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Cultivating Resilience: The Socio-Economic Impact of Homegardens in Kabwe District, Zambia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Homegardens, diverse crop production systems adjacent to or near households, play a significant role in the socioeconomic well-being of communities in Kabwe District, Zambia. This study aimed to assess the socio-economic impact of these homegardens in Kabwe District, located approximately 140 km from Lusaka, the capital city of Zambia. The research was conducted in the Highridge and Nkrumah extension areas, where 52 randomly selected households were interviewed using structured questionnaires. Data analysis was performed using SPSS and Microsoft Excel 2019. The study revealed that 67% of respondents owned homegardens, primarily backyard gardens ranging from 0.1 to 0.5 acres in size. These homegardens provided significant economic benefits, with approximately 78% of households earning between ZMK100 to ZMK3,000, primarily from

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sales to marketers and neighbours. The income earned was mainly used for purchasing inputs for the next farming season, groceries, and food for domestic consumption, demonstrating the gardens' role in household sustainability. Despite not being large-scale commercial operations, homegardens proved crucial for household income and food security. However, challenges such as high-water bills, pests and diseases, and lack of extension support were identified. To improve the homegarden industry, the study recommends collaborative efforts between the government and other stakeholders to address these challenges, potentially leading to improved socio-economic outcomes for households in Kabwe District and similar regions in Zambia.

Keywords: Socio-economic role; homegardens; households; sustainability.

1. INTRODUCTION

Zambia has experienced ongoing economic and social problems since the 1970s, which has caused many people's living standards to decline [1]. Food security, health, sanitation, education, and employment problems have gotten worse due to rising costs [2]. In response, the government has taken steps to enhance the distribution of resources and the availability of food, in line with the UN Sustainable Development Goals and Vision 2030 [3]. Food security is the ability of every Zambian to obtain an adequate supply of wholesome food, according to the Ministry of Agriculture and Cooperatives [4-6]. Home gardens, which are small-scale agroforestry systems close to houses, have gained attention as possible sources of income and food security [1].

Homegardens sustain communities by providing food and supporting social and political structures. Given their significance, a comprehensive study of their socio-economic dynamics is warranted [2,3]. This research aims to assess the adoption rates and challenges of homegarden owners in Kabwe District, Zambia, addressing knowledge gaps regarding productivity and potential. It will examine socio-economic benefits and promote the incorporation of agroforestry components to enhance productivity.

The study will use a mixed-methods approach, combining quantitative surveys and qualitative interviews. Stratified sampling and standardized instruments will collect robust data, with in-depth statistical analyses conducted to generate insights into adoption, management, and impact [1]. Findings are expected to highlight the importance of homegardens for income and food security, reveal their medicinal, nutritional, and aesthetic value, and inform policy decisions for targeted interventions [4].

This research will contextualize findings within global food security challenges and sustainable development initiatives, comparing with similar studies in other developing countries to identify best practices and areas for knowledge transfer [4,5]. The study represents a critical step towards understanding and harnessing the potential of small-scale agroforestry systems in addressing food insecurity, poverty, and environmental sustainability.

The research seeks to assist policies that maximize Homegarden's advantages for rural communities and support Zambia's sustainable development goals by fostering informed decision-making and offering a strong evidence base. This study aims to close the knowledge gap between homegarden systems theory and practice, which could help guide similar projects in other developing nations.

2. METHODOLOGY

2.1 Description of Study Area

Kabwe District, located in Zambia's Central Province, formerly known as Broken Hill, is approximately 139 kilometres north of the capital, Lusaka [6]. The district encompasses both urban and rural areas, with a diverse population engaged in various economic activities, including agriculture, mining, and small-scale trading. Kabwe's climate is characterized by distinct wet and dry seasons, typical of Zambia's tropical savanna. The region's soil composition varies, presenting both opportunities and challenges for agricultural practices. Kabwe's historical significance as a mining center and its current socio-economic dynamics make it an ideal location to examine the adoption and impact of homegardens in addressing food security and livelihood challenges.

2.2 Farming Typologies

Kabwe District in Zambia showcases a diverse array of farming typologies, reflecting the region's varied landscape, socio-economic conditions, and agricultural traditions. The most prevalent

form is smallholder subsistence farming, where families cultivate small plots of 1-5 hectares primarily for household consumption, growing staples like maize, groundnuts, and sweet potatoes. Some of these smallholders have transitioned to semi-commercial operations, producing surplus crops for local markets [7]. Larger commercial farms also exist, focusing on cash crops such as cotton, tobacco, and sunflowers, and employing modern farming techniques [8-11]. Given Kabwe's urban centre, urban and peri-urban agriculture is significant, with many residents maintaining backyard gardens and small plots within city limits. Mixed crop-livestock systems are common, integrating crop production with the rearing of cattle, goats, pigs, and poultry. Agroforestry practices, including homegardens, are gaining traction, as is conservation agriculture, which emphasizes minimal soil disturbance and crop rotation [8]. Some farmers have formed cooperatives to pool resources and improve market access, while others engage in contract farming with larger agricultural companies. In areas with sufficient water resources, irrigation-based farming allows for year-round crop production [9,10]. These diverse farming typologies often overlap and evolve in response to market demands, climate conditions, government policies, and technological advancements, creating a rich agricultural landscape in Kabwe that provides an ideal context for studying the role and potential of homegardens in local food security and economic development [12-16].

2.3 Data Sources and Type

2.3.1 Household survey

This study employed a mixed-methods approach, with social surveys as the primary data collection tool. The survey instruments included structured questionnaires, semi-structured interviews with adult respondents, and direct observational techniques. A total of 52 questionnaires were administered using random sampling to ensure representativeness. Data collection occurred in two phases: initial distribution of questionnaires followed by retrieval and follow-up interviews to clarify any ambiguities. Primary data encompassed various aspects of homegardens, such as spatial dimensions, economic productivity, crop diversity, and challenges faced by proprietors. Respondents present during the survey were interviewed immediately, while questionnaires were left for unavailable respondents with careful documentation for accurate follow-up.

Integrating questionnaires and interviews aligns with established mixed-method practices, allowing for both breadth and depth in data collection. Face-to-face interviews elucidated complex questions and used visual aids when necessary, enhancing data quality and reliability. The questionnaire was crucial for gathering quantitative data on the economic viability and sustainability of homegardens in the study area [17]. The target population comprised residents of Nkrumah Extension and Highridge, including both homegarden owners and non-owners.

The questionnaire featured primarily closed-ended questions, utilizing a binary (Yes/No) response format to facilitate standardization and ease of analysis. Open-ended follow-up questions were included for more detailed responses. Data collected included demographic information, economic indicators, and other relevant variables. This standardized approach minimized bias and facilitated comparative analysis across the sample population. The use of questionnaires is justified by their efficiency in generating quantifiable data amenable to statistical analysis and their capacity to provide standardized responses, thereby enhancing the reliability and validity of the findings.

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2.4 Sampling Design

Stratified random sampling was applied in this study to address the diverse demographic of Nkrumah Extension Townships and Highridge Townships. Based on common characteristics including soil types and climate, the area was split into two strata. This approach was selected due to its effectiveness in gathering data and its analytical benefits when dealing with diverse groups. To guarantee impartial representation, all homes in the study area—regardless of whether they owned home gardens or not—were eligible to receive questionnaires. Following the guidelines for probability sampling, a random selection process was AROUND inside each stratum. In line with recommended methods in social science research, this method strikes a compromise between analytical precision and representativeness with the goal of producing solid, broadly applicable findings while taking population diversity into consideration.

2.5 Data Analysis

Data analysis was conducted using a combination of Microsoft Excel (2019) and the Statistical Package for Social Sciences (SPSS version 16). Excel was employed for initial data entry, cleaning, and preliminary descriptive statistics, facilitating the organization of raw data and the creation of basic visualizations. SPSS was utilized for more complex statistical analyses, including inferential statistics, correlation analyses, and regression models. This powerful software allowed for in-depth quantitative analysis, handling large datasets and performing sophisticated multivariate analyses. The dual-software approach ensured a thorough examination of the data, from basic descriptive statistics to complex analytical procedures, enhancing the reliability and depth of the research findings on homegardens in Kabwe District.

3. RESULTS

3.1 Descriptive Results

Sex of respondent: Fig. 1 illustrates the distribution of respondents by sex, detailing both the total number and the percentage of male and female participants. Specifically, there are 27 male respondents, accounting for 51.9% of the total, and 25 female respondents, making up 48.1% of the total.

Age group of respondents: Fig. 2 presents the age distribution of respondents, illustrating the percentage of participants within five distinct age groups. The largest group is those aged 35 and over, comprising 42.3% of the respondents. This is followed by the 21-25 age group, which makes up 28.8% of the participants. The 26-30 age group accounts for 15.4% of the respondents, while the 31-35 age group represents 5.8%. The smallest group is the 15-20 age bracket, constituting only 7.7% of the respondents. This distribution indicates a higher representation of older individuals in the study, particularly those aged 35 and above. The relatively lower percentages in the younger age groups, especially the 15-20 and 31-35 brackets, suggest that these age groups are less represented among the respondents. The data provides valuable insights into the demographic composition of the study population, highlighting a predominance of older participants.

Marital status: The Fig. 3 illustrates the marital status distribution of respondents, divided into three categories: single, married, and widowed. The largest group is the married respondents, who make up 50% of the total population surveyed. Following this, 44% of the respondents are single. The smallest group comprises widowed individuals, who account for 6% of the total respondents. This data indicates that half of the respondents are married, suggesting a significant proportion of the population is in a marital relationship. The single respondents also represent a substantial portion, close to half of the surveyed group. The widowed respondents constitute a smaller fraction, indicating fewer

individuals in this category compared to the other two. This distribution provides a clear view of the marital composition of the respondents, highlighting the predominant presence of married individuals.

Education level of respondents: As observed below in Fig. 4, it is clear that most of the respondents in the study area are secondary school certificate holders with a frequency of 22 (42.3%) followed by 13 (25%) who haven't completed secondary school. This shows that the majority of respondents have not attained tertiary education as is only represented by 17, which is 7 (13.5%) degree holders and 10 (19.2%) diploma holders added together.

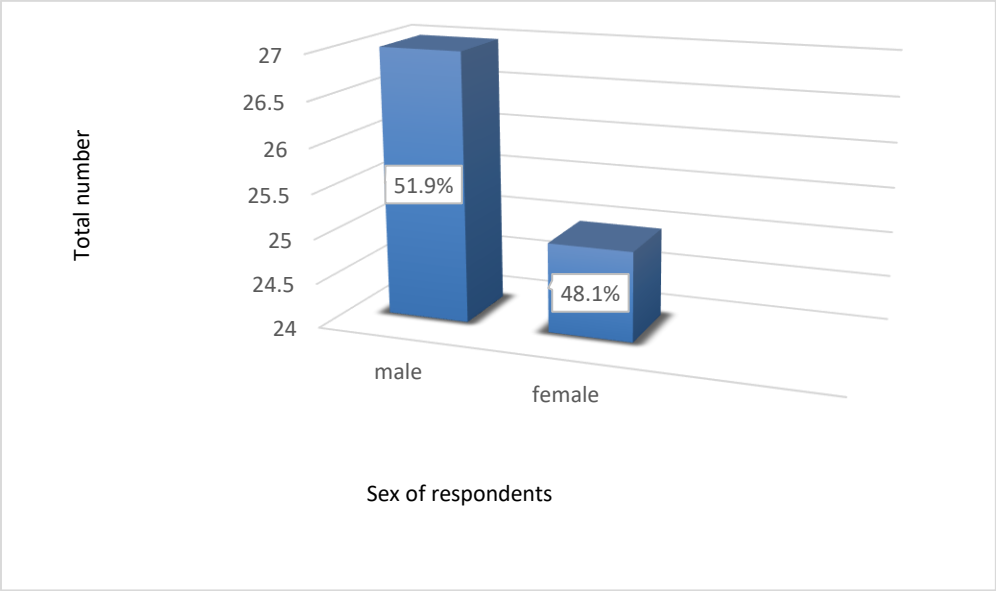

Fig. 1. Gender of the respondents in the study area (n=52)

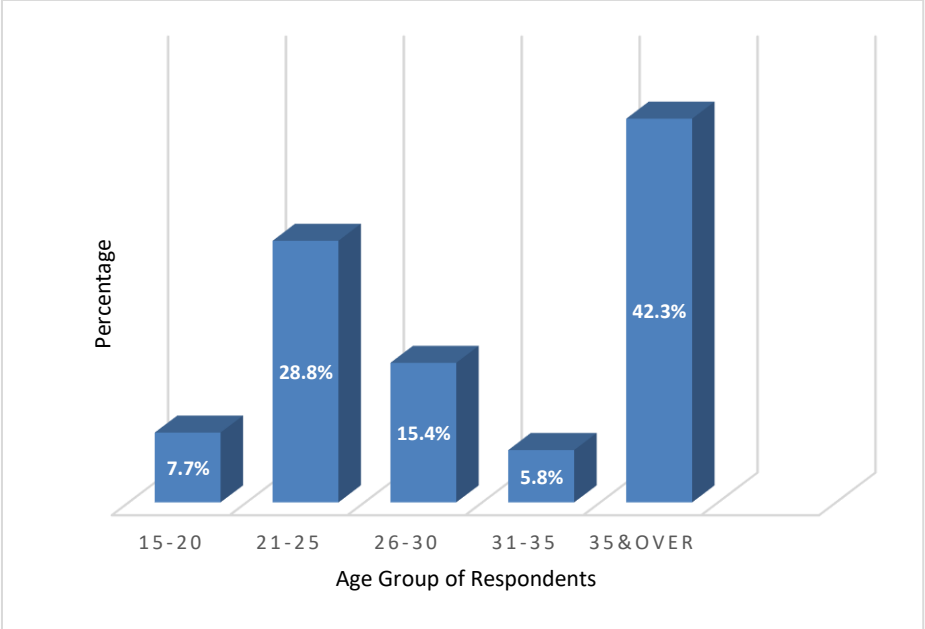

Fig. 2. Age distribution of respondents (n=52)

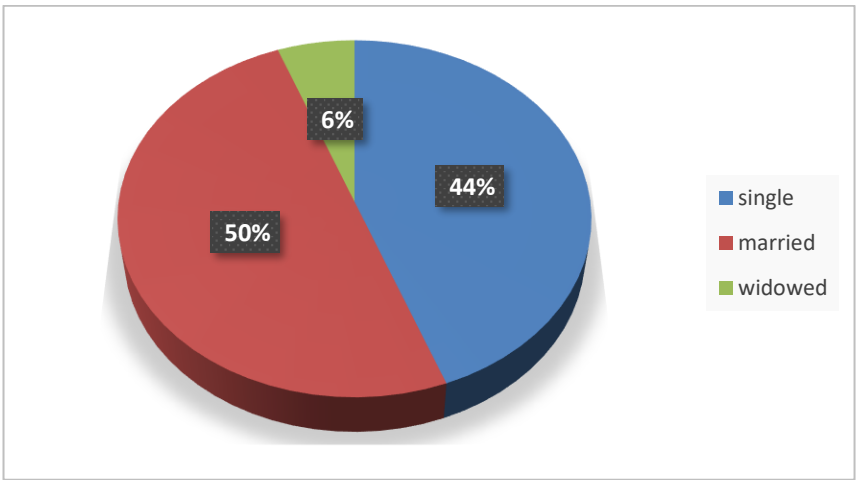

Fig. 3. Marital status of the respondents (n=52)

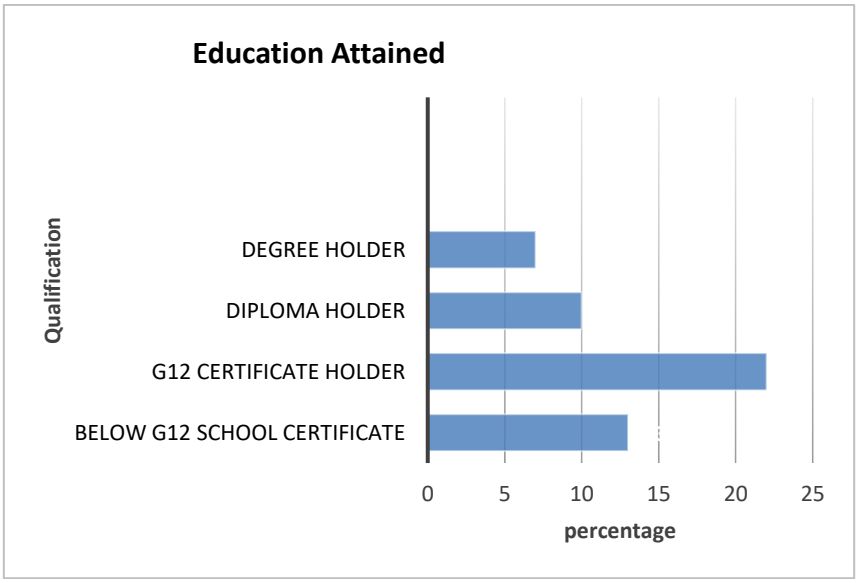

Fig. 4. Education level of respondents (n=52)

The education attained by the respondents; also, clearly shows the levels of employment. It shows that most respondents from the study area have attained low levels of education or are yet to go into tertiary education and are unemployed thus turn into gardening as a source income generation. Fig. 5 elaborates that 71% of respondents were not in formal employment while only 29% had formal jobs.

3.2 Homegardens

Ownership of a homegarden: As illustrated in Fig. 6, 35 respondents (67%) own gardens, while 17 respondents (33%) do not. These results suggest that the majority of people in the study area have their gardens and are engaged in gardening activities.

Location of the garden: Fig. 7 presents the distribution of home garden locations among smallholder farmers. The overwhelming majority of home gardens, 91.4%, are situated in backyards. This prevalence suggests that most smallholder farmers prefer or are limited to using their immediate residential surroundings for gardening. Backyard gardens are typically more accessible, making it easier for farmers to manage and maintain their crops regularly.

A small percentage, 5.7%, of home gardens are located at stream or dambo sites. These areas,

often characterized by wetter conditions, may offer specific advantages such as enhanced soil moisture and fertility. However, the relatively low percentage indicates that not many farmers have access to such locations or choose to utilize them for home gardening. The smallest portion, 2.9%, represents gardens located on farms. These farm gardens might be larger or part of a broader agricultural activity but are the least common among the surveyed farmers.

Size of the garden (acres): The bar graph (Fig.8) illustrates the distribution of garden sizes among smallholder farmers practicing home gardening. The majority of respondents, accounting for 85.7%, have gardens ranging between 0.1 and 0.5 acres. This indicates that most smallholder farmers are working with relatively small plots of land, which may influence their agricultural practices, crop choices, and productivity levels. A smaller portion, 11.4%, have gardens sized between 0.6 and 1.0 acres. These slightly larger plots provide more space for diverse planting and potentially higher yields, though they still fall within the small-scale farming category.

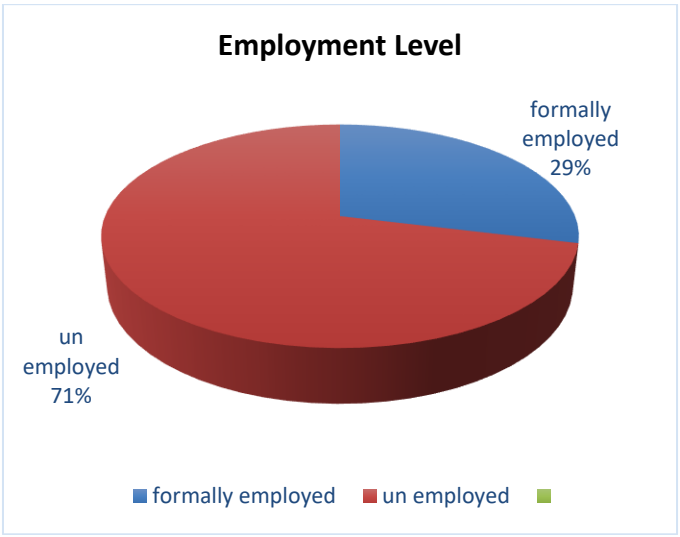

Fig. 5. Level of employment of respondent

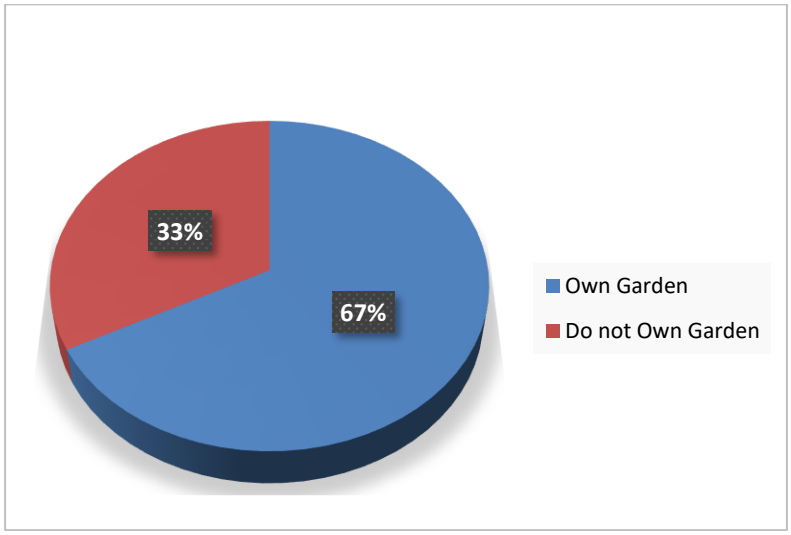

Fig. 6. Ownership of home gardens in the study area

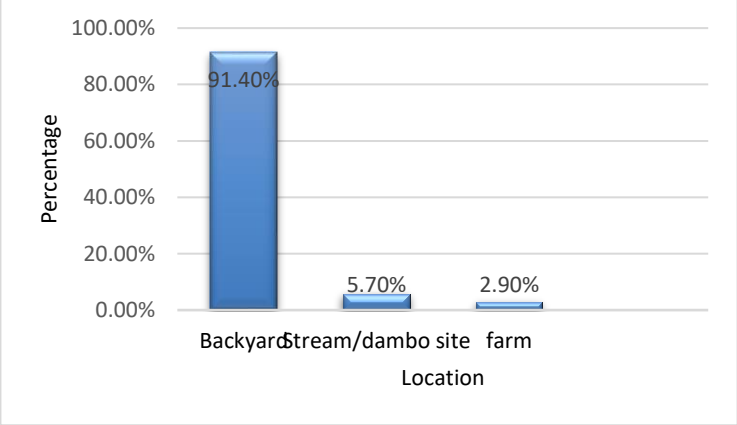

Fig. 7. Location of the gardens

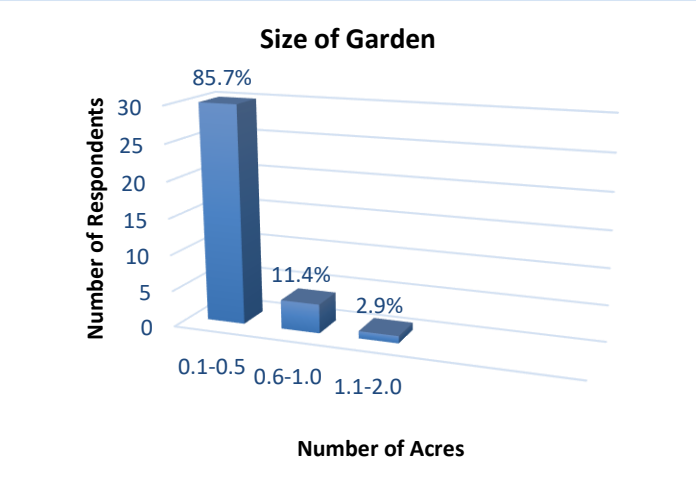

Fig. 8. Size of the garden shown in acres

The smallest group, 2.9%, has garden sizes between 1.1 and 2.0 acres. This minority of farmers with larger plots may benefit from greater productivity and the ability to implement more varied and intensive farming practices. This prevalence of small garden sizes emphasizes the need for efficient and sustainable agricultural practices tailored to maximize output on limited land areas.

Land ownership: The pie chart (Fig. 9) illustrates the distribution of land ownership among smallholder farmers practicing home gardening. The majority, 74%, own their gardens, indicating a significant level of autonomy and stability in their agricultural activities. This ownership likely contributes to better investment in and maintenance of the gardens, as farmers can make long-term improvements without fear of losing access to the land. A substantial portion, 23%, rents the land they use for home gardening. Renting can introduce a level of uncertainty, as tenants may face potential displacement or changes in rental terms, which could impact their gardening practices and productivity. Despite these challenges, renting still provides access to land for those who do not own property, allowing them to engage in productive gardening activities.

A small fraction, 3%, falls into the 'Other' category. This could include various arrangements such as sharecropping, community gardens, or informal agreements. These alternative forms of land access play a crucial role in enabling diverse groups of farmers to participate in home gardening, particularly those who might be excluded from traditional ownership or rental markets.

The data highlights that a significant majority of smallholder farmers in Kabwe have stable access to land through ownership, which supports their home gardening activities.

However, the notable proportion of rented land indicates that rental agreements are also vital for facilitating agricultural practices among farmers without land ownership. The 'Other' category, though small, underscores the importance of flexible and varied land access arrangements in promoting inclusivity in home gardening.

Crops grown: Across the analyzed households, there was a noticeable variation in crop cultivation throughout this inquiry. Crop choices varied significantly amongst household gardens, indicating differences in growing methods and tastes. A thorough inventory of all the cultivated species was created to methodically record this diversity. A taxonomy classification of the crops that were observed is included in the following table, along with information on their common names, scientific names, and documented uses. The inclusion of each crop species' recognized applications also sheds light on the multipurpose character of home gardens, including their possible cultural significance, economic value, and ability to supply food security.

Economic returns: The bar graph (Fig. 10) data on the economic and social benefits of homegarden ownership, revealing significant positive impacts in both areas. Economically, a substantial 77.1% of respondents (approximately 27 individuals) reported that homegardens provide financial assistance, while only 22.9% (about 8 respondents) indicated no economic benefit. On the social front, 68.6% of participants (roughly 24 individuals) acknowledged social advantages from homegardens, compared to 31.4% (about 11 respondents) who did not perceive social benefits. These findings strongly suggest that homegardens are viewed as valuable assets by the majority of respondents, with their economic impact slightly outweighing the social benefits. The high percentage reporting economic benefits indicates that homegardens play a crucial role in household economies, potentially through direct income generation or reduced food expenses. While social benefits are less prevalent, they still represent a significant majority, suggesting homegardens contribute to community interactions and family well-being. The presence of negative responses in both categories highlights that the benefits of homegardens are not universal, possibly due to individual challenges or varying perceptions of what constitutes "help."

Approximate income: Fig. 11 the income distribution across a population, revealing three distinct categories. The largest segment, representing 76% of the population, falls within the k100-k3000 income range, indicating a substantial middle-income group. The second-largest category comprises individuals earning below k100, accounting for 18% of the population and representing the lowest income bracket. The smallest segment, at just 6%, consists of those earning between k5100-k7000, marking the highest income level in this distribution. This data suggests a society characterized by a dominant middle class, with a notable low-income minority and a very small high-income group. The stark contrast between the proportion of low-income (18%) and high-income (6%) individuals highlights significant income disparity. It's worth noting the gap in the income ranges between k3000 and k5100, which may indicate either missing data or a specific focus on these particular brackets in the study.

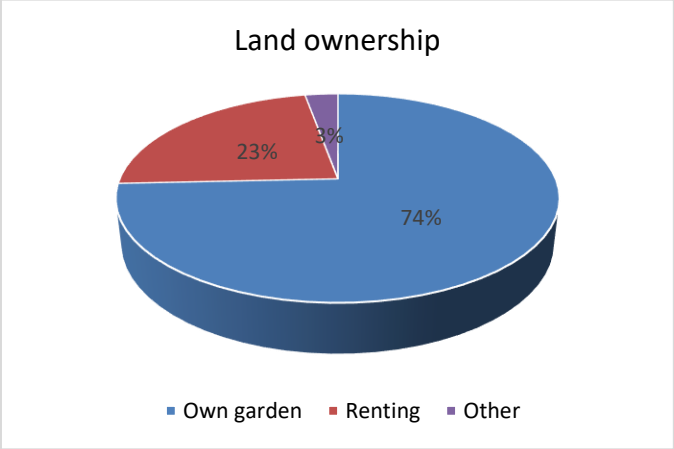

Fig. 9. Land ownership among smallholder farmers

Table 1. Crops grown in the study area both in scientific names and local names

Botanical name	English name	Use of crop
Solanum melongena	Eggplant	Grown for its fruits
Brassica oleracea	Cabbage	Grown for its leaves
Brassica napus	Rape	Grown for its leaves
Brassica rapa spp	Chinese cabbage	Grown for its leaves
Solanum lycopersicum	Tomatoes	Grown for its fruit
Allium cepa	Onion	Grown for leaves and bulb
Cucurbita maxima	Pumpkin leaves	Grown for leaves
Spinacia oleracea	Spinach	Grown for leaves
Abelmoschus esculentus	Okra	Grown for the fruit
Daucus carota	Carrots	Grown for the roots
Capsicum annuum	Green pepper	Grown for the fruit
Fragaria ananassa	Strawberries	Grown for the fruit

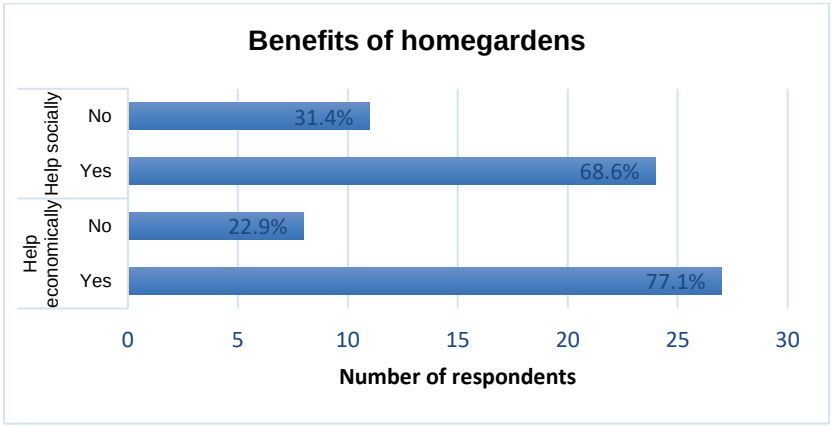

Fig. 10. Frequency of economic and social returns

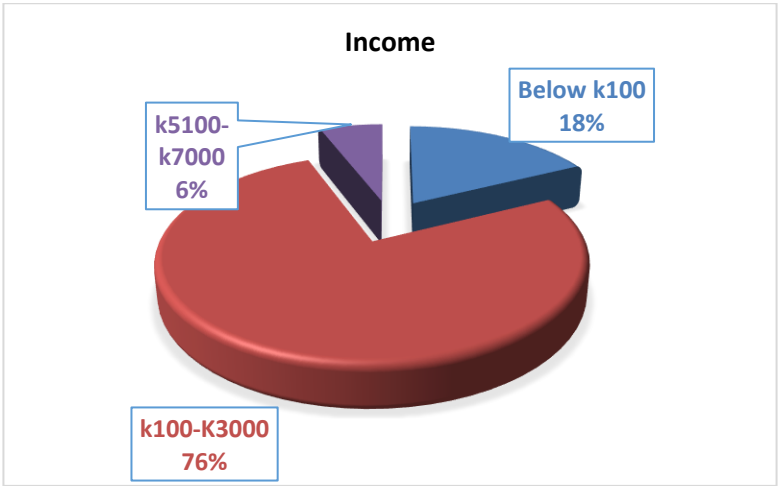

Fig. 11. Income generated per month from garden produce

Use of income from homegardens: Fig. 12 illustrates the allocation of income derived from homegardens across four primary categories. The most significant use of homegarden income is for purchasing inputs, accounting for 44.4% of the total. This suggests that a large portion of the earnings is reinvested into the homegarden itself, likely for items such as seeds, fertilizers, or tools. The second most common use is for relish and groceries, representing 33.3% of the income. This indicates that homegarden earnings contribute substantially to household food

security and dietary diversity. Water bills constitute the third largest expense at 16.7%, highlighting the importance of water access and its cost in maintaining homegardens. Lastly, 5.6% of the income is allocated towards building houses, suggesting that while a small portion, homegarden earnings do contribute to long-term household investments and asset building. This data reveals that income from homegardens is primarily used for immediate household needs (food and utilities) and agricultural inputs, with a small portion supporting larger investments in housing.

Customers: Marketers constitute the largest customer base, accounting for 56% of the total (Fig. 13). This suggests that a majority of homegarden produce is sold through intermediaries or to resellers, potentially indicating a significant role for these farmers in local or regional supply chains. Neighbours form the second largest customer group at 25%. This highlights the importance of local community networks in distributing and consuming homegarden produce, showcasing a direct farm-to-table model at a neighborhood level. Local people, distinct from immediate neighbors, represent 13% of the customer base. This category likely includes customers from the broader local area who are not immediate neighbors but are still within the community. Institutions make up the smallest customer segment at 6%. This could include schools, hospitals, or other organizations that purchase produce in bulk, albeit in smaller quantities than other customer types. This distribution indicates that smallholder farmers with homegardens rely heavily on local and community-based markets, with a strong emphasis on selling to marketers who may have wider distribution networks. The data suggests a diverse customer base, balancing between larger-scale distribution (through marketers) and direct community sales, which could provide these farmers with a resilient and varied market structure.

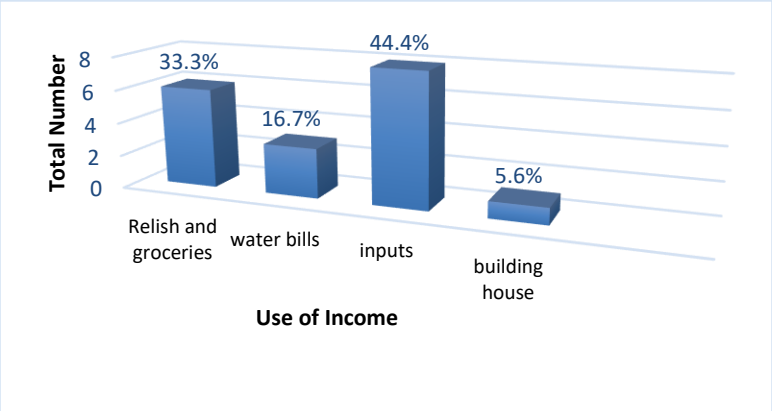

Fig. 12. A chart showing how money obtained from gardens is used

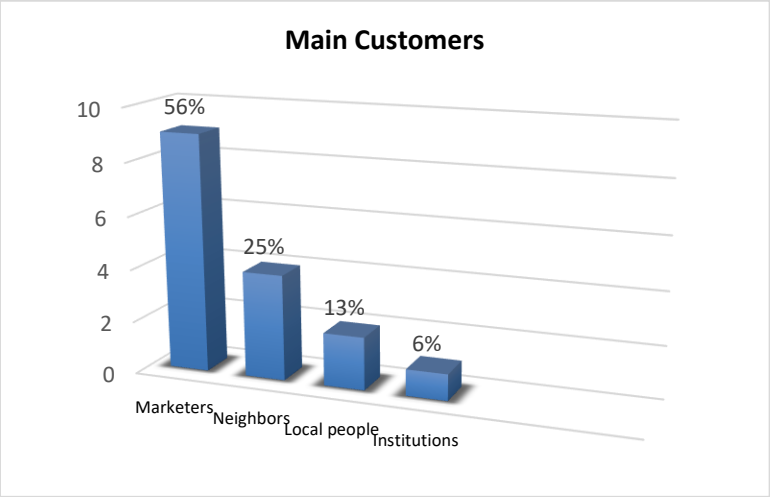

Fig. 13. Chart showing main customers of the garden produce

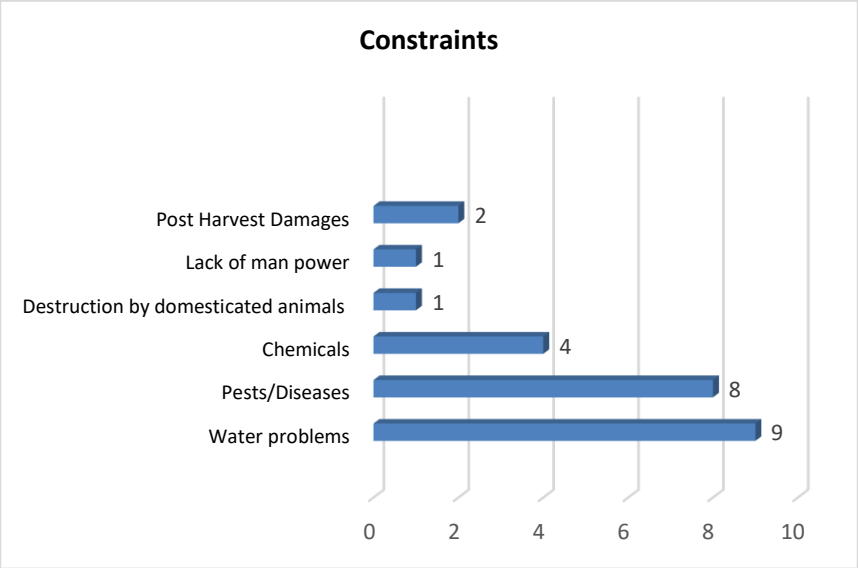

Fig. 14. Chart showing constraints encountered in the study area during research

Fig. 15. Selected captions from the study area; Chebelo Habowa

a: Eggplant (Solanum melongena)
b: Leaves acting as mulch on transplanted Spinach (Spinacia oleracea)
c: Spinach (Spinacia oleracea)
d: Onion intercropped with cabbage and bananas

Constraints: The study identified several challenges faced by smallholder farmers with home gardens in the Kabwe district (Fig. 14). Numerous constraints were discovered in the study area, as detailed below. Water-related issues, including high water bills and the drying up of wells, emerged as the most common constraint, exhibiting the highest frequency according to the graph. Pests and diseases were the second most frequent challenge reported by the respondents. Additional problems included a lack of chemicals for pest control, the destruction caused by domesticated animals such as chickens, insufficient manpower, and post-harvest damages to crops. Another significant constraint was the lack of extension services available to garden owners, with many respondents being unaware of what extension services were. These findings highlight the various obstacles that smallholder farmers in the Kabwe district must overcome to maintain and improve their home gardens.

4. DISCUSSION

The challenges faced by smallholder farmers with home gardens in the Kabwe district are consistent with findings from recent studies on agricultural constraints in similar settings. Water issues, such as high-water bills and wells drying up, emerged as the most common and significant problems. This aligns with research by Elfrida et al. [9] and Thamilini et al. [10] which highlights water access as a major constraint for small-scale farmers in Sub-Saharan Africa, exacerbated by unreliable rainfall and inadequate irrigation infrastructure. High water bills add a financial burden, as noted by Ethridge [11] and Santos et al. [5], who emphasize the need for affordable water supply solutions to support sustainable agricultural practices.

Pests and diseases were identified as the second most frequent challenge. Park et al. [12] discuss the substantial impact of pests and diseases on food security in Sub-Saharan Africa, advocating for integrated pest management (IPM) strategies. The lack of chemicals compounds this issue, making it difficult for farmers to control infestations effectively [13].

Crop destruction by domesticated animals, such as chickens, is another common problem in rural farming communities. Saaka et al. [14] and Whitney et al. [15] emphasize the importance of measures to protect crops from livestock, including better fencing and community-based management practices. Manpower shortages also hinder agricultural productivity. According to Thondhlana and Ruwanza [16] labor shortages in rural areas result from migration, aging farming populations, and the lack of youth engagement in agriculture. Addressing these issues requires policies that promote rural employment and support labor-saving technologies.

Post-harvest losses significantly affect food availability and farmer incomes. Ibarra et al. [17] suggest that these losses can be mitigated through improved storage facilities, better handling practices, and the introduction of post-harvest technologies. Lastly, the lack of extension services is a critical issue preventing farmers from accessing vital information and support. Sharma et al., [18] highlight the importance of extension services in disseminating knowledge and best practices, suggesting increased investment in agricultural extension programs to enhance farm productivity and resilience.

The level of education significantly impacts the adoption and success of home gardens in Africa, as highlighted by several recent studies [19]. Education influences a farmer's ability to access, understand, and implement agricultural innovations and best practices, which are crucial for the successful management of home gardens.

A study by Santos et al. [5] found that educated farmers are more likely to adopt improved agricultural techniques and innovations. This is because education enhances their ability to process information, utilize new technologies, and adopt sustainable farming practices. Educated farmers can better navigate agricultural extension services, seek out resources, and engage in community-based agricultural programs that support home gardening. Furthermore, Gebrehiwot et al. [20] demonstrated that higher education levels correlate with better farm management skills and increased productivity. Educated farmers are more likely to employ diversified cropping patterns and integrated pest management practices, which are essential for maintaining the health and productivity of home gardens [8]. This increased knowledge base also enables them to optimize the use of inputs such as fertilizers and water, leading to higher yields and improved food security.

In their research, Thamilini et al. [10] emphasize the role of education in enhancing farmers' market access. Educated farmers are more

capable of identifying market opportunities and negotiating better prices for their produce. This economic advantage is particularly important for home gardeners, who often rely on their gardens for both subsistence and supplementary income.

A study by Ramli et al. [21] also highlights that education facilitates the adoption of climate-smart agricultural practices. As climate change poses significant challenges to agriculture in Africa, educated farmers are better equipped to implement adaptive strategies that mitigate the adverse effects of climate variability on their home gardens. These strategies include water conservation techniques, soil management practices, and the use of drought-resistant crop varieties.

Additionally, Roy et al. [4] found that education plays a critical role in enhancing women's participation in home gardening. Educated women are more likely to engage in home gardening activities, which not only improves household nutrition but also empowers them economically and socially. This empowerment is crucial for fostering gender equality in agricultural communities [3].

Home gardens significantly enhance household food security by providing a consistent and diverse supply of fresh produce. According to a study by Nair et al. [3], home gardens contribute to food availability and nutritional diversity, which reduces household expenditure on food purchases. This is particularly crucial for smallholder farmers in Kabwe, who often face challenges in accessing affordable and nutritious food. By growing their own fruits, vegetables, and herbs, these farmers can save money that would otherwise be spent on purchasing food, thus improving their economic stability.

Additionally, home gardens serve as a source of supplementary income for smallholder farmers. A study by George and Christopher [1], and Rayol et al. [2] indicates that surplus produce from home gardens can be sold in local markets, providing farmers with extra revenue. This income can be used to meet other household needs, invest in farm improvements, or cover educational and healthcare expenses. In Kabwe, where economic opportunities may be limited, the ability to generate additional income from home gardens can significantly enhance the financial well-being of farming households.

Moreover, home gardens contribute to economic resilience by diversifying income sources and reducing dependency on a single crop or farming activity. This diversification is essential in mitigating the risks associated with crop failure or market fluctuations. According to Rajagopal et al. [22], home gardens enable farmers to cultivate a variety of crops, which not only improves dietary diversity but also spreads economic risk. In the context of Kabwe, where farmers might be vulnerable to environmental and market shocks, home gardens provide a reliable safety net.

Home gardens also promote the efficient use of available resources, leading to cost savings and increased productivity. A study by Huai and Hamilton, [23] highlights that home gardens often utilize organic waste for composting, reducing the need for chemical fertilizers and lowering input costs. This practice enhances soil fertility and crop yields, thereby improving the overall productivity and profitability of smallholder farms in Kabwe.

Furthermore, home gardens can contribute to women's economic empowerment. According to Panyadee et al. [24], women in many African communities are primarily responsible for managing home gardens. By engaging in home gardening, women can generate income and contribute to household financial decisions. This economic empowerment has broader social benefits, including improved gender equality and better outcomes for children's health and education.

Lastly, home gardens foster community economic development through local trade and the sharing of agricultural knowledge and resources. A study by Hensel, et al. [13] found that home gardeners often exchange seeds, seedlings, and farming techniques, which enhances social cohesion and collective economic resilience. In Kabwe, such community-based interactions can strengthen local economies and improve overall agricultural practices.

Moreover, home gardens contribute to household savings by reducing the need to purchase food. According to Korpelainen [25], home gardens improve food security and reduce household expenditure on food. For smallholder farmers in Kabwe, this means that the money saved on food can be redirected to other essential needs such as education, healthcare, and farm investments. The consistent supply of diverse and nutritious food from home gardens ensures that families are less reliant on market

purchases, thereby enhancing their economic stability.

Home gardens also provide opportunities for value addition and entrepreneurial activities. A study by Thamilini et al. [10] indicated that farmers can engage in processing and preserving surplus produce, such as drying vegetables and fruits or making jams and pickles. These value-added products can be sold at higher prices, further increasing household income. In Kabwe, smallholder farmers who engage in such activities can create small-scale enterprises that contribute to their financial resilience and economic growth.

Additionally, the cultivation of high-value crops in home gardens can significantly boost household income. Research by Santos et al. [5] found that the introduction of high-value horticultural crops in home gardens led to increased incomes for smallholder farmers in various African regions. In Kabwe, farmers who grow high-demand crops such as tomatoes, peppers, and leafy greens can take advantage of local market demands, thereby enhancing their profitability.

Home gardens also support economic diversification, which is crucial for mitigating risks associated with climate variability and market fluctuations. According to Varah [26], home gardens enable farmers to diversify their agricultural activities, reducing their dependence on a single income source [27,28]. For smallholder farmers in Kabwe, this diversification helps to spread economic risks and ensures a more stable income throughout the year. In Kabwe, the collective impact of multiple home gardens contributes to the local economy by supporting market activities, creating employment opportunities, and fostering community-based trade.

5. CONCLUSION AND RECOMMENDATIONS

The findings of this study highlight the significant socio-economic role of homegardens in Kabwe District, Zambia. With 67% of households owning homegardens, these small-scale agricultural systems are a vital source of food, income, and livelihood diversification for local communities. Homegardens contribute approximately 78% of household income, ranging from ZMK100 to ZMK3,000 per household. However, this income is primarily used for purchasing inputs for the next farming season, indicating that production is not on a large commercial scale. The study identifies several constraints faced by homegarden owners, including water bills, pests and diseases, and lack of extension support, which hinders their ability to maximize the potential of these systems. To address these challenges, the government, NGOs, and development agencies needs to collaborate and provide the necessary support for the growth and sustainability of homegardens. Increased investment in extension services and capacity-building programs is crucial to improve homegarden owners' knowledge and skills in sustainable agricultural practices, pest and disease management, and post-harvest handling. Facilitating access to affordable and quality agricultural inputs, such as seeds, fertilizers, and tools, can help increase productivity. Additionally, establishing reliable market linkages and providing market information can help homegarden owners sell their products at fair prices. Policies that recognize the importance of homegardens and provide targeted support, such as subsidies, tax incentives, or land tenure security, can further promote the growth and sustainability of this sector. The socioeconomic function of home gardens in Kabwe District can be further improved, enhancing the general resilience and well-being of local communities, by putting these ideas into practice and offering comprehensive support to home garden owners.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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