rich in minerals such as calcium and phosphorus, important for bone health and energy metabolism. They also contain vitamins, including vitamin A, vitamin C and some B complex vitamins, which support immunity, vision, and overall health (Tuyen *et al.* 2021). However, these findings are based largely on laboratory analysis without examining how nutritional values may be altered during traditional cooking or preservation practices.

Similarly, a scientific study done by (Balama 2015) found out that the nutritional value of locally and solar dryer-dried *Z. Chalybeum* leaves is underscored, as they also have low moisture content, prolonging their shelf life by inhibiting microbial growth. These dried leaves contain carbohydrate and protein levels compared to fresh leaves due to nutrient concentration during evaporation, maintaining consistent fat content and Vitamin A content within dietary recommendations. Furthermore, fiber content significantly increases in dried leaves, Vitamin C content increases in fresh leaves. Although this study provides useful comparisons, it was conducted under controlled conditions and may not fully reflect household-level processing practices in rural settings. The findings were in line with a study done by Grivetti on the nutritional attributes of *Z. chalybeum* leaves' significance as valuable sources of energy, vitamins, and micronutrients in rural diets (Grivetti 2000).

In the Malawian context, despite the wide availability of Pupwe, there is limited literature on its nutritional composition as used by local communities. This represents a major knowledge gap, since most studies are either regional (Kenya, Tanzania) or laboratory-based, without focusing on local processing, preparation and consumption patterns in Malawi. This highlights the need for local nutritional profiling studies to validate its potential contributions to food security and dietary diversity. Additionally, documenting how Malawians process and consume Pupwe would strengthen efforts to

promote it as a culturally acceptable and nutritionally rich wild vegetable. Although findings by (Bussmann *et al.* 2018), found that higher education levels in Peru were more likely to be aware of the nutritional value. This suggest that socio-demographic factors may also influence Pupwe's uptake in Malawi, a dimension that requires further local investigation.

2.1.3 Other uses

In addition, *Zanthoxylum Chalybeum* tree is valued as a source of firewood and is utilized in the crafting of various utensils such as spoons and combs. Its wood is also used in the production of charcoal and intricate carvings. The fruits of *Z. chalybeum* possess a spicy taste and are chewed by Pokot women in Kenya to promote good breath. Branches of the tree are traditionally employed for sweeping household areas to eliminate fleas and mites due to their natural insect-repellent properties. Additionally, these branches are often placed in grain stores to deter weevil attacks, safeguarding food supplies (Richardson 2011).

Despite all these uses, studies by (Bussmann *et al.* 2018) in Peru and (Cunningham, Shanley and Laird 2012) in southern Africa, revealed that many wild plants are used occasionally rather than daily, with cultural habits and seasonal availability playing a more prominent role in consumption than daily necessity. Further, (Cunningham, Shanley and Laird 2012) found that income levels do not strongly impact the use of wild plants, with cultural traditions and community practices being more important.

2.2 Potential for Value Addition and Market Development

Mbinile's study further emphasizes its economic value, with 57% of respondents citing its importance for providing employment opportunities for Masai herbalists. The increasing demand for powdered *Z. chalybeum* leaves in response to the scarcity of

vegetables in urban areas, coupled with climatic challenges, has driven its availability in local marketplaces, fetching prices of TZS 5,000 (USD 3.5) for 0.5 kg. Additionally, its medicinal properties contribute to its economic value, as it is traded in herbal markets. Exports to regions like Europe and the United States, primarily for making herbal tea, further enhance its economic significance (Mbinile *et al.*2020). However, the study's focus on urban Kenyan markets may not fully capture the realities of rural producers or cross-border trade dynamics. (Ndangalasi, Bitariho and Dovie 2007), Also reported that wild plants in southern Africa serve as both subsistence resources and highly profitable commodities in local and regional markets. The authors found that non-monetary exchanges, such as sharing and bartering, still play a role but that increasing urban demand has contributed to the commercial viability of herbal medicines. Similar trends have been observed in southern Africa (Cunningham, Shanley and Laird2012), where wild plants are mainly used for subsistence despite their economic potential. These studies highlight regional patterns but rarely quantify market volumes, making it difficult to compare across contexts. although a study by (Mbinile *et al.*2020a) reported similar constraints in the commercialization of wild edible plants in Africa, emphasizing that technological innovations in processing, drying, and branding could enhance product appeal and expand market reach. additional research by Belcher and (Hishe, Asfaw and Giday 2016) highlights the role of value chain actors such as harvesters, processors, and traders in strengthening market systems. These actors often lack access to technical support and infrastructure, limiting their ability to scale production and improve product quality. This limitation underscores the importance of capacity-building and institutional support, which remains underexplored in the literature.

In a broader African context, studies by Kansiime and Mastenbroek (2016) assessed the commercialization of indigenous vegetables and found that inadequate market access, poor packaging, and the absence of structured marketing strategies were major constraints. Their research recommends targeted policy interventions and innovations to enhance post-harvest handling, branding, and the development of farmer cooperatives. Yet, these recommendations have been slow to translate into practice in Malawi, where institutional and financial barriers remain significant.

Furthermore, the application of value chain analysis models, such as those suggested by (Kaplinsky, Morris and Readman 2002) Enables the identification of leverage points where value can be added. For example, investment in solar dryers and community processing units has been shown in other contexts (Vorley et al. 2008) to increase the shelf life and market value of indigenous vegetables. Such interventions could similarly benefit Pupwe producers. However, their feasibility depends on resource availability and community organization, factors that vary widely across rural Malawi.

The emergence of health-conscious consumer trends in urban centers, coupled with global interest in organic and traditional products, provides further opportunities for value addition. As noted by (Hunter *et al.* 2019). The growing demand for natural health products can be harnessed through certification schemes, improved packaging, and ecommerce platforms to reach wider markets. These approaches could be adapted for Pupwe to increase its competitiveness locally and internationally.

2.3 Conservation practices of Pupwe

The conservation status of *Zanthoxylum chalybeum*, particularly in Kenya, Uganda and Tanzania, is alarming as indicated by studies conducted by Richardson and Mbinile. Over-exploitation for medicinal purposes and habitat destruction have led to the scarcity of *Z. chalybeum* in many regions, and its habitat is significantly degraded. The

study done by (Mbinile *et al.* 2020) found out that Pupwe will become extinct in the long run as the demand for medicinal plants is increasing and unsustainable harvesting methods, as most plant parts harvested are roots and stem barks. This is in line with research conducted in the Simanjiro area of Northern Tanzania, which found that *Zanthoxylum chalybeum* is primarily harvested through digging and cutting of roots, as well as bark removal (Drucker *et al.* 2023). Such methods were observed to cause severe damage to the plant, leading to wilting, stagnant growth and in many cases, plant mortality. While these studies provide strong evidence of overharvesting, they mainly rely on field observations without systematically quantifying regeneration capacity, which weakens their predictive strength.

Zanthoxylum chalybeum produces approximately 30,000 seeds per kilogram, but the seeds lose viability quickly and must be sown immediately after collection for successful germination (JEROME GADI KIMARO 2007). The seeds have strong dormancy imposed by the hard seed coat, which can limit germination, although treatments like scarification with concentrated sulphuric acid have been used to improve success. Germination is epigeal, meaning the seedling emerges above the soil. In addition to seed propagation, the plant naturally regenerates through root suckers, allowing it to maintain populations in the wild. These biological traits suggest resilience, yet the persistence of destructive harvesting undermines natural recovery — a contradiction that is underexplored in the literature. However, in Kenya and Tanzania, overharvesting for medicinal purposes has reduced natural populations, and in Uganda the species has become scarce due to habitat degradation, emphasizing the need for sustainable harvesting to protect genetic resources (JEROME GADI KIMARO 2007).

this pattern of destructive harvesting is consistent with findings from (Shackleton *et al.* 2015) who documented that unsustainable use of wild plants in southern Africa poses

serious threats to biodiversity and ecosystem stability. Furthermore, (Cocks and Wiersum 2014) emphasize the importance of integrating local ecological knowledge into conservation strategies to prevent overharvesting and promote sustainable use of medicinal plants.

The study conducted by Mbinile aligns with Schippers' study, which reported that indigenous vegetables are crucial for food security in both urban and rural areas. However, these vegetables are particularly vulnerable to the adverse effects of changing climatic conditions, a situation expected to worsen in the future (Schippers 1997).

climate change exacerbates pressures on wild plant populations, as observed by (Thornton *et al.* 2019) who highlight that shifts in rainfall patterns and temperature can reduce the availability and regeneration rates of important indigenous species. This necessitates proactive conservation efforts that incorporate climate adaptation measures.

Sustainable improvement of community livelihoods through the utilization of this wild vegetable can be achieved through good management practices and on-farm cultivation of the plant (Cowie 2007). A study by (Martin, Melubo and Jensen 2020), found that indigenous knowledge played a more significant role than formal education in medicinal plant conservation, with elders possessing greater conservation knowledge due to cultural practices and experiences. (Mwaura, Kagendo and Raphael 2024), which highlighted that many wild plant species across East Africa face conservation challenges due to a lack of structured community initiatives.

In line with this, Berkes (2009) argues that community-based natural resource management (CBNRM) approaches, which empower local institutions and respect indigenous knowledge, are critical for effective conservation. These perspectives

highlight the centrality of community institutions, yet there is a lack of Malawi-specific studies documenting how local structures manage Pupwe conservation, which is a critical gap. Additionally, Agrawal and Gibson (1999) stress that collective action among communities can mitigate the tragedy of the commons by establishing locally accepted rules and monitoring mechanisms. These perspectives highlight the centrality of community institutions, yet there is a lack of Malawi specific studies documenting how local structures manage Pupwe conservation, which is a critical gap.

In summary, while regional studies identify overharvesting, ecological challenges, and climate change as major threats, they often lack Malawi-specific evidence and provide limited insights into community-led conservation of Pupwe. This study addresses these gaps by examining local conservation practices in Chitipa District and their implications for sustainable use (Objective iii).

2.4 Conceptual Framework

The conceptual framework for this study is built on the understanding that the traditional use of Pupwe provides the basis for recognizing its medicinal and nutritional value. Communities have long relied on Pupwe for different purposes and this indigenous knowledge forms an important starting point in identifying its potential uses. This traditional knowledge is supported by scientific findings; it creates an opportunity to inspire value addition and innovation. In particular, scientific research can provide evidence on the safety, efficacy and nutritional benefits of Pupwe, thereby strengthening confidence in its broader utilization.

Value addition and innovation are expected to drive market development for Pupwe. Through improved processing, packaging, and branding, Pupwe products can be made more attractive to consumers, both locally and beyond. This process enhances the

marketability and competitiveness of Pupwe, which in turn increases consumer demand. The growth in demand signals an opportunity for communities to benefit economically from the commercialization of Pupwe products.

However, increased demand has both positive and negative implications. On the one hand, it can create strong economic incentives for communities to adopt sustainable harvesting and management practices. When communities recognize Pupwe as a valuable resource with long-term market potential, they are more likely to engage in conservation and responsible utilization to secure continuous supply. On the other hand, if demand rises without appropriate management practices, it could lead to overharvesting, resource depletion, and eventual scarcity of Pupwe in the wild.

To address this dual outcome, the framework emphasizes the need for integrating sustainable harvesting and management practices into Pupwe commercialization efforts. By balancing market growth with conservation measures, communities can both explore the economic potential of Pupwe and ensure its availability for future generations. This framework therefore highlights the interconnectedness of traditional knowledge, scientific validation, value addition, market development and sustainable management in unlocking the full potential of Pupwe.

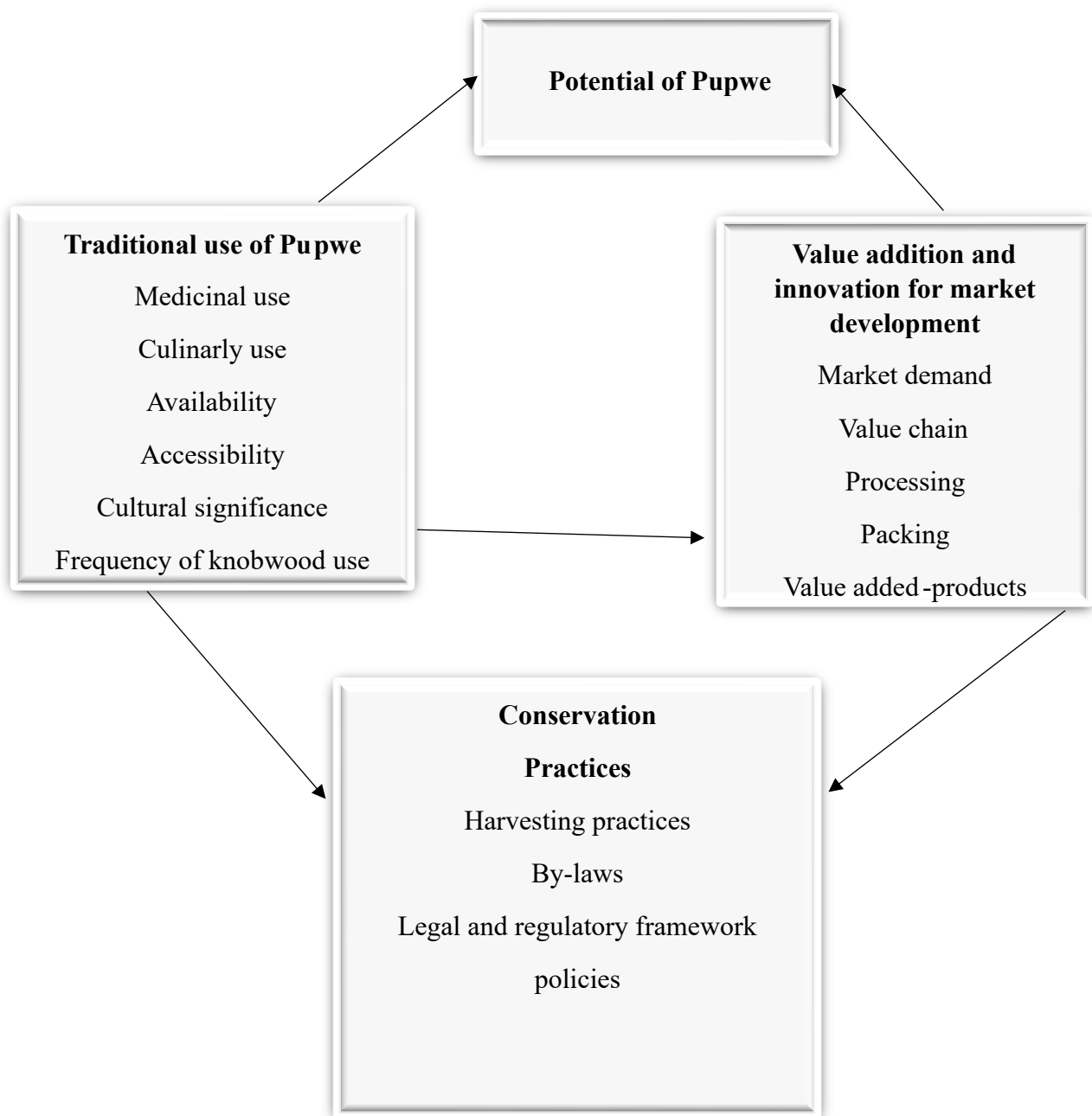


Figure 1: Conceptual Framework

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2.5 Theoretical frameworks

Indigenous Knowledge Systems (IKS) Theory

This theory guides objective one, to assess the traditional use of Pupwe in the communities of Chitipa District. Indigenous Knowledge Systems (IKS) Theory recognizes traditional knowledge as a valid and valuable source of information for understanding the use and management of natural resources. This theory emphasizes that local knowledge transmitted through generations guides how communities utilize plants for food, medicine, and cultural purposes. Scholars such as (Chilisa 2011) have extensively discussed the significance of IKS in research methodologies. Applying IKS Theory allows for a comprehensive exploration of how Chitipa communities traditionally use Pupwe. It ensures that research respects and integrates community perspectives, supporting cultural preservation and sustainable development.

Value Chain Theory and Innovation Systems Theory

The theories guide objective two to evaluate the potential for value addition at each stage of the value chain and innovations for market development of Pupwe (*Zanthoxylum chalybeum*). Value Chain Theory Developed by Michael E. Porter (1985), Value Chain Theory examines the full range of activities involved in bringing a product from conception to the consumer, identifying opportunities for value addition and market development at various stages. Innovation Systems Theory Articulated by the World Bank (2006), this theory focuses on the interactions among various factors such as farmers, traders, processors and institutions that contribute to the generation, adoption, and adaptation of innovations within a value chain. These theories guide the analysis of Pupwe's transformation into high-value products, the roles of different

stakeholders, existing challenges, and how institutional support and knowledge exchange can enhance market expansion and economic empowerment.

Common Property Resource (CPR) Theory

The theory guides objective three to assess the conservation practices of Pupwe in the communities of Chitipa district. (Dasgupta 2008) introduced CPR Theory, which addresses the collective management of natural resources, emphasizing the importance of local institutions and community rules in preventing overexploitation and promoting sustainable use. The framework facilitates an exploration of how Pupwe is conserved, the traditional or formal rules guiding its harvesting and how communities balance utilization with preservation, particularly in the face of commercialization or deforestation pressures.

2.6 Chapter Conclusion

This chapter has reviewed literature relevant to the study, including the traditional uses, nutritional and medicinal potential, value addition opportunities, market development, and conservation practices related to Pupwe (*Zanthoxylum chalybeum*). It has also presented the conceptual framework guiding the relationship between key study variables and the theoretical foundations that underpin the research. The review has highlighted key knowledge gaps, including limited local studies on Pupwe in Malawi, minimal commercialization efforts, and inadequate documentation of sustainable conservation practices. These insights provide the basis for the study's methodological approach and inform the development of appropriate data collection and analysis strategies. The next chapter, therefore, outlines the research methodology adopted to assess Pupwe's potential in Chitipa District, covering the research design, sampling procedures, data collection methods and analytical techniques.

CHAPTER THREE: METHODOLOGY

Chapter Introduction

This chapter presents the methodological approach used in conducting the study. It begins with an overview of the study area, providing context on the geographical and socio-economic setting where Pupwe (*Zanthoxylum chalybeum*) is found. It then outlines the research design adopted to guide the study, followed by a description of the sampling techniques and determination of the sample size. The chapter also details the data collection methods used to gather both qualitative and quantitative data, and the procedures followed during data analysis. Finally, the chapter discusses ethical considerations observed during the research, and highlights potential limitations of the study along with the mitigation strategies applied.

3.1. Study Site

The study was conducted in TA Mwabulambya and TA Nthalire in Chitipa district. Chitipa district is located to the northwest of the northern region of Malawi. It is bordered by two international boundaries, Tanzania to the north (Ileje district) and Zambia to the east (Isoka district) it also shares boundaries with Karonga. The total land area of the district is 118,484 square kilometres and abundant of the area is covered with rocks and 112 km² is covered by natural forest, extending over 27% of its land area. The study area was chosen purposively because that's where Pupwe is mainly found and used. *Zanthoxylum Chalybeum* occurs in semi-evergreen, dry bushland and wooded grassland, often in rocky localities.

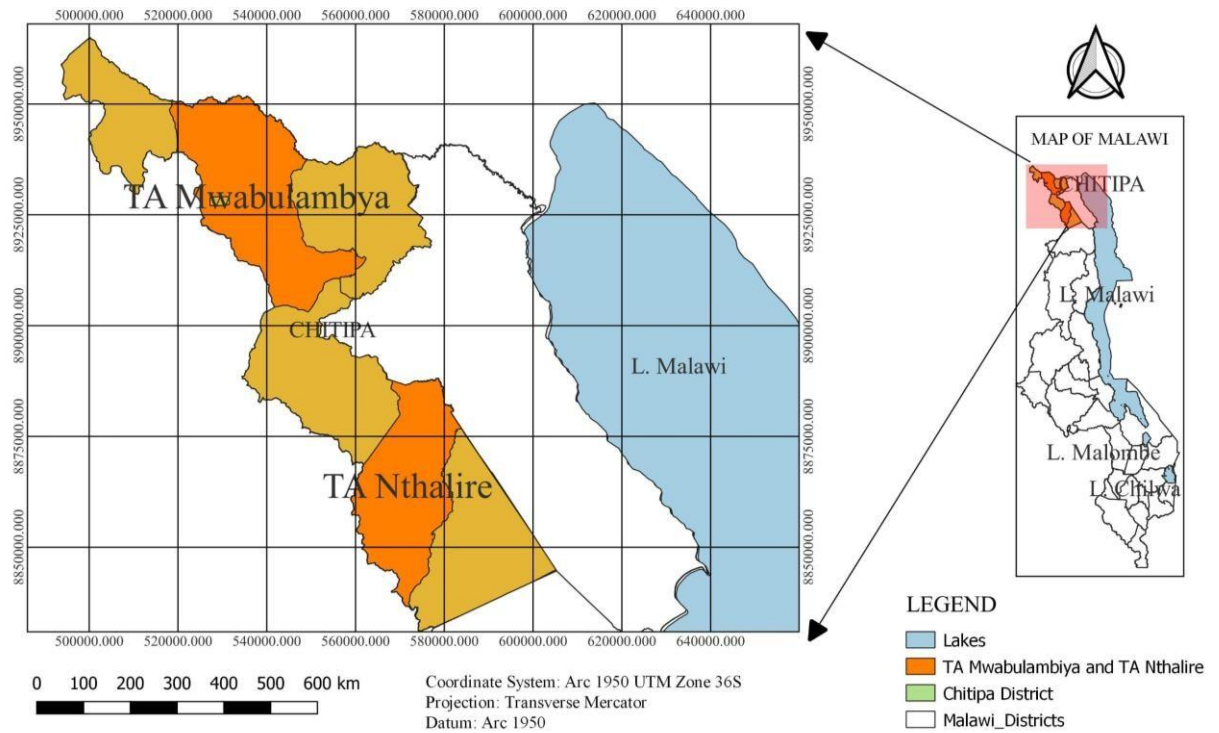


Figure 2: Map of Chitipa District showing T/A Mwabulambya and T/A Nthalire

3.2 Research Approach and Design

The study adopted a mixed methods approach, which combined both quantitative and qualitative strategies to provide a comprehensive understanding of the research problem. The approach was considered appropriate because the study sought to measure the extent of Pupwe use, value addition and conservation practices while also exploring the cultural, social and economic meanings attached to it. Using both methods made it possible to capture not only measurable trends but also detailed explanations behind those trends.

The quantitative component enabled the researcher to assess patterns in the traditional use of Pupwe, the prevalence of value addition practices and the extent of conservation measures. Quantitative data helped to provide generalizable results by showing the magnitude and frequency of these practices within the community.

The qualitative component was employed to complement the numerical findings by offering more detailed insights. Data collected explored community members' perceptions, attitudes and lived experiences related to Pupwe. This approach provided a deeper understanding of why certain practices exist and how local knowledge influences Pupwe's management and potential commercialization.

The integration of both approaches was achieved through triangulation, where findings from the qualitative methods were used to validate and enrich the quantitative results. This ensured that the study findings were not only statistically reliable but also contextually meaningful.

The study employed an explanatory design. This design was appropriate because it enabled the researcher to not only describe the existing situation regarding *Pupwe's* traditional use, value addition, and conservation practices in Chitipa District but also to explore the relationships among variables.

3.3 Sampling Design and Sample Size Determination

A three-stage sampling method was employed, combining purposive and simple random sampling. Traditional Authorities and villages where Pupwe is commonly used were purposively selected, while households within these villages were randomly sampled. As responses may have been correlated within clusters, the lack of explicit adjustment for clustering could have slightly underestimated standard errors, a limitation acknowledged in the study.

Table 1: Targeted villages in TA's

Traditional Authority	Villages
Mwabulambya	Mwenelufita
	Mwenekaseye
	MweneIyela
	Chizimu
	Lwakwa
	Ishalikira
	MweneIbanda
	Muselema
	Namuyemba
Nthalire	Kamguze
	Mchina
	Kavukuvuku
	Kajaliro
	Kamilazovu
	Kapirinkhonde

3.4 Sample Size Determination

To determine the sample size of the respondents, Cochran's sample size determination formula for a known population was used.

$$n = \frac{Nz^2(P)(1-P)}{Ne^2 + z^2(P)(1-P)}$$

Where;

- n is Sample Size
- e is the margin of error
- P is the (estimated) proportion of the population which has the attribute in question,
- $Z_{\alpha/2}$ is the critical z value of the desired confidence level
- N is the size of the population

The total population of TA Mwabulambya, and TA Nthalire is 86,574. a two-tailed Z value of 1.96 at 95% confidence level and the margin of error of 0.05 (reciprocal of confidence level i.e. significance level) was used. Although the calculated sample size was 383, only 306 households were successfully interviewed due to non-response rate, giving a response rate of 79.9%. The reduction in sample size has minimal impact on power since 306 households remain sufficient to detect moderate effect sizes at 95% confidence.

3.5 Pilot Survey

For the quantitative component of this study, a pilot survey was conducted with 20 respondents in a non-probability, convenience-sampled village in Chitipa District. According to Teijlingen and Hundley (2001), a pilot survey is a preliminary, smallscale study conducted before the main survey to test the research design, data collection methods, and survey instrument. Piloting assists researchers in identifying issues such as unclear wording, logistical challenges, and potential data collection flaws, thereby improving the reliability and validity of the final research instrument.

In this study, the pilot survey indicated that the questionnaire was generally clear and well understood by respondents. Only minor adjustments were required, mainly the

addition of follow-up questions to capture more detailed information on Pupwe utilization, value addition and conservation practices. These refinements ensured that the final instrument was comprehensive, user-friendly, and reliable for use in the main data collection

3.6 Data Collection Methods for Objective 1,2 and 3

The study utilized primary data to ensure comprehensive coverage of the research objectives. Primary data was collected directly from respondents in Chitipa District to capture community-level information on the traditional use, value addition, and conservation practices of Pupwe. Structured questionnaires were administered to households to obtain quantitative data, while key informant interviews and focus group discussions were conducted to gather qualitative insights. These methods made it possible to collect first-hand information from different stakeholders, including community members, herbalists, and local leaders, thereby ensuring that the data reflected lived experiences

3.6.1 Survey

Individual interviews were conducted directly with the selected respondents in Chitipa District. The study used face-to-face interviews to ensure that all respondents clearly understood the questions and could provide accurate information on their experiences with Pupwe. A structured questionnaire was employed, which included questions to capture comprehensive data on the traditional uses of Pupwe, opportunities for value addition and existing conservation practices.

The questionnaire was uploaded into Kobo Toolbox, a digital data collection platform, which enabled the researcher to efficiently collect, store and organize responses. Using

Kobo Toolbox helped in minimizing data entry errors and facilitated real-time data monitoring during the fieldwork. The survey allowed the researcher to gather detailed and structured primary data directly from community members.

Data collected through the survey contributed significantly to the study by quantifying patterns of traditional use, identifying potential value addition practices, and highlighting existing conservation measures. It also provided a foundation for comparison with qualitative data from interviews and discussions, allowing the researcher to develop a fuller understanding of Pupwe's role in local livelihoods, cultural practices and potential for sustainable commercialization.

3.6.2 Key Informant Interviews

A total of 12 key informant interviews were conducted to gather in-depth insights from individuals with significant knowledge and experience related to Pupwe. The key informants included community leaders, elders with historical knowledge, traditional healers, a district forestry officer, a chemistry scientist, entrepreneurs involved in Pupwe-related businesses, and a representative from the forestry department.

The interviews were conducted using semi-structured interview guides, allowing the researcher to explore specific themes while also giving informants the freedom to share detailed information and experiences. The discussions focused on areas such as the traditional uses of Pupwe, potential for value addition, challenges in its commercialization and practices for sustainable management and conservation. Information obtained from these key informants provided critical contextual and technical knowledge that was not captured through the surveys.

These interviews helped the study to triangulate the survey data, providing a deeper understanding of community practices and expert perspectives. The combination of

community and technical knowledge enabled the researcher to develop a more comprehensive picture of Pupwe's utilization, potential for value addition, and strategies for sustainable management in Chitipa District.

3.6.3 Focus Group Discussions

A total of 10 focus group discussions (FGDs) were conducted with community members to generate a broader understanding of the study objectives. Each group consisted of 8 to 10 participants, carefully selected to include a diverse mix of community members, such as men, women, and youth, to ensure representation of different perspectives.

The FGDs were guided by a structured discussion guide, which covered topics related to the traditional uses of Pupwe, opportunities for value addition, conservation practices, and challenges affecting its sustainable management. Participants were encouraged to share their experiences, perceptions and suggestions, which provided rich qualitative data on community knowledge, attitudes and practices.

These discussions helped the study to complement and validate the survey and key informant data, by capturing community-level consensus and variations in opinions. The interactive nature of FGDs allowed participants to build on each other's responses, revealing insights that might not emerge through individual interviews. The FGDs contributed significantly to the study by highlighting community perspectives, priorities and local knowledge, which were essential for identifying potential value addition opportunities and designing sustainable management strategies for Pupwe in Chitipa District.

3.8 Data analysis

Quantitative data was cleaned and analysed using the Statistical Package for Social Sciences (SPSS) version 27. Data was analysed for each specific objective according to variables as in the methodology matrix and data protocol.

3.8.1 Data Analysis on the Traditional Use of Pupwe

Descriptive Analysis

Descriptive analysis was also used to perform frequencies and percentages of various variables. Descriptive analysis was employed to summarize the collected data by calculating frequencies and percentages for various categorical variables. This approach involved counting the number of occurrences (frequencies) of each response category and determining their relative proportions (percentages) within the dataset. The results were organized into frequency distribution tables, which provided a clear overview of the distribution of responses across different categories. This method facilitated an understanding of the data's composition without inferring relationships or causality between variables.

Analysis of variance

One-way ANOVA was used to determine whether monthly income levels have a statistically significant effect on the frequency of Pupwe use. The one-way ANOVA model is specified as

$$Y_{ij} = \mu + \alpha_i + \epsilon_{ij} \dots \dots \dots (3.1)$$

where:

- Y_{ij} = Observed dependent variable (frequency of Pupwe use)
- μ = Overall mean

- α_i = Effect of the i^{th} monthly income level
- ϵ_{ij} = Error term

A significant F-value (typically $p < 0.05$) indicates that there is a statistically significant difference in the frequency of Pupwe use among at least one pair of income groups.

Although some outcome variables, such as frequency of Pupwe use, are ordinal, they were treated as approximately continuous for analysis purposes.

A normality test was conducted to determine whether the data followed a normal distribution, a key assumption for many statistical tests. Although minor deviations from normality were observed, the large sample size ($n = 306$) allowed the use of OneWay ANOVA, which are robust to moderate violations of normality. This ensured that the analysis of group differences in the frequency of Pupwe use was appropriate and reliable.

Income Grouping

Household income levels were grouped into three categories to assess economic disparities among respondents and explore how income influenced the frequency of Pupwe usage. Low Income: Households earning MK 0–50,000 per month, Middle Income: Households earning MK 50,001–90,000 per month and High Income: Households earning MK 90,001 and above per month

Chi-square

Chi-square was also used to determine the Effect of education level on awareness of Pupwe nutrients. Chi-square test was employed to assess whether there is a statistically significant association between individuals' education levels and their awareness of Pupwe's nutritional benefits. The Chi-square test statistic is given by:

$$\chi^2 = \left(\frac{O-E}{E} \right)^2 \dots \dots \dots (3.2)$$

A significance level of **0.05** was used to determine whether the observed associations were statistically significant (Agresti, 2006).

For categorical variables such as education level and awareness of Pupwe nutritional componets, the Chi-square test of independence was applied. The expected cell frequencies were checked and found adequate, ensuring that the results of the Chisquare tests were valid and reliable.

3.8.2 Data Analysis on the Value Chain and Innovation for Market Development

Descriptive Analysis

Descriptive analysis was also used to perform frequencies and percentages of various variables. Descriptive analysis was employed to summarize the collected data by calculating frequencies and percentages for various categorical variables. This approach involved counting the number of occurrences (frequencies) of each response category and determining their relative proportions (percentages) within the dataset. The results were organized into frequency distribution tables, which provided a clear overview of the distribution of responses across different categories. This method facilitated an understanding of the data's composition without inferring relationships or causality between variables.

Value Chain Analysis

Value chain analysis was also used to understand the activities, stakeholders, and linkages involved in the production, processing, distribution, and consumption of a product. To comprehensively understand the activities, stakeholders, and linkages involved in the production, processing, distribution, and consumption of Pupwe, this

study employed Value Chain Analysis (VCA) based on Michael Porter's framework. Porter's Value Chain Model categorizes business activities into primary and support activities, facilitating the identification of areas where value is added and opportunities for improvement exist.

Market Classification

To analyze the extent of Pupwe's market reach, market locations were categorized into four levels based on proximity. Local Market: Trading centers within the respondent's village and trading centers, Regional Market: Chitipa town, National Market: other districts in Malawi, including Mzuzu, Karonga and Rumphi and International Market: Cross-border markets such as Zambia and Tanzania.

Table 2: Porter's Value Chain Model business activities categories

Primary activities	Support activities include
Inbound Logistics: Processes related to receiving and handling raw Pupwe materials.	Procurement: Acquiring necessary resources for Pupwe processing.
Operations: Transforming raw Pupwe into consumable products	Technology Development: Implementing technological advancements to enhance Pupwe processing and distribution.
Outbound Logistics: Distributing processed Pupwe products to various markets.	Human Resource Management: Recruiting and training personnel involved in the Pupwe value chain.
Marketing and Sales: Promoting Pupwe products to consumers. Service: Post-sale support and services related to Pupwe consumption	Firm Infrastructure: Organizational structures and systems supporting Pupwe-related activities.

The analysis involved mapping each activity, identifying key stakeholders and examining the interconnections between them. This approach provided insights into the efficiency of the Pupwe value chain and highlighted areas for potential enhancement.

Gross Margin Analysis

Gross margin analysis was conducted to determine the profitability potential of Pupwe. Gross Margin Analysis was employed to evaluate the profitability potential of Pupwe by assessing the financial efficiency of its processing and marketing processes. The gross margin was determined using the following formula

$$\text{Gross Margin} = \text{Total Revenue} - \text{Total Variable Costs}$$

Gross margin analysis was based on 15 respondents engaged in the processing and sale of Pupwe relish powder and 13 respondents involved in selling Pupwe herbal products. Cost which mainly included labour and plastic packaging for buyers and revenue data were collected through interviews using a structured questionnaire, capturing current prices as of the 2024 market year. Because individual prices varied across respondents, average gross margins were calculated to represent typical profitability levels within each product category. The gross margins were expressed in United States Dollars (USD) 2024 currency for consistency and comparability.

3.8.3 Data Analysis on the Conservation of Pupwe

Descriptive analysis

Descriptive analysis was also used to perform frequencies and percentages of various variables. Descriptive analysis was employed to summarize the collected data by calculating frequencies and percentages for various categorical variables. This approach involved counting the number of occurrences (frequencies) of each response category and determining their relative proportions (percentages) within the dataset. The results were organized into frequency distribution tables, which provided a clear overview of the distribution of responses across different categories. This method

facilitated an understanding of the data's composition without inferring relationships or causality between variables.

Chi-square

Chi-square was also used to determine the Effect of education level on awareness of Pupwe Conservation practices. Chi-square test was employed to assess whether there is a statistically significant association between individuals' education levels and their awareness of Pupwe's nutritional benefits. The Chi-square test statistic is given by:

$$\chi^2 = \sum \frac{(O-E)^2}{E} \dots \dots \dots (3.2)$$

A significance level of **0.05** was used to determine whether the observed associations were statistically significant (Agresti, 2006).

For categorical variables such as education level and awareness of Pupwe conservation, the Chi-square test of independence was applied. The expected cell frequencies were checked and found adequate, ensuring that the results of the Chi-square tests were valid and reliable.

1.8 .4 Qualitative Data Analysis for Objective 1,2 and 3

Recorded data was transcribed and then analyzed using NVIVO version 14 to generate themes, a Computer-Assisted Qualitative Data Analysis Software (CAQDAS) designed to facilitate the organization and interpretation of non-numerical data. The process followed a systematic approach to ensure the credibility and depth of the findings.

Initially, all recorded interviews and focus group discussions were transcribed verbatim to capture the participants' exact words. These transcripts were then imported into NVivo 14, where they were organized into relevant folders for efficient management and retrieval. The researchers thoroughly read through each transcript to become

intimately familiar with the content. This step involved noting initial impressions and identifying significant statements related to the research objectives.

Ethical Consideration and Dissemination of Results.

The ethical approval was sought from Mzuzu University Research Ethics Committee (MZUNIREC). Permission from the respected authorities of the study sites was sought from the forestry department and Traditional Leaders (TAs and GVH). The researcher ensured that consent is obtained from study participants. In research, consent must be given freely. Voluntary consent was obtained upon full explanation of what will be involved in the research

Participants' agreement to participate in this study was obtained only after a thorough explanation of the research process. On the same note, as regards voluntary participation, informed consent, and harmlessness, the researcher explained to study participants that their participation in the study was voluntary and that they had the freedom to withdraw from the study at any time without any unfavorable consequences, and that they would not be harmed as a result of their participation or non-participation in the study.

The anonymity and confidentiality of the participants was preserved by not revealing their names and identities in the data collection, analysis, and reporting of the study findings. Privacy and confidentiality of the interview environment was managed carefully during interview sessions, data analysis, and dissemination of the findings. The results will be disseminated through publications in reputable journals, in addition to dissemination through conference presentations to foster discussions and gain valuable feedback.

Chapter Conclusion

This chapter has presented the methodology used to investigate the potential of Pupwe (*Zanthoxylum chalybeum*) in Chitipa District. It began with an overview of the study area and described the research design, sampling methods, and data collection tools used to gather both qualitative and quantitative data. The chapter also outlined the approaches taken for data analysis and addressed ethical considerations and study limitations. The methods were carefully selected to align with the study's specific objectives on traditional use, value addition opportunities, and conservation practices. The next chapter presents the results derived from the field data.

CHAPTER FOUR: RESULTS

Chapter Introduction

Chapter 4 presents the empirical findings of the study in relation to the three specific research objectives. The chapter begins by analyzing the traditional uses of Pupwe (*Zanthoxylum chalybeum*) within the communities of Chitipa District, drawing on both quantitative survey data and qualitative insights from focus group discussions and key informant interviews. It then explores opportunities for value addition and innovations in the Pupwe value chain, highlighting current practices, processing methods, and market development strategies. Finally, the chapter examines existing conservation practices and community efforts to ensure the sustainable use of Pupwe. The findings are discussed in relation to the conceptual and theoretical frameworks outlined in Chapter 2, providing a foundation for the interpretation and discussion of results in the next chapter.

4.1 Socio-demographic Profile of the Respondents in T.A Mwabulambya and Nthalire in Chitipa District

Based on the data collected from 306 respondents, 58.3% were female, while 41.7% were male. The majority of respondents (63.07%) identified farming as their primary occupation. In terms of education levels, 44.0% had attained secondary education, followed by 42.7% with primary education. The respondents ages ranged from a minimum of 18 years to a maximum of 84 years.

4.2 Traditional Use of Pupwe In T.A Mwabulambya and Nthalire In Chitipa District

4.2.1 Community Perspectives on Pupwe: Awareness, Availability, Accessibility and Utilization of Pupwe in T.A Mwabulambya and Nthalire.

The findings in Table 2 indicate a high level of awareness of Pupwe, with 99% of respondents stating they are familiar with Pupwe. Availability is also notable, as 89.5% reported that Pupwe

is present in their communities, small percentage of 1.3% stated it is not available. In terms of accessibility, 79.8% of respondents indicated that Pupwe is easily accessible, while 9.8% found it difficult to access, 90.8% of respondents reported having used Pupwe before, whereas 8.2% had never used it.

Table 3:Community Perspectives on Pupwe: Awareness, Availability, Accessibility and Utilization of Pupwe in T.A Mwabulambya and Nthalire

Variables	Description of the variable	Percent
Awareness	Yes	99
	No	1
Availability	Yes	89.5
	No	1.3
	Not commonly found	6.5
	Not sure	1.6
Accessibility	Easily accessible	79.8
	Not easily accessible	9.8
Ever used Pupwe	Yes	90.8
	No	8.2

4.2.2 Traditional Knowledge and use of Pupwe in T.A Mwabulambya and Nthalire

Respondents reported multiple uses of Pupwe, with the majority indicating its role in food and medicine. Culinary use was the most common (54.7%), followed by medicinal use at 42.1%. Ritual use was the least common, with 3.2% of responses. Insights from FDG also stated that:

Pupwe is a favourite feed for livestock, especially goats. During the dry season when other forage is scarce, it becomes very useful” (FGD001)

Table 4: Traditional Knowledge Use of Pupwe in T.A Mwabulambya and Nthalire

Use	Percentage
Culinary	54.7
Medicinal	42.1
Rituals	3.2

4.2.2.1 Culinary use of Pupwe in T.A Mwabulambya and Nthalire

The findings in Table 4 indicate that Pupwe is primarily used as a relish (okra-based dish) by the majority of respondents (75.5%). A smaller proportion (16.1%) utilize it as a flavoring agent, while 8.4% incorporate it as tea leaves. Insight from Focus Group Discussions stated that:

“As I said earlier on, we mostly use Pupwe as okra. It has this nice aroma and flavor, so some people even use the powder as tea leaves. Others just add it to beans to give them a better taste.” (FGD001)”.

Table 5: Culinary Use of Pupwe in T.A Mwabulambya and Nthalire

Incorporation of Pupwe in meals	percentage
Relish (okra)	75.5
Flavoring agent	16.1
Pupwe leaves herbal drink	8.4



Plate 2: Cherished local pairing of Pupwe and beans

4.2.2.2 Awareness of Pupwe’s nutritional Content Among Communities in T.A Mwabulambya and Nthalire

The findings in Table 7 revealed that a significant proportion of respondents (64.7%) are not aware of Pupwe’s nutritional value, while only 35.3% have knowledge of its benefits. Participants from FGD expressed doubts about the nutritional value of Pupwe stating that:

“Eh, you know, when we prepare Pupwe, we often add bicarbonate soda. It’s a common practice. But many believe that adding soda, especially to okra like Pupwe, reduces its nutritional value. So, that’s why some people doubt how healthy it really is.” (FGD002)

Insights from a Chemistry Scientist also confirmed that:

“I haven’t tested Pupwe specifically, so I can’t say for sure if it’s acidic. However, many vegetables like okra contain natural acids. When baking soda, which is a base, is added during cooking, it can neutralize acids and potentially cause the breakdown of some nutrients especially delicate vitamins like vitamin C. This is a general chemical principle, but without specific tests on Pupwe, we can only assume similar effects might occur.” (KII003)

Table 6: Awareness of Pupwe's Nutritional Components Among Communities in T.A Mwabulambya and Nthalire

Awareness	Percent
No	64.7
Yes	35.3

4.2.2.3 Respondents' Knowledge on Nutritional Components in Pupwe in T.A Mwabulambya and Nthalire

The results in Table 8 indicate that respondents associate Pupwe with various nutrients, with vitamins being the most commonly recognized (45.0%). Minerals, including calcium, iron and potassium, were acknowledged by 27.3% of the respondents. Carbohydrates were the least mentioned, with only 3.0% of respondents identifying them as a component of Pupwe.

Table 7: Respondents' Knowledge on Nutritional Components in Pupwe T.A Mwabulambya and Nthalire

Nutrients	Percent
Vitamins	45.0
Carbohydrates	3.0
Minerals (calcium, iron, potassium)	27.3
Fiber	7.8
Proteins	16.9

4.2.2.4 Effect of education level on knowledge of Pupwe's nutritional Components in T.A Mwabulambya and Nthalire

The results in Table 9 reveal a significant association between education level and awareness of Pupwe's nutritional value. Among respondents with no formal education and only primary

education, only 29 were aware of its nutritional Components, whereas 77 of those with secondary or tertiary education knew its nutritional value. A Chi-square test ($\chi^2 = 31.959$, $df = 1$, $p < 0.001$) confirms that this relationship is statistically significant, indicating that education level plays a crucial role in shaping awareness of Pupwe's nutritional value. **Table 8: Effect of Education Level on knowledge of Pupwe Nutrients**

Education Level	Aware of Nutrients (N)	Not Aware of Nutrients (N)	χ^2	p-value
Never attended + Primary	29	117	31.96	$p < 0.001$
Secondary + Tertiary	77	79		

4.2.2.5 Perceived Health Conditions Treated with Pupwe in T.A Mwabulambya and Nthalire

The findings in Table 5 indicate that Pupwe is used to treat a variety of health conditions, with cough being the most frequently reported at 47.9%, while ulcers (1.6%) and anemia (0.8%) were the least common conditions treated with Pupwe. Insights from a herbalist mentioned that:

Initially Pupwe is one of our main traditional medicines. We use it alone or sometimes mix it with other trees to treat many health problems except epilepsy or mental illnesses. We even use it to treat animals, especially when they have difficulties during birth,”

“I also use Pupwe in rituals. I mix it with Palibe Kanthu and another tree though I can't reveal its name to protect homes, people, football players, businesses, farms and livestock kraals from witchcraft and theft.” (KII00)

Table 9: Perceived health conditions treated by Pupwe in T.A Mwabulambya and Nthalire

Health condition	Percentage
Cough	47.9
Malaria	8.3
Healing Wounds	21.4
Ulcers	1.6
TB	18.5
Anemia	0.8

4.2.2.6 Frequency of Pupwe Use for Medicinal Purposes in T.A Mwabulambya and Nthalire.

The results in Figure 3 indicate that Pupwe is not used consistently but remains a valued part of community routines, particularly for occasional consumption. The majority of respondents (46.7%) reported using Pupwe sometimes, followed by 20.1% who said they use it rarely and only 10.9% reported using it always. Participants in a focus group discussion stated that:

“Uuh... these days we don’t really use Pupwe that much as medicine, because most people now prefer going to the hospital. But we still turn to it sometimes especially for treating coughs or as quick medicine in emergencies.”

Another one said

When it comes to eating, mmm... we cook it mainly when we miss the taste of Pupwe, just to satisfy that craving and Mmm... sometimes we just cook Pupwe when we’re in a hurry or when there’s no time to prepare a proper relish. It’s fast you just boil water, remove it from the fire, and stir in the Pupwe powder. Within few minutes, it’s ready. That’s why it’s our go-to when we need something quick.” (FGD005)

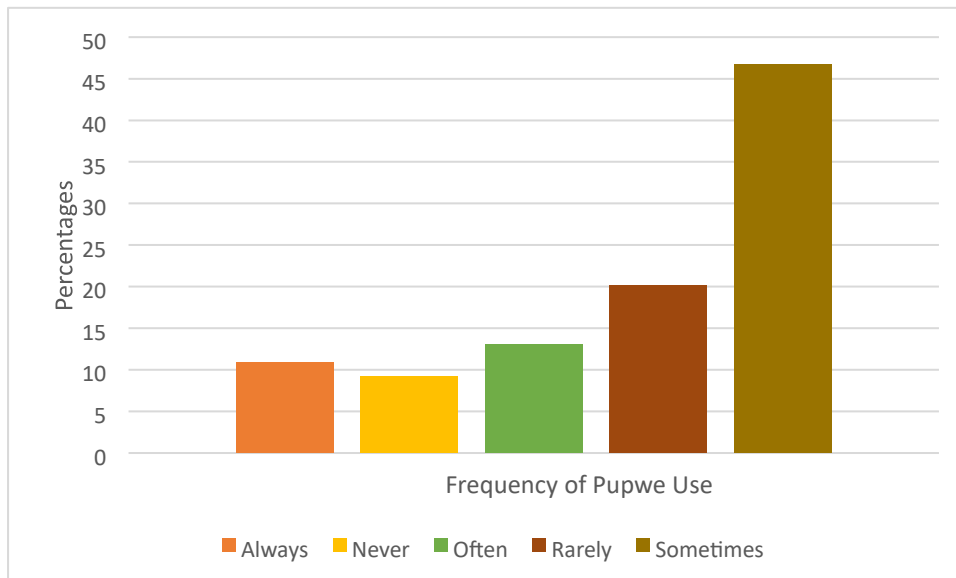


Figure 3: Frequency of Pupwe Use for Medicinal Purposes

4.2.2.7 Effect of Monthly Income Levels on the Frequency of Pupwe Use in T.A Mwabulambya and Nthalire.

The analysis showed that monthly income does not significantly influence how often people use Pupwe. Statistical results from a one-way ANOVA confirmed that there was no significant difference in the frequency of Pupwe use among low, medium and high-income groups, $F(2, 303) = 1.909$, $p = 0.151$. The mean frequency of Pupwe use for the low-income group was 2.00 ($SD = 1.24$), for the medium-income group was 2.51 ($SD = 1.49$), and for the high-income group was 2.18 ($SD = 1.37$). While the medium-income group reported slightly higher usage, the difference was not statistically significant ($p > 0.05$).

Table 10: Effect of Monthly Income Levels on the Frequency of Pupwe Use in T.A Mwabulambya and Nthaire

Income	Mean	St. Deviation	F	Sig
Low income	2.00	1.24	1.909	0.151
Medium income	2.51	1.49		
High income	2.18	1.37		

Tukey Post Hoc Test for Frequency of Pupwe Use by Monthly Income Level

To further examine potential differences among income groups, post hoc comparisons were conducted using Tukey's HSD test. The results indicated that there were no statistically significant differences in the frequency of Pupwe use between the income groups.

Specifically, the difference between low- and medium-income groups was not significant ($p = .15$), nor were the differences between low- and high-income groups ($p = .78$) or medium- and high-income groups ($p = .42$). These findings confirm that monthly income level does not significantly influence Pupwe use.

Table 11: Tukey Post Hoc Test for Frequency of Pupwe Use by Monthly Income Level

Income Group	Income Group	Mean Difference	Std. Error	Sig.
Low income	Medium income	-0.51	0.25	0.15
Low income	High income	-0.18	0.28	0.28
Medium income	High income	0.33	0.26	0.26

4.2.2.8 Methods of Accessing Pupwe in T.A Mwabulambya and Nthaire

The results in Table 10 show that harvesting is the most common method of obtaining Pupwe, with 42.3% of respondents collecting it themselves. Buying is also a significant source,

accounting for 29.9% of respondents, while 11.9% acquire it through exchange (bartering).

Table 12: Methods of Accessing Pupwe in T.A Mwabulambya and Nthalire

Obtaining	Percentage
Buying	29.9
Harvesting	42.3
Exchanging	11.9
Sharing	15.9

4.3 Potential for Value Addition at Each Stage of Value Chain and Innovations for Market Development of Pupwe (*Zanthoxylum Chalybeum*)

4.3.1 Traditional Value-added products of Pupwe in T.A Mwabulambya and Nthalire

The Results in Table 11 indicates that value addition of Pupwe is traditionally manual processing, where Pupwe is pounded using a mortar and pestle. The most common product is Pupwe culinary powder, making up 66.7%, followed by Pupwe herbals powder at 25.9%, primarily for medicinal purposes. Animal feed additives account for 7.1%, indicating a smaller but notable use in agriculture.

Table 13: Traditional Value-added products of Pupwe in T.A Mwabulambya and Nthalire

Value added products	Percent
Pupwe herbals powder	25.90
Animal feed additives	7.10
Pupwe leaves powder	66.7



Plate 3: Traditionally made Pupwe leaves powder.

4.3.2 Commercial Engagement and Market Participation for Pupwe in T.A Mwabulambya and Nthalire

The results in Table 12 indicate a low level of commercial engagement with Pupwe within the community. 95.0% of respondents reported that they do not sell Pupwe, they harvest it for personal consumption. On the other hand, 5.0% of respondents engage in selling Pupwe products, which includes both culinary and medicinal. Since Pupwe is locally available in the community participants from a focus group discussion expressed that:

“Mmm... we feel like there’s really little opportunity for buying or selling Pupwe among ourselves. Most of us just harvest it for home use. Selling Pupwe is seen as something done by people who have nothing else to do. We prefer farming in our gardens rather than selling Pupwe”. (FGD005)

Table 14: Market Participation for Pupwe in T.A Mwabulambya and Nthalire

Sell of Pupwe	Percent
No	95.0
Yes	5.0

4.3.3 Value Chain Analysis of Pupwe

In the context of the value chain for Pupwe, the findings reveal that commercial harvesting is primarily driven by two distinct groups, culinary harvesters (mostly women) and medicinal harvesters (typically herbalists). These two groups both contribute to the commercial distribution of Pupwe, but their approaches differ based on the intended use of the plant.

Culinary harvesters, predominantly women in the community, focus on harvesting Pupwe leaves for food-related purposes. These harvesters engage in a processing cycle that includes drying, pounding and sieving the Pupwe to make it suitable for culinary use. Once processed, they sell directly to consumers or through small traders who then distribute the product to end consumers. Consumers typically purchase this processed Pupwe to use as a relish (okra) or flavoring agent in cooking.

Medicinal harvesters, primarily herbalists, gather Pupwe for its medicinal properties. The processing methods they use are relatively simple, typically involving drying and pounding, with some herbalists opting to sell the plant unprocessed. These harvesters sell their product either directly to consumers or through small traders, who in turn distribute it to the final consumers.

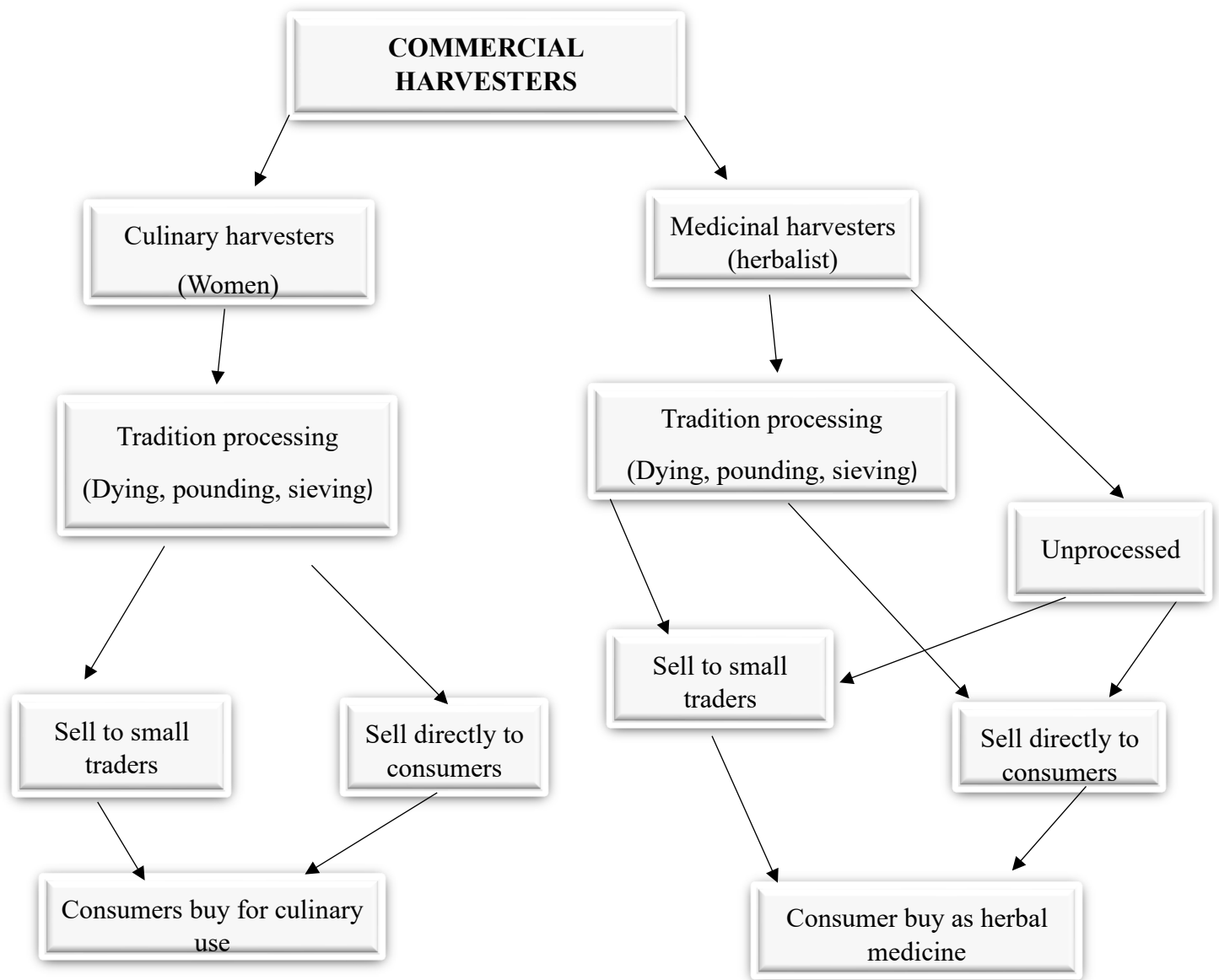


Figure 4: Value Chain Map of Pupwe Culinary Powder and Ailments products



Plate 4: Traditional processing of Pupwe leaves powder

4.3.4 Gross margin analysis for Pupwe culinary powder

The average gross margin analysis for Pupwe sales in Table 13 highlights the profitability of the product, with a 1kg sale generating an average cost of USD 0.45 and Average gross margin of USD 2.13, For 5 kg, the average cost increases to USD 0.96, while the average gross margin rises to 8.57. One of the woman sellers mentioned that:

First Seller:

"Pupwe is a profitable business for me, with minimal investment. The labor cost to produce one liter bottle is only USD 0.57, and I sell it for USD 2.31. I primarily sell it at trading centers, especially in drinking spots, where it is popular among drinkers who find it smooth and easy to swallow when intoxicated. Additionally, I have regular customers with health conditions like high blood pressure and diabetes, who say that Pupwe helps them manage their health." (KII-PUP-S001)

Second Seller:

..... as for me I mostly sell on special market days, orders for Pupwe come from people who come to sell their goods at our market from Karonga, Mzuzu, Nakonde (Zambia) and Isongole (Tanzania), who buy in bulk, usually in 5 Kgs at USD 9.23. Locally we use mobile business,

walking around trading centers selling a tablespoon at 0.12 USD . We actively search for customers to ensure the Pupwe sells quickly and it doesn't lose its aroma due to a lack of proper packaging. (KII-PUP-S002)

Table 15:Gross Margin Analysis for Pupwe Culinary Powder

Quantity (kg)	Average cost (USD)	Average gross margin (USD)
1-Kg sales	0.45	2.13
5- kg sales	0.96	8.57



Plate 5: 1 kg package of pupwe powder and a tablespoon and 5kg package respectively.

4.3.5 Gross Margin Analysis for Pupwe Herbals

The average gross margin analysis in Table 14 for herbalist sales of Pupwe reveals significant profitability. For the treatment of T.B., the average cost is USD 1.01, with average gross margin of USD 12.1, indicating a high return. In the case of body pains, the average cost is USD 0.61, and the average gross margin is USD 7.07. For woman delivery, the cost is USD 0.66, leading to a gross margin of USD 9.95. Insights from herbalists also stated that:

LocalHerbalist1:

“You know, the price of Pupwe herbal medicine mostly depends on how serious the illness is not really the cost of the ingredients. If someone comes with a more critical condition, then of course the price goes up. That’s how we work. Mmm... this is actually how I survive. Many people come to me for help, and most of them are referrals from those I’ve treated before and who got better.”(KII-PUP-H001)

LocalHerbalist2:

“You see, some of my customers actually come all the way from Mzuzu and Karonga just to buy my herbal medicine in bulk. They resell it in their areas. And the fact that they keep coming back for more it really shows that what I give them works. Mmm... even with this demand, my production costs are still low, so yes, this business is quite profitable for me.”(KII-PUP-H002)

Table 16:Gross Margin Analysis for Ailments Associated with Pupwe products

Disease	Average cost (USD)	Average gross margin (USD)
Persistent cough	0.98	3.82
Deep wounds	0.69	3.97
T.B	1.01	12.1
Body Pains	0.61	7.07
Woman delivery	0.66	9.95
B.P	0.92	17.74

4.3.6 Economic Value of Pupwe Ritual Practices

The findings indicate that Pupwe is not only valued for its medicinal properties but also plays a crucial role in ritualistic protection. Herbalists use Pupwe roots, along with other plants like Palibe Kanthu and other sacred trees, to perform rituals that safeguard homes, businesses, farms, and livestock from theft and witchcraft. These services are considered more expensive than medicinal treatments, with prices ranging from USD 230.82 to USD 461.64, depending on the type of protection needed. One of the herbalists stated that

"You know, when I perform these rituals, at night witches see the house like a big lake so they can't come near or harm the people inside. And for businesses, mmm... it attracts more customers and brings in good luck. Even in farms or livestock kraals, if someone tries to steal, they get stuck right there, like frozen, until they're caught. That's the power of the ritual."(KII-PUP-H003)

4.3.7 Demand of Pupwe products in T.A Mwabulambya and Nthalire

The demand for Pupwe in the community varies across different levels. A significant portion of the respondents indicated a very high demand, accounting for 30.7%, followed closely by those reporting high demand at 33%. On the other hand, moderate demand was reported by 19.1%, and low demand was indicated by 17.2%. Insights from a focus group discussion stated that:

.....as for me I often see women selling Pupwe returning from the markets with empty buckets, which indicates that there is a demand for the product. Additionally, people from other areas have started asking for it, further highlighting the growing interest."

Table 17: Demand of Pupwe Products in T.A Mwabulambya and Nthalire

Demand	Percent
High	33
Low	17.2
Moderate	19.1
Very high	30.7

4.3.8 Innovation Opportunities in Pupwe Value Chain

Results in Table 16 indicates that the most frequently mentioned area was processing machines, with 19.6% identifying it as a key innovation opportunity. Other notable areas include marketing strategies at 13.1%, followed by drying machines and packaging, each accounting for 13.0%. Branding was seen as a potential innovation by 10.9%. Insights from focus group discussions also stated that:

"Uuh... harvesting Pupwe is not easy, you know. The tree has a lot of thorns, so it's hard to get enough without scratching yourself. We mostly use hand-picking knives or stick to help bring the leaves down. But the real challenge comes during processing. Mmm... pounding it is so tiring we still use mortar and pestle. Honestly, if we had proper machines, it would really help us with both quality and speed. And then there's the issue of packaging. Right now, we just use sugar or fertilizer plastic bags, tie them tight to keep the smell and taste. Because, if you store it in buckets, eeh... the aroma and flavor go away fast." (KII-PUP-P002)

..... You see, harvesting Pupwe is not for everyone. The thorns alone can discourage you. Sometimes we even get injured just trying to collect enough leaves. For processing, we have no machines it's all manual. We pound it using a mortar and pestle, and it takes a lot of time and

energy, especially when doing large quantities. And packaging? Hmm... that's another problem. We just reuse fertilizer or sugar bags because they're the only ones that can hold the aroma longer (KII-PUP-P003)

Table 18: Innovation Opportunities in Pupwe Value Chain

Potential innovations	Percent
Product diversification	15.2
Harvesting machines	15.3
Drying machines	13.0
Packaging	13.0
processing machines	19.6
Branding	10.9
Marketing strategies	13.1



Plate 6: Value-added Pupwe leaves powder relish in Zambia.

4.3.9 Market size of Pupwe Products in T.A Mwabulambya and Nthalire.

Results in Table 17 shows that market size for Pupwe products is largely concentrated in the local market, with 66.2% indicating that the product is primarily sold within the local area. A

significant portion of respondents also identified regional markets as a key avenue for sales, with 19.3% recognizing regional demand. National and international markets accounted for 8.4% and 6.0% respectively.

Table 19: Market Size of Pupwe Products in T.A Mwabulambya and Nthalire

Market size	Percent
local	66.2
Region	19.3
National	8.4
International	6.0

4.4 Conservation Practices of Pupwe in the Communities of T.A Mwabulambya and Nthalire

4.4.1 Awareness of Pupwe's conservation practices in T.A Mwabulambya and Nthalire.

The results in Table 18 indicate that awareness of Pupwe's conservation practices is low, with 53.8% of reporting no awareness of these practices. Only 46.2% are aware of conservation efforts for Pupwe. Insights from the district forestry officer and community member mentioned that:

"Honestly, there are no specific conservation methods for Pupwe. What we usually do is generallike stopping people from cutting down trees, avoiding bush fires, or encouraging tree planting. But when it comes to Pupwe itself, we don't really know how to grow it. We don't even know where to get the seeds or how to preserve them for planting in the future." (KII-PUP-C001)

Community member"When it comes to Pupwe trees, we don't really have any special ways to protect them. People just try not to cut down too many trees, avoid setting bushfires, and plant more trees generally. But honestly, no one seems to know how to grow Pupwe from seeds or

take care of it properly for the future. It's like we're just hoping it will keep coming back on its own." (KII-PUP-C004)

Table 20: Awareness of Pupwe's Conservation Measures in T.A Mwabulambya and Nthalire

Awareness	percentage
Yes	46.2
No	53.8

4.4.2 Effect of education level on awareness of conservation practices Among Communities in T.A Mwabulambya and Nthalire

The results in Table 19 show a significant association between education level and awareness of conservation practices. Individuals with higher education levels (secondary and tertiary) were more likely to be aware of conservation practices compared to those with no formal education or only primary education. A Chi-square test of independence confirmed that this relationship was statistically significant, $\chi^2(1, N = 302) = 5.00, p = 0.025$. This shows a moderate association between education level and awareness of Pupwe conservation practices among the communities in T.A. Mwabulambya and Nthalire.

Table 21: Effect of Education on Awareness of Pupwe Conservation Methods Among Communities in T.A Mwabulambya and Nthalire

Awareness	Never Attended + Primary	Secondary + Tertiary	χ^2	p-value
Aware	58	82	5.00	0.025
Not aware	88	74		

4.4.3 Parts of Pupwe Tree Used for Medicinal Purposes in T.A Mwabulambya and Nthalire.

The results in Table 20 indicates that roots are the most frequently utilized part of trees for medicinal purposes, accounting for 43.3% of usage. This is followed by leaves at 23.0%, bark at 19.6%, and stems at 14.0%. A herbalist shared that:

“You know, when we harvest the Pupwe roots, we don’t fill the holes afterward. It’s a tradition I believe that if you fill the holes, it’s like burying the sickness in the ground, and then the healing won’t happen properly.” (KII-PUP-H001)

Table 22:Parts of Pupwe Tree Used for Medicine T.A Mwabulambya and Nthalire

Parts	Percentage
Roots	43.3
Bark	19.6
Leaves	23.0
Stem	14.0

4.4.4 Harvesting Methods of Pupwe in T.A Mwabulambya and Nthalire

The results in Table 21 indicates that the most common harvesting method is handpicking leaves, accounting for 35.5% of the responses. Harvesting bark with panga knives represents

14.2% of the responses, while using sticks to harvest leaves is the least common method, comprising 3.6% of the responses.

Table 23:Harvesting Methods of Pupwe in T.A Mwabulambya and Nthalire

Harvesting method	percent
Leaves using handpicking	35.5
Barks using panga knives	14.2
Roots using hoes	19.9
Leaves using knives	26.8
Leaves using stick	3.6

4.4.5 Measures Taken to Ensure Sustainability of Pupwe in T.A Mwabulambya and Nthalire

The study revealed that 27.3% of respondents limit their harvesting activities, while 14.8% rotate harvesting areas to allow natural regeneration, 28.5% reported no specific measures in place and 24.1% are uncertain about any sustainability practices. Additionally, 5.2% adhere to a practice of not cutting down Pupwe trees. During a focus group discussion, participants stated that;

“Yeah, We are interested in planting Pupwe near our homes, but honestly, we’ve never seen the seeds. Usually, the plant just grows on ant hills. It’s very resilient even if it’s burned when we are clearing our gardens, it can still sprout again. We are lucky because that shows how strong and persistent Pupwe is, able to survive tough conditions.” FGD003

Table 24: Measures Taken to Ensure Sustainability of Pupwe in T.A Mwabulambya and Nthalire

Measurers	Percent
Rotate harvesting areas to allow natural regeneration	14.8
Harvesting is limited	27.3
No any specific measures	28.5
Not sure	24.1
Minimize Cutting of Pupwe tress	5.2



Plate 7: Pupwe Tree Sprouts after being Burned

4.4.6 Community led initiatives for Pupwe conservation in T.A Mwabulambya and Nthalire

The study indicates that 77.1% of respondents reports that they are no community-led initiatives for Pupwe conservation. In contrast, 12.2% are reported that they are communityled projects

initiatives for Pupwe conservation and 10.7% participate in occasional awareness programs. Focus group discussion in communities stated that:

“Honestly, we don’t have any formal groups or programs in the community specifically aimed at protecting Pupwe or the forests. But maybe that’s a good thing in a way because most of us don’t get involved in destructive activities like charcoal making or tobacco farming, so the trees get some protection naturally. We all rely on these trees for our livelihoods and traditional medicine, so there’s an unspoken respect for them. On top of that, the government has been helping by employing forest guards who regularly patrol the area to stop illegal cutting and protect our natural resources. Still, I feel like if we had more organized community efforts, it could make a real difference in conserving Pupwe and other important plants.” FGD005.

Table 25:Community Led Initiatives for Pupwe Conservation in T.A Mwabulambya and Nthalire

Initiatives	Percent
community -led projects	12.2
Occasional awareness	10.7
Currently there no community initiatives	77.1

4.5 Chapter Conclusion

This chapter has presented the results of the study in relation to the research objectives. It began by outlining the traditional uses of Pupwe (*Zanthoxylum chalybeum*) in Chitipa District, highlighting its role in culinary and medicinal practices. The chapter then explored the value addition and market development opportunities, identifying potential areas such as processing technologies, product diversification, and improved marketing. It also examined current conservation practices, revealing limited community-led efforts and low awareness of sustainable harvesting.

The findings demonstrate that Pupwe is a valuable but underutilized resource with significant potential to contribute to nutrition, income generation, and environmental sustainability. However, challenges such as limited commercialization and weak conservation efforts need to be addressed. These results provide a strong foundation for the next chapter, which will interpret the findings using theoretical and conceptual frameworks, and present a discussion of their implications for community development and policy.

CHAPTER FIVE: DISCUSSION

Chapter Introduction

Chapter 5 presents a critical interpretation of the empirical findings outlined in Chapter 4, drawing on the theoretical and conceptual frameworks introduced in Chapter 2, as well as insights from relevant literature reviewed in Chapter 2. This chapter engages in a reflective analysis of how the results align with, extend or contrast existing knowledge on the traditional use, value addition potential, and conservation of Pupwe (*Zanthoxylum chalybeum*) in Chitipa District, Malawi. The discussion is organized around the study's specific objectives

The chapter highlights key patterns in community knowledge, utilization practices, economic engagement and environmental concerns, interpreting them through both local context and broader African experiences. Connecting the study's findings with theoretical insights and empirical evidence from other countries, this chapter identifies practical implications for community development, health and environmental sustainability, while also pointing out critical gaps and opportunities for future research and policy action.

5.1 Traditional Use of Pupwe in the Communities of Chitipa District

5.1.1 Community Awareness, Availability, Accessibility and Utilization of Pupwe The findings reveal that Pupwe is widely recognized, with 99% of respondents familiar with it, this implies a strong traditional significance in the community. The high availability rate (89.5%) aligns with a study by Mbinile et al. (2020b), which found that *Zanthoxylum chalybeum* is widely distributed in Southern Africa, including Malawi.

Despite this, 90.8% of respondents report using Pupwe, underscoring its continued importance in local livelihoods. However, the slight difficulty in accessing it, as reported by 9.8% of respondents, implies that the resource may already be under pressure from overharvesting.

5.1.2 Traditional Uses of Pupwe

5.1.2.1 Culinary Use

The culinary use of Pupwe, particularly as a relish, underscores its cultural significance within local diets. This implies that the plant is not only valued for tradition but also holds potential for promoting food diversification and enhancing nutritional security. Leveraging this cultural acceptance could inform interventions aimed at integrating Pupwe into broader dietary programs, nutrition education and local food systems. This aligns with findings by Gladys (2023), who documented the use of *Zanthoxylum chalybeum* leaves in food preparation in Kenya. Additionally, its role as a flavoring agent (16.1%) and tea ingredient (8.4%) corresponds with Mbinile et al. (2020a), who noted the plant's aromatic properties in tea preparation. This traditional knowledge and utilization suggest opportunities for promoting Pupwe as a sustainable food resource, potentially contributing to dietary diversity and food security.

5.1.2.2 Awareness and Nutritional Knowledge

Despite widespread usage, only 35.3% of respondents were aware of Pupwe's nutritional value. This knowledge gap implies that while the plant is consumed traditionally, its nutritional and health benefits are poorly documented or disseminated. Previous studies, such as Balama (2015), have documented the rich nutritional profile of *Zanthoxylum chalybeum*, including vitamins, proteins minerals and fiber. Interestingly, the data showed a significant association between education level and awareness ($p < 0.001$), suggesting that formal education plays a role in knowledge dissemination. However, it's important to note that even among educated individuals, awareness of Pupwe's nutritional properties may be limited.

This discrepancy could be attributed to the lack of integration of indigenous plant knowledge into formal education curricula. This result is in line with findings by Bussmann et al. (2015), who found that higher education levels in Peru were more likely to be aware of the nutritional values.

5.1.2.3 Medicinal use

The patterns of medicinal use implies that traditional knowledge regarding Pupwe is selective, with well-established applications for conditions such as cough and tuberculosis, while its use for ailments like anaemia and ulcers remains minimal. This implies that awareness of its broader healing potential is limited or that communities may prefer alternative remedies for certain illnesses. Strengthening awareness and documentation of its medicinal value could therefore promote more comprehensive utilization of the plant.

Previous studies in Tanzania revealed a wide range of Pupwe applications, including treatment of women's health complications, fever, pneumonia, malaria, cancer, and skin diseases (Mbinile et al.2020). Similarly, in Kenya, overexploitation of the species has been reported due to its medicinal demand (Mguni et al.2023). These findings affirm the high medicinal importance of Pupwe across regions, although most of these studies relied on ethnobotanical surveys and self-reported data without extensive pharmacological validation, limiting their generalizability.

Scientific studies further substantiate the plant's pharmacological potential, identifying alkaloids such as tembetarine, nitidine, and skimmianine with anti-malarial properties, and chelerythrine and nitidine with anti-inflammatory effects (Masumbu et al. 2023). These bioactive compounds support its traditional use in treating respiratory infections and inflammation-related illnesses. However, most pharmacological studies were conducted under laboratory conditions, and their practical application in rural communities remains underexplored.

Only 3.2% of respondents reported using Pupwe for rituals, implying a decline in its spiritual or ceremonial significance likely due to cultural shifts and reduced reliance on traditional belief systems. While the plant's medicinal use aligns with the Indigenous Knowledge Systems (IKS)

perspective, the findings emphasize the need for collaboration between traditional healers and scientific researchers to validate and expand the therapeutic applications of Pupwe for both local and broader health benefit

5.1.3 Frequency of Use and Monthly Income Use

The majority (46.7%) of respondents reported using Pupwe occasionally, while only 10.9% used it always. This intermittent usage pattern implies that although Pupwe remains relevant, it is not considered a daily necessity. This finding is consistent with studies such as Bussmann et al. (2015) in Peru and Cunningham (2001) in southern Africa, which revealed that many wild plants are used occasionally rather than daily, with cultural habits and seasonal availability influencing their consumption more than daily needs.

The ANOVA results ($p = 0.151$) implies that income does not significantly influence Pupwe usage, suggesting that factors such as cultural traditions, taste preferences, and availability play a more dominant role than economic status. This aligns with Cunningham (2001), who noted that the use of wild plants is largely shaped by cultural values and community practices rather than household income levels.

However, the occasional use and lack of strong economic influence on Pupwe consumption may also reflect the broader perception of neglected and underutilized species (NUS) as “poor man’s food.” Such perceptions, as highlighted by Padulosi (2013), undermine the economic and nutritional importance of these species and contribute to their marginalization in research, policy and markets. This stigma discourages regular consumption and limits investment in their value addition and commercialization, despite their potential to enhance food security and promote sustainable livelihoods.

5.1.4 Methods of obtaining Pupwe

The reliance on wild harvesting indicates that Pupwe remains largely a non-commercialized resource. However, the substantial proportion of buyers reflects an emerging market demand, signalling opportunities for value addition and structured commercialization. Furthermore, the continued use of exchange and sharing underscores the social and communal significance of Pupwe, highlighting the need for commercialization strategies that respect traditional practices while enhancing economic benefits, the findings are in consistent with Cunningham (2001) and Dovie et al. (2007), who highlighted that wild plants in southern Africa are often sourced through harvesting and sharing within communities, while not fully commercialized.

Reflecting on these findings, it becomes evident that while Pupwe retains its traditional significance, there is a growing shift towards market-oriented practices. This transition presents both opportunities and challenges. Commercialization can enhance livelihoods and promote the broader use of Pupwe. On the other hand, increased demand may lead to overharvesting, threatening the sustainability of the resource.

5.1.5 Engagement with the theory of Indigenous Knowledge Systems (IKS)

The widespread awareness and utilization of *Pupwe* within Chitipa communities reflect key principles of Indigenous Knowledge Systems (IKS), which view traditional knowledge as a living system rooted in community experience, cultural values and local ecology. The high recognition of *Pupwe* (99%) and its diverse traditional applications in food, medicine, and cultural practices demonstrate how indigenous knowledge is created, preserved and transmitted across generations, guiding daily livelihoods and shaping people's relationship with their environment.

This aligns with Cajete (2001) and Chilisa (2012), who argue that indigenous knowledge is more than practical know how it embodies a holistic worldview that connects people, plants,

and wellbeing. Within this framework, *Pupwe* is not just a resource but a symbol of identity and community resilience, reflecting how indigenous knowledge informs traditional food systems, healthcare and social practices.

However, modernization and lifestyle changes pose risks to the continuity of this knowledge, as younger generations may become less engaged in traditional practices. This underscores the need to document and validate IKS related to *Pupwe* to safeguard its cultural and practical significance. In this context, the IKS theory provides a useful lens for understanding how local communities perceive, value and apply *Pupwe* in their daily lives, highlighting the role of indigenous wisdom in sustaining traditional use patterns and promoting community wellbeing.

5.2 Potential for Value Addition at Each Stage Of Value Chain and Innovations for Market Development of *Pupwe* (*Zanthoxylum Chalybeum*)

5.2.1 Value-Added Products and Market Development

While community level value addition of *Pupwe* is evident, commercialization remains limited due to social perceptions that selling the plant is undignified. Such cultural attitudes discourage entrepreneurial engagement and hinder the development of formal market structures, ultimately constraining the economic potential of *Pupwe*. Addressing these social barriers through awareness campaigns, marketing strategies and community empowerment could promote broader participation in its commercialization and enhance its value in both local and regional markets. Similar trends have been observed in southern Africa (Cunningham 2001), where wild plants are mainly used for subsistence despite their economic potential. Nonetheless, rising demand of respondents indicates that commercialization opportunities exist. Proper market linkages, innovations value chain development could integrate *Pupwe* into formal markets and enhance its economic significance.

Reflecting on the findings that while value addition is occurring at a basic level, market development is being held back by both social attitudes and lack of structured market systems.

The persistence of cultural perceptions that associate the sale of Pupwe with a lack of dignity may deter individuals from engaging in its commercialization. Additionally, the absence of organized market structures and value chains limits opportunities for scaling up production and reaching broader markets

5.2.2 Value Chain Analysis and Market Profitability

The Pupwe value chain in Malawi remains largely informal and locally managed, with culinary harvesters (mostly women) and medicinal harvesters (mainly herbalists) driving harvesting and trade. Although processing methods like drying and pounding add value, the chain lacks innovation, structured marketing and technological support. Limited investment in storage, processing equipment and value addition constrains market reach and product quality. These gaps highlight the need for targeted interventions to strengthen the value chain, improve efficiency and expand economic opportunities for producers.

Gross margin analysis shows that culinary powder yields USD 2.13 per 1 kg and USD 8.57 per 5 kg, while medicinal applications generate USD 7.06–17.69 per treatment. This implies that despite low commercialization, value creation is economically feasible, which implies that strengthening the value chain could significantly increase profits. Regional and international demand from Tanzania, Zambia, Mzuzu and Karonga further supports the potential for market expansion.

This aligns with findings from Dovie et al. (2007), who reported that wild plants in southern Africa serve as both subsistence resources and highly profitable commodities in local and regional markets. The authors observed that while non-monetary exchanges such as sharing and bartering remain significant although the rising urban demand has increasingly enhanced the commercial viability of herbal medicines. This implies that Pupwe commercialization could follow a similar path, with medicinal and culinary applications expanding market opportunities.

Reflecting on the results that while Pupwe commercialization is currently limited, there is potential for market expansion. The existing profitability and regional demand indicate opportunities for value addition and broader market integration.

Innovation Systems Theory explains that the limited profitability and market expansion are partly due to weak stakeholder coordination. Harvesters, traders and herbalists operate in silos, and institutional support and market linkages are minimal. Addressing these systemic gaps could improve both efficiency and value capture within the Pupwe chain.

5.2.3 Demand and Innovation Opportunities

The high demand for Pupwe implies considerable market potential, indicating that consumers value its culinary and medicinal uses. However, realizing this potential requires addressing structural and technological barriers, including the labour-intensive nature of harvesting, limited mechanization and insufficient product diversification and packaging. Without targeted interventions to improve processing efficiency, develop new product lines, and enhance packaging, producers may struggle to scale up operations and meet growing demand. Addressing these constraints could expand market access, increase profitability and promote sustainable harvesting practices. Shackleton et al. (2015) similarly note that wild plant commercialization in Africa is constrained by technological limitations and inadequate branding. From a Value Chain perspective, these barriers reduce the efficiency of product transformation and limit market competitiveness. Innovation Systems Theory further emphasizes that adoption of improved techniques, packaging, or diversification requires collaborative efforts among producers, researchers, policymakers and entrepreneurs. Therefore, targeted interventions that introduce mechanization, diversify products and improve packaging and marketing strategies could unlock both local and regional market potential.

5.2.4 Market Size and Expansion Potential

The predominance of local markets for Pupwe, coupled with minimal penetration at regional, national, and international levels, implies that there is substantial untapped potential for market expansion. While current trade largely satisfies immediate community demand, strategic interventions such as improved processing, branding and establishment of market linkages could enable producers to access wider consumer bases. Expanding into regional and international markets may not only enhance the economic value of Pupwe but also incentivize sustainable harvesting and production practices, ultimately contributing to both livelihood improvement and the long-term conservation of this indigenous resource. The success of vendors in Iringa, Tanzania, who have exported *Z. chalybeum* products to Europe, the U.S., and the Middle East (Mbinile et al. 2020), indicates that Pupwe could achieve similar international recognition with proper marketing and regulatory support. While the findings indicate potential for market expansion, several factors warrant consideration. The limited presence in national and international markets may be attributed to challenges such as inadequate processing facilities, lack of standardized packaging and insufficient marketing strategies.

5.1.6 Engagement with the theories of Value Chain Theory and Innovation Systems Theory

The findings on value addition and market development of *Pupwe* align strongly with both Value Chain Theory and Innovation Systems Theory. According to Porter's Value Chain Theory, opportunities to enhance economic value exist at various stages of the product lifecycle from harvesting and processing to marketing and distribution. The presence of products such as culinary powder and herbal remedies demonstrates that value addition is already occurring at the community level, even though the methods remain basic. However, the low levels of commercialization and persistent challenges in processing, packaging and market integration highlight inefficiencies and missed opportunities within the value chain, as theorized by Porter.

This interpretation implies that strengthening these stages through improved organization, investment, and innovation could increase profitability and competitiveness.

In parallel, Innovation Systems Theory provides a broader understanding of why *Pupwe* remains underutilized despite its economic promise. The study revealed that while harvesters, traders and herbalists play distinct roles, interactions among key stakeholders such as policymakers, researchers, and entrepreneurs are weak. As the theory emphasizes, the generation and diffusion of innovations, including mechanized processing, product diversification, improved packaging and branding, depend on effective collaboration across these actors. The absence of such systemic coordination limits the adoption of new technologies and constrains market expansion.

Critically, the integration of these two theories explains both the current constraints and the pathways for improvement. Value Chain Theory highlights the internal inefficiencies within Harvesting and marketing processes, while Innovation Systems Theory reveals external systemic weaknesses that hinder technological and institutional progress. Together, they underscore the need for integrated interventions linking community knowledge with institutional support, market development, and technological innovations to strengthen the *Pupwe* value chain and expand both local and regional markets.

5.3 Conservation Practices of Pupwe in the Communities of Chitipa District

5.3.1 Awareness of Pupwe Conservation Practices

The results reveal that awareness of conservation practices for *Pupwe* is low, with 53.8% of respondents reporting no knowledge of conservation efforts. However, a significant relationship was observed between education level and awareness ($p = 0.025$), with individuals who attained secondary or tertiary education being more likely to be aware of conservation practices. This implies that education plays a crucial role in enhancing environmental

awareness and promoting sustainable harvesting practices, as more educated individuals are better able to understand and adopt conservation measures. These findings contrast with Msuya and Kideghesho (2020), who found that indigenous knowledge, rather than formal education, was more influential in medicinal plant conservation, especially among elders. This contrast may be attributed to the limited transfer of indigenous knowledge to younger generations and the decline of traditional conservation practices, which has made formal education a more dominant source of environmental awareness in the study area.

5.3.2 Parts of the Tree Used for Medicine

Heavy reliance on root extraction poses a significant threat to the survival of *Pupwe*, as it directly damages the plant and limits its natural regeneration. A critical factor exacerbating this threat is the traditional belief among herbalists that refilling the holes after root harvesting would “bury” the disease and prevent healing. Such cultural practices discourage sustainable harvesting methods and can contribute to the gradual depletion of the species over time. This not only reduces the availability of *Pupwe* for medicinal and other uses but also has long-term ecological implications, including loss of biodiversity and disruption of local ecosystems. These findings align with Mbinile et al. (2020), who observed that destructive harvesting techniques, combined with rising medicinal demand, contribute to species decline. Addressing this challenge requires integrating conservation education with cultural respect, ensuring that local beliefs are complemented not replaced by sustainable practices.

The combination of high demand for *Pupwe* roots and cultural beliefs that discourage sustainable methods poses a significant threat to the species' survival. Addressing these challenges requires integrating conservation education with respect for cultural practices to promote sustainable use of *Pupwe*.

5.3.3 Harvesting Methods

The study findings indicate that while some harvesting methods, such as handpicking leaves, are relatively sustainable, destructive techniques involving hoes and panga knives significantly damage the plants and reduce their capacity for natural regeneration. This implies that current harvesting practices, if unregulated, may threaten the long-term survival of *Pupwe* in the community. These results align with research conducted in the Simanjiro area of Northern Tanzania, which found that *Zanthoxylum chalybeum* is primarily harvested through digging and cutting of roots, as well as bark removal (Mduma et al. 2020). Such methods were observed to cause severe damage to the plant, leading to wilting, stagnant growth and in many cases plant mortality

5.3.4 Measures Taken to Ensure Sustainability

A significant proportion (28.5%) of respondents reported no specific sustainability measures. These findings imply that without targeted interventions such as training in sustainable harvesting, community-based management and technical support for propagation local conservation efforts for *Pupwe* will remain weak. During focus group discussions, participants expressed interest in cultivating *Pupwe* near their homes but noted that they had never seen its seeds, making propagation difficult. This finding aligns with Cowie (2007), who emphasized that sustainable improvement of livelihoods through indigenous vegetables requires proper management practices and on-farm cultivation strategies. However, literature indicates that *Pupwe* can regenerate both through its roots and by seed, though germination may be slow and irregular (Mbinile et al. 2020). This implies that what communities perceive as a lack of seeds may actually reflect limited knowledge of *Pupwe*'s reproductive ecology or seed dispersal mechanisms. Therefore, strengthening awareness of both regeneration methods and providing practical training on propagation could help bridge this gap enhancing sustainability while reducing dependence on wild populations

5.3.5 Community-Led Initiatives for Pupwe Conservation

The absence of formal community-led initiatives for *Pupwe* conservation, as reported by most respondents, implies a weak institutional framework for collective conservation action. Although focus group discussions revealed some indirect conservation practices such as avoiding deforestation through reduced charcoal production and tobacco farming these efforts remain passive and uncoordinated. This situation is inline with broader patterns in East Africa, where communities engage in informal conservation but lack structured initiatives to ensure long-term sustainability (Mwaura et al.2023). Similarly, the limited adoption of sustainability measures, such as rotational harvesting or controlled collection, further implies that without organized leadership and awareness programs, community conservation will remain fragmented.

The expressed desire by participants to cultivate *Pupwe* near their homes, coupled with their limited knowledge of seed availability, suggests both interest and constraint indicating an opportunity for targeted interventions. This aligns with Cowie (2007), who emphasized that improving livelihoods through indigenous plants requires deliberate cultivation and management strategies. Therefore, the findings imply that transforming passive conservation attitudes into structured community-led programs, supported by training in propagation and sustainable harvesting, is essential for ensuring the long-term survival and utilization of *Pupwe* in Chitipa District.

5.3.6 Engagement with the theories of Value Chain Theory and Innovation Systems Theory

The findings on *Pupwe* conservation in Chitipa District strongly align with the principles of Common Property Resource (CPR) Theory (Ostrom 1990), which highlights the role of local communities, institutions, and informal norms in sustainably managing shared natural resources. The low awareness of conservation practices and the absence of formal communityled initiatives indicate weak institutional frameworks for managing *Pupwe* as a

communal resource. Although some passive conservation occurs, such as avoiding deforestation for charcoal or tobacco farming, the lack of organized governance and enforcement mechanisms undermines sustainability.

CPR Theory posits that effective conservation requires clearly defined rules for access, harvesting, and regeneration, supported by active community participation. The prevalence of harmful harvesting methods (e.g., root digging and bark removal) and restrictive cultural beliefs such as not refilling holes after root extraction demonstrates the ecological risks when such rules and norms are absent. While community members express interest in cultivating Pupwe, limited access to seeds and propagation knowledge constrains sustainable management.

These findings imply that transitioning from passive to active conservation is critical. Integrating traditional knowledge, formal education and community-based governance structures can strengthen collective action, ensure equitable resource access, and enhance the long-term sustainability of Pupwe.

5.4 Chapter Conclusion

This chapter has provided an in-depth discussion of the study's findings in relation to the research objectives and existing literature. The results revealed that Pupwe (*Zanthoxylum chalybeum*) holds significant traditional, nutritional, and medicinal value within communities in Chitipa District, yet its potential remains largely underutilized. While community awareness of Pupwe is relatively high, scientific documentation and structured promotion of its uses are lacking.

The study also showed limited commercial engagement and minimal value addition practices, with most community members using Pupwe for subsistence purposes. However, there is clear potential for scaling up value-added products such as culinary and medicinal powders, which

could generate income and support local livelihoods. Moreover, conservation practices remain informal, with no structured systems in place to manage sustainable harvesting posing longterm risks to Pupwe availability.

Through the lens of the conceptual and theoretical frameworks established earlier, the findings reinforce the need for multi-sectoral efforts to promote Pupwe as a locally available solution to challenges related to health, nutrition, and poverty. This chapter lays the foundation for Chapter 6, which provides conclusions, policy recommendations, and areas for further research to ensure the sustainable utilization of Pupwe in Malawi.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

Chapter Introduction

This final chapter presents the overall conclusion of the study and offers practical recommendations based on the findings discussed in the previous chapters. It begins by summarizing the key insights drawn from the assessment of Pupwe (*Zanthoxylum chalybeum*) in Chitipa District, focusing on its traditional uses, value addition opportunities, and conservation practices. The chapter then outlines actionable recommendations aimed at policymakers, researchers, and community stakeholders to enhance the sustainable utilization of Pupwe for health, economic development, and environmental management. Lastly, the chapter identifies areas for further research to address remaining knowledge gaps and support evidence-based decision-making.

6.1 Conclusions

The study revealed that Pupwe is a highly valued plant within the communities of T.A Mwabulambya and Nthalire, with widespread awareness, accessibility and utilization. Pupwe is primarily used for culinary purposes, particularly as a relish, and for medicinal purposes, with treatments targeting conditions such as coughs, wounds, and tuberculosis. Its use in rituals, though less common, highlights its cultural significance. Frequency of use varies, with most respondents using Pupwe occasionally, and this usage is not significantly influenced by monthly income. While the majority of the community is aware of Pupwe's traditional uses, knowledge of its nutritional value is limited and significantly associated with education level. Pupwe is mainly accessed through harvesting, but some purchase or exchange also occurs.

Overall, these findings underscore the strong traditional knowledge and cultural importance of Pupwe, as well as the potential for promoting its use and g within and beyond these communities.

The study revealed that Pupwe value addition in T.A Mwabulambya and Nthalire is largely traditional and manual, primarily producing culinary and herbal powders, with limited commercialization and market participation. Despite low engagement in selling, Pupwe products are profitable, and local demand is high, indicating untapped economic potential. Key innovation opportunities were identified in processing, drying, packaging, branding, marketing strategies, and product diversification, highlighting avenues to improve efficiency, product quality, and competitiveness. Expansion into regional, national and international markets remains largely unexplored, underscoring the need for structured market systems, capacity building, and extension support to enhance sustainable commercialization of Pupwe products.

The study revealed that awareness of Pupwe's conservation practices among communities in T.A Mwabulambya and Nthalire is generally low, with more than half of respondents unaware of specific measures to protect the species. Education level significantly influences awareness, as individuals with higher education were more likely to understand conservation practices. Harvesting methods largely focus on leaves, bark, and roots, with many practices potentially compromising the sustainability of the plant. Limited measures are in place to ensure regeneration, and structured community-led initiatives are largely absent. These findings highlight the need for targeted interventions to enhance knowledge, promote sustainable harvesting, and strengthen community engagement in the conservation of Pupwe to safeguard its ecological and cultural value.

6.2 Recommendations

Based on the findings of this study, several interventions are proposed to enhance the utilization, commercialization and sustainable management of Pupwe (*Zanthoxylum chalybeum*) in Chitipa District.

- Disseminate indigenous knowledge on the culinary and medicinal uses of Pupwe to other areas where the tree grows but its uses are not well known, through agricultural and health extension programs, community awareness initiatives, and inter-community knowledge exchange to enhance utilization and cultural preservation.
- Strengthen the Pupwe value chain by introducing innovations in processing, drying, packaging, branding, marketing strategies, and product diversification, including tea bags, spices and mosquito repellents through training and extension support for producers, to improve product quality, expand market reach, enhance profitability and promote sustainable commercialization of Pupwe products. commercialization, efforts should also focus on addressing negative perceptions surrounding the sale of Pupwe. Awareness campaigns can educate communities on its economic potential and encourage greater participation from small-scale harvesters.
- Enhance the conservation and sustainable utilization of Pupwe, targeted awareness campaigns should be implemented to improve community knowledge of sustainable harvesting practices, particularly among herbalists and harvesters. Training programs should emphasize techniques such as selective root extraction and bark harvesting without girdling to minimize plant damage. Promoting the domestication and cultivation of Pupwe can reduce pressure on wild populations, supported by research institutions and forestry departments developing effective propagation methods.

Additionally, community-led conservation initiatives should be strengthened by establishing local conservation groups, integrating traditional ecological knowledge, and incentivizing sustainable practices to ensure the long-term availability and ecological sustainability of Pupwe.

6.3 Areas of further study

Conduct clinical trials on the efficacy of Pupwe in disease treatment, dosage requirements and safety protocols. This area of further study should focus on scientifically evaluating the medicinal efficacy of Pupwe (*Zanthoxylum chalybeum*) using evidence-based dosages, in order to determine the safety and effectiveness of its use for medicinal purposes

Chapter Conclusion

This study explored the traditional uses, value addition potential and conservation practices of Pupwe in Chitipa District. Findings revealed that while Pupwe is widely used for both medicinal and culinary purposes, its potential remains underutilized due to limited documentation, weak value chains and poor conservation strategies. The research underscores the need for enhanced awareness, scientific validation and structured interventions to support its sustainable use and commercialization. Strengthening policy support and community engagement is key to unlocking Pupwe's contribution to rural health, food security and economic development in Malawi.

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Appendices A: Data Collection Protocol

OBJECTIVE 1: TO ASSESS THE TRADITIONAL USE OF PUPWE IN THE COMMUNITIES OF CHITIPA DISTRICT

Definition	The objective aims to assess the practices, knowledge and customs related to how local communities in Chitipa district traditionally use this plant for various purposes, this includes traditional medicine, culinary practices, cultural rituals, or any traditional applications.			
Respondents/Data source	• Community members • Elderly • Herbalists			
Data type	• Availability • Accessibility • Medicinal use • Culinary use • Rituals			
Method of data collection	• Survey, key informant interviews, document reviews			
Sample size	• 383 respondents will participate in the questionnaire survey. The respondents will be randomly sampled in the villages of TA Mwaumbi and Ntharire			
Data collection site	• TA Mwaumbi and Ntharire in Chitipa district			
Data collection tools	• Questionnaire • Interview guide			
Question to be included in the tool	<u>SURVEY QUESTIONNAIRE</u>			
	#	Questions	Responses	Skip Logic
	1	Age of the respondent		

	2	Gender of respondent	1=Male 2=Female	
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	3	What is your educational level?	1=Never attended 2=Primary 3=Secondary 4=Tertiary 5=Adult school	
	4	What is your occupation?	1=Farmer 2=Business 3=Piece work 4=Employed 5= Skilled labour	
	5	How much is your monthly income?		
	6	Do you know Pupwe?	1=Yes 2=No	If yes go to 7
	7	Is Pupwe available in your community?	1=Yes 2= No 3= Not commonly found 4= Am not sure	If yes go to 8
	8	Is Pupwe easily accessible in this community?	1=Yes Pupwe is easily accessible 2= No Pupwe is not easily accessible 3=Not sure	

	9	How do you obtain Pupwe which you use?	1=buying 2=harvesting 3=exchanging	
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	10	What do you use Pupwe for ?	1=Culinary use 2= Medicinal use 3=Rituals 4=others, specify	
	11	What specific health conditions have you used to treat Pupwe?	1=cough 2=malaria 3=healing wounds 4=ulcers 5=TB 6=Anamia 7=None 7=others,specify	
	12	Which parts of the Pupwe tree do you use to prepare medicine?	1= leaves 2=bark 3= Stem 4=roots 5=fruits 6=None	

	13	How often do you use Pupwe for Medicinal purposes?	1= every time I am sick 2=rarely 3=only in emergencies 4=other (specify)	
	14	How do you incorporate Pupwe in your meals?	1= use Pupwe leaves for tea	

			2=use Pupwe leaves as flavouring agent in my soup 3=use Pupwe leaves as relish 4= use Pupwe leaves as salad 5=None	
	15	Are you aware that Pupwe is considered to be highly nutritious just like other vegetables?	1= yes 2=No	If yes go to 16
	16	What nutrients are contained in Pupwe?	1=Vitamins 2=Carbohydrates 3= Minerals (calcium, iron and potassium) 4=Fiber 5=Proteins	
	17	Do you believe Pupwe has any spiritual or symbolic significance in your community?	1=Yes 2=No	If ye go to 18

	18	What are these symbolic or spiritual significances?		
	<u>INTERVIEW GUIDE</u> FOCUS GROUP DISCUSSION WITH COMMUNITY MEMBERS 1. Is Pupwe available and accessible in this community 2. What traditional medicinal uses of Pupwe are known or practiced in the community?			
	3. Can you share any specific experiences or stories related to using Pupwe for traditional purposes? 4. How is Pupwe traditionally harvested, processed, and prepared for medicinal use and culinary use? 5. Have you ever used Pupwe in culinary dishes? If so, how do you typically incorporate it into your meals? 6. Do you believe Pupwe adds nutritional value to dishes? 7. In your opinion, does Pupwe hold any spiritual or symbolic significance in the community? 8. Have you heard of any cultural beliefs or practices related to Pupwe having spiritual meanings? Key in format Herbalist/Elderly 1. Is Pupwe available and accessible for you 2. What parts of pupwe do you harvest for medicinal use 3. What specific treatment do you use for each part of the tree 4. does Pupwe hold any spiritual or symbolic significance in the community? 5. How is Pupwe traditionally harvested, processed, and prepared for medicinal use			

Data analysis	• Quantitative: ○ Descriptive statistics (frequency, percentage, mean, and Standard. deviation) ○ One way ANOVA ○ Linear regression • Qualitative: Nvivo, Thematic analysis
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OBJECTIVE 2: Assess the potential for value addition at each stage of value chain and innovation for market development of Pupwe

Definition	The objective aims to evaluate the opportunities and possibilities for enhancing the value of Pupwe (<i>Zanthoxylum chalybeum</i>) including processing, packaging, distribution, and marketing. This assessment will also focus on identifying innovative strategies and initiatives that can contribute to the development and expansion of Pupwe's market reach, leading to increased economic value and market competitiveness
Respondents/Data source	• Community members • sellers
Data type	• Market demand • Value chain • Value-added products • Cost • Income generated • Innovation potential • Competitive advantage • Market size

Method of data collection	• Semi-structured questionnaire • Key informant interviews • FDG's
Sampling	See 1
Data collection site	See 1
Sample size	See 1
Question to be included in the tool	<u>Questionnaire</u>

#	Questions	Responses	Skip Logic
1	Have you ever sold Pupwe products?	1=Yes 2=No	If yes go to 2
2	How much money do you invest from harvesting, processing and transportation to the market of Pupwe?		
3	How much do you earn after selling Pupwe products?		
4	How would you rate the current demand of Pupwe products in the market?	1=Very high 2=High 3=Moderate 4=Low 5=Very low	

	6	Are you aware of any value-added products derived from Pupwe in this community?	1=Yes 2=No	If yes go to 7
	7	What are some of these value-added products of pupwe?	1=Herbals tea 2=Pupwe powders 3=Cosmetics 4=Flavouring agents 5=Animal feed additives	

	8	In your opinion, what are the potential areas for innovation?	1=Product diversification 2=Harvesting machines 3=Drying machines 4=Packaging 5=Branding 5=Marketing strategies	

	9 How would you describe the size of the market for pupwe products in Chitipa? 1=Local 2=Regional 3=National 4=International <u>Interview</u> Sellers 1. Can you describe the existing value chain for Pupwe products from harvesting to distribution 2. What do you use to measure when selling Pupwe and how much do you sell? 3. What are the potential areas for innovations 4. After processing Pupwe how long does it take for Pupwe to go bad 5. How do customers perceive Pupwe products 6. What is your target market (e.g location, aged, health status,social status) 7. What are the main barriers with Pupwe markets
Data collection tools	• Questionnaire • Interview guide
Data analysis	Quantitative: Descriptive statistics (frequencies, tables and graphs)
	Gross margin analysis, value chain analysis Qualitative: thematic analysis

OBJECTIVE 3: ASSESS CONSERVATION PRACTICES OF PUPWE IN THE COMMUNITIES OF CHITIPA DISTRICT

Definition	The objective aims to evaluate the methods, strategies, and efforts implemented by communities in Chitipa District to conserve Pupwe (<i>Zanthoxylum chalybeum</i>). This assessment includes examining practices aimed at protecting and preserving Pupwe's natural habitats, promoting sustainable harvesting techniques, and ensuring the long-term viability and abundance of Pupwe populations within the district.
Respondents/Data source	• Community members • Community leaders • Forestry staff • Environmental management staff
Data type	• Harvesting practices • Legal and regulatory framework • By-laws • Knowledge on pupwe conservation
Data collection tools	• Questionnaire • Interview guide • Document review
Sample size	• 383 respondents will participate in the questionnaire survey.
Question to be included in the tool	<u>Questionnaire</u>

#	Questions	Responses	Skip Logic	
1	Are you aware of any pupwe's conservation practices	1=Yes 2=No		

	2	What methods do you use to harvest Pupwe?	1=Harvest leaves using handpicking 2=Harvest leaves using knives 3=Harvest barks using panga knives 4=Harvest roots using hoes 5=None 6=Others (specify)		
	3	Are there any local rules or guidelines regarding Pupwe harvesting and conservation?	1=Yes 2=Yes but not wisely enforced 3=No		
	4	What measures do you take to ensure the sustainability of Pupwe population?	1= We rotate harvesting areas to allow natural regeneration 2=Harvesting is limited 3=No any specific measures		

			4=Not sure		
	5	Are there any community initiatives or projects focused on Pupwe conservation	1=yes we have community -led projects that educate residents on conservation practices 2=occasional awareness 3=currently their no community initiatives addressing Pupwe conservation		
	play in promoting sustainable practices?				

Interview guide

Focus group discussion/ key

1. What methods do you or your community use to harvest Pupwe leaves, roots, and bark?
2. Are there any specific practices followed during Pupwe harvesting to ensure sustainable
3. Are you aware of any Pupwe conservation practices?
4. Have there been any efforts or initiatives to educate you about sustainable Pupwe harvesting and conservation?
5. Are there any local regulations or by-laws governing Pupwe harvesting and conservation in your community?
6. What are these by-laws
7. How well are these regulations enforced, and what role do they

	8. What are the main challenges or obstacles faced in conserving Pupwe in your area and how do you deal with them? Key informants' forestry 9. How would you describe the level of awareness among community members regarding Pupwe conservation practices? 10. Have there been any efforts or initiatives to educate the community about sustainable Pupwe harvesting and conservation 11. Do you have laws and regulations that govern Pupwe conservation 12. How well are these regulations enforced, and what role do they play in promoting sustainable practices? 13. Do community members follow these laws 14. What are the main challenges or obstacles faced in conserving Pupwe in your area and how do you deal with them?
Data analysis	• Descriptive statistics (frequency and percentage) • Thematic analysis

Appendices B: Methodology Matrix

Table 25: methodology matrix describing variables, data collection methods, data collection tools and analysis.

Objective	Variables	Method of data collection	Data collection tools	Analysis
1. Assess the of Pupwe communities of distric	• traditional use availability accessibility medicinal use • culinary use frequency of use • chitipa cultural significance •	• Individual interview • Key informant Interview • Focus group discussion	• Semi-structured questionnaire • Interview guide	• Descriptive statistics (frequency, percentage, mean) • One way ANOVA • Chi-square • content analysis .

2. Assess the potential for value addition at each stage of value chain innovation for market development of Pupwe	• potential addition at value- added products • Cost invested • Income generated • Innovation potential • Market size • Target market • •	• Market demand • Value chain • Individual interviews • Secondary data • Key informant Interview • Focus group discussion	• Semi-structured questionnaire • Interview guide	• Descriptive statistics • (frequency) • Narrative analysis • Value chain analysis • Gross Margin analysis
3. Assess conservation practices of Pupwe in the communities of Chitipa district	• Harvesting practices • By-laws • Knowledge on pupwe conservation	• Individual interviews • Key informant Interview • Focus group discussion	• Individual interviews • Key informant Interview • Focus group discussion	• Descriptive statistics (frequency, percentage, mean) • Chi-square • Narrative analysis



MZUZU UNIVERSITY

DIRECTORATE OF RESEARCH

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MALAWI
TEL: 01 320 722
FAX: 01 320 648

MZUZU UNIVERSITY RESEARCH ETHICS COMMITTEE (MZUNIREC)

Ref No: MZUNIREC/DOR/24/106

14/10/2024.

Milcah Mlazamirwa Kalinga,

Mzuzu University,

P/Bag 201, Luwinga, Mzuzu 2.

Email: milcahkalinga1@gmail.com

Dear Milcah,

**RESEARCH ETHICS AND REGULATORY APPROVAL AND PERMIT FOR
PROTOCOL REF NO. MZUNIREC/DOR/24/106: THE TRADITIONAL USE,
VALUE ADDITION AND CONSERVATION OF PUPWE (*Zanthoxylum
Chalybeum*) IN CHITIPA DISTRICT, MALAWI.**

Having satisfied all the relevant ethical and regulatory requirements, I am pleased to inform you that the above referred research protocol has officially been approved. You are now permitted to proceed with its implementation. Should there be any amendments to the approved protocol in the course of implementing it, you shall be required to seek approval of such amendments before implementation of the same.

This approval is valid for one year from the date of issuance of this approval. If the study goes beyond one year, an annual approval for continuation shall be required

to be sought from the Mzuzu University Research Ethics Committee (MZUNIREC) in a format that is available at the Secretariat. Once the study is finalised, you are required to furnish the Committee with a final report of the study. The Committee reserves the right to carry out compliance inspection of this approved protocol at any time as may be deemed by it. As such, you are expected to properly maintain all study documents including consent forms.

Wishing you a successful implementation of your study.

Mzuzu University Research Ethics Committee

Directorate of Research

Mzuzu University

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Mzuzu 2

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MZUZU UNIVERSITY RESEARCH ETHICS COMMITTEE (MZUNIREC) Ref

No: MZUNIREC/DOR/24/106.

Milcah Mlazamirwa Kalinga .

Mzuzu University,

P/Bag 201, Luwinga, Mzuzu 2.

Email: milcahkalinga1@gmail.com

Dear Milcah,

**LETTER OF INTENT TO ISSUE A RESEARCH ETHICS AND REGULATORY
PERMIT FOR PROTOCOL REF NO. MZUNIREC/DOR/24/106: THE
TRADITIONAL USE, VALUE ADDITION AND CONSERVATION OF PUPWE
(Zanthoxylum Chalybeum) IN CHITIPA DISTRICT, MALAWI.**

The Mzuzu University Research Ethics Committee (MZUNIREC) reviewed your submission. The committee is now pleased to inform you that the protocol is at the stage at which the Principal Investigator is being required to pay the stipulated 10% regulatory fee of the actual budget as indicated in the research protocol being a regulatory **compliance and capacity building fee** before ethics approval and regulatory permit could be issued. This fee is required to be paid to the Committee. The mode of payment is either a cash or cheque deposit into the following bank account:

Description	Details
Beneficiary name and address	Mzuzu University, Private Bag 201, Luwinga, Mzuzu 2, Malawi
Beneficiary account name	MZUNIREC
Beneficiary account No.	1007578888

Bank name and address	National Bank of Malawi, Mzuzu Branch, PO Box 20, Mzuzu
Swift code or ABA number	N/A

Once payment is made, send a deposit slip/wire transfer slip for the verification of our Accounts Department.

Yours Sincerely,



Wanangwa K. Msowoya

MZUNIREC Secretariat

FOR: MZUNIREC CHAIRPERSON

Mzuzu University Research Ethics Committee

Directorate of Research

Mzuzu University

P/Bag 201

Luwinga

Mzuzu 2

Email: mzunirec@mzuni.ac.mw

Appendices D: Mzuzu University Research Ethics Committee Informed Consent Form
(English)



Mzuzu University Research Ethics Committee (MZUNIREC)

Informed Consent Form for Research in The Traditional Use, Value Addition and Conservation of Pupwe (*Zanthoxylum Chalybeum*) Introduction

I am **Milcah Mlazarwa Kalinga** from the **Department of Agriscience** in the Faculty of Environmental Sciences at Mzuzu University. We are researching on the traditional use, value addition and conservation of pupwe (*Zanthoxylum Chalybeum*). This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them of me or another researcher.

Purpose of the research

This research aims to **assess** the potential of Pupwe focusing on the traditional use, value addition and conservation of Pupwe (*Zanthoxylum Chalybeum*)

Type of Research Intervention

This research will involve your participation in a group discussion and/or individual interview.

Participant Selection

You are being invited to take part in this research because **of your knowledge and usage of Pupwe.**

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate nothing will change. You may skip any question and move on to the next question.

Duration

The research takes place for a period of two months from May to June

Risks

You do not have to answer any question or take part in the discussion/interview/survey if you feel the question(s) are too personal or if talking about them makes you uncomfortable.)

Reimbursements

You will not be provided any incentive to take part in the research.

Sharing the Results

The knowledge that we get from this research will be shared with you and your community before it is made widely available to the public. Following, we will publish the results so other interested people may learn from the research.

Who to Contact

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact: Dr. Ulemu Msiska (who is my supervisor and program coordinator) Mzuzu University, Private Bag 201, Luwingu, Mzuzu 2. Email: msiska.u@mzuni.ac.mw
Phone: 0994954025

This proposal has been reviewed and approved by Mzuzu University Research Ethics Committee (MZUNIREC) which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find about more about the Committee, contact Mr. Gift Mbwele, Mzuzu University Research Ethics Committee (MZUNIREC) Administrator, Mzuzu University, P/Bag 201, Luwingu, Mzuzu 2, and Phone: 0999404008/0888641486

Do you have any questions?

Part II: Certificate of Consent

I have been invited to participate in research about, The Traditional Use, Value Addition and Conservation of Pupwe (*Zanthoxylum Chalybeum*)

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant _____

Signature of Participant _____

Date _____

Day/month/year

***If illiterate*¹**

¹ A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb print as well.

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.



Print name of witness _____ Thumb print of participant Signature of witness
 _____ Date _____

Day/month/year

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands the research project. I confirm the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent _____

Date _____

Day/month/year

Appendices E: Mzuzu University Research Ethics Committee Informed Consent Form (Chichewa)



Mzuzu University Research Ethics Committee (MZUNIREC)

Mau oyamba

Dzina langa ndi **Milcah Mlazarwa kalinga** kuchokera ku gawo la maphunziro la Agrisciences mu nthambi ya Environmental Sciences ku Mzuzu University. Ndikuchita

kafukufuku pa kusagwilitsi tchito Kwa mitengo yakutchite yomwe Ili

ndikuthekela, Phunzilo la Pupwe boma lachitipa. Kalata ya chilolezoyi itha kukhala ndi mau oti simukutha kuwamvetsa bwino. Chonde muzindiuza kuti ndiime ndifotokozele pamene tikuchita kafukufukuyu. Ngati muli ndi mafuso ena, ndifunseni ineyo kapena amzanga omwe ndikuchita nawo kafukufukuyu.

Cholinga cha kafukufuku

Kafukufukuyu akufuna kuunika **kafukufuku pa kuthekela Kwa Pupwe**

Mtundu wa kafukufuku

Kafukufukuyu akudalila kutengapo gawo kwanu poyankha mafuso amene ndikufuseni mkucheza kwathu.

Mchifukwa chani mwasankhidwa?

Mwasankhidwa kuti muchite nawo kafukufukuyu potengela kuti mumagwilitsa tchito Pupwe

Kutengapo gawo pa kafukufuku mosakakamiza

Kutengapo gawo kwanu pa kafukufukuyu mkosakakamiza. Muli ndi ufulu kutengapo gawo kapena ayi. Mukasankha kusachita nawo kafukufukuyu palibe icho chisinthe kapena kukuchitikilani. Muli ndi ufulu kusiya mafuso ena osayankha mkuyankhako ena.

Kafukufukuyu atenga nthawi yotalika bwanji?

Kafukufukuyu atenga miyezi iwili kuchokela mwezi wa May chaka chino cha 2024 mpaka mwezi wa June.

Zodetsa Nkhawa

Simukuyenera kuyankha mafuso kapena kutengapo mbali mkucheza ngati mukuona kuti mafunso ena salibwino kapena simunasangalare nawo, kapena mukuganiza kuti kuyankhapo kukhoza kubwelesa chiopsezo paumoyo wanu.

Cholowa/Kulipidwa

Kutenga nawo gawo pa kafukufukuyu ndi kwa ulere ndipo simudzalandira kalikonse.

Kugawana zotsatila za Kafukufuku

Zotsatila za kafukufukuyu zidzagawidwa kwa inu amene mutengepo mbali ndi anthu a mdela lanu zisanagawidwe ku mtundu wose wa aMalawi. Zotsatila za kafukufukuyu zidzasindikizidwa mu buku kuti anthu ose ofuna kumva zambiri za kafukufukuyu athe kutero.

Oti mungathe kulumikizana nawo

Ngati muli ndi mafuso, mutha kufusa panopa kapena nthawi ina. Ngati mukufuna kudzafunsa nthawi ina chonde alembeleni kalata a Doc ulemu msiska omwe ndi aphuzitsi amene akundiyang'anira pa kafukufuku ameneyu ku Mzuzu University ndipo ndiamenso amayanganira zones zokhuza ophuzila amene akuchita pologalamuyi pansi pa nthambi ya angriscience .pa adilesi iyi: Private Bag 201, Luwingu, Mzuzu, kapena aimbileni foni pa 0994954025. Mutha kutumizaso kalata pa makina a intaneti ku adilesi iyi:msiska.u@mzuni.ac.mw.

Kafukufukuyu waunikidwa ndi kuvomerezedwa ndi nthambi ya koleji yotchedwa Mzuzu University Research Ethics Committee (MZUNIREC) yomwe ndi komiti yoonetsetsa kuti ochita nawo kafukufuku ndi otetezedwa mu njira ina iliyose. Ngati mukufuna kumva zambiri za komitiyi lumikizananani ndi a Gift Mbwele pa adilesi iyi: Mzuzu University Research Ethics (MZUNIREC) Administrator, Mzuzu University, P/Bag 201, Luwingu, Mzuzu 2, Ma nambala awo a foni ndi: 0999404008/0888641486 Muli ndi mafuso Lirilonse?

Gawo lachiwiri: Kalata yovomereza

Ndaitanidwa kuti ndichite nawo kafukufuku pa kusagwilitsi tchito Kwa mitengo yakutchite yomwe Ili ndikuthekela, thunzilo la Pupwe boma lachitipa

Ndawelenga komaso andiwelengera zonse zoyenera pa kafukufukuyu. Ndinapatsidwa mwayi oti ndifunse mafunso pa kafukufukuyu ndipo mafunso ose ndinafusa andiyankha mogwira mtima. Ndikuvomereza kuchita nawo kafukufuyu mwakufuna kwanga

Dzina la ochita nawo kafukufuku _____

Signature _____

Tsiku _____

Tsiku/Mwezi/Chaka

Ngati ali osatha kulemba ndi Kuwelenga²

Ndaonelela kuwerenga kolondola kwa kalata ya chivomerezo kwa otenga nawo mbali pa kafukufuku. Ndipo otenga nawo mbaliyu anapatsidwa mwayi ofusa mafuso. Ndikutsimikizira kuti otenga nawo mbaliyu wavomereza yekha kutenga nawo mbali pa kafukufukuyu.



Dzina la mboni _____ Otenga nawo mbali adinde ndi chala apa

Signature ya mboni _____

Tsiku _____

Tsiku/Mwezi/Chaka

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability, I made sure that the participant understood the research project. I confirm that the participant was allowed to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of

²

Mboni yodziwa kulemba imusainile uyu ochita nawo kafukufuku (ngati mkotheke mboniyi isankhindwe ndi uyu ochita nawo kafukufuku osati awo ochititsa kafukufuku). Ochita nawo kafukufuku omwe sadziwa kulemba adindeso ndi chala.

my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent _____

Date _____

Day/month/year