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## SMALLHOLDER MAIZE FARMING IN ZAMBIA: A SYSTEMATIC REVIEW OF CHALLENGES AND OPPORTUNITIES

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## ABSTRACT

Agriculture remains a key priority sector in many developing countries, serving as the backbone of their economies and providing livelihoods for a significant portion of the population. In Zambia, agriculture plays a crucial role in ensuring food security, generating employment, and fostering rural economic development. Smallholder farmers dominate the Zambian agricultural landscape, primarily engaging in maize production, which is the country's staple food. The smallholder maize farmers play a crucial role in ensuring food security, creating employment opportunities, and contributing to rural development. Despite their important role to food security and economic growth, smallholder maize farmers in Zambia have consistently struggled with low productivity over the years, even though a substantial part of the agricultural budget is dedicated to maize support. Understanding the challenges faced by smallholder maize farmers and identifying opportunities is essential to unlocking their potential, boosting yields, and improving livelihoods across rural communities. This paper explores the challenges and opportunities encountered by smallholder maize farmers in Zambia. Relying on secondary sources through a systematic literature review, including academic literature, agricultural reports, and publications from research institutes and private organizations from 2013 to 2023, the study employs thematic analysis using NVivo software to interpret the data. Key themes of challenges identified include; limited access to finance, inadequate farming inputs, limited market access, fluctuating maize prices, climate change impacts, inadequate extension service, and poor infrastructure. Conversely, opportunities such as the adoption of climate-smart agriculture, increased funding towards agricultural program initiatives, and regional market opportunities can be leveraged to enhance the productivity and sustainability of smallholder maize farming. Understanding these dynamics enables policymakers, researchers, and stakeholders to devise strategies and interventions that enhance the resilience and productivity of smallholder maize farming in Zambia. This paper contributes to the existing literature on smallholder farming and offers insights for sustainable smallholder maize farming in Zambia and similar contexts.

**Key words:** Agriculture, smallholder maize farmers, challenges, opportunities, thematic analysis, Zambia



## INTRODUCTION

Agriculture is a priority sector in Zambia, contributing to sustainable economic growth, food security, and poverty reduction. At the heart of this sector is maize, the cornerstone of Zambia's agriculture and a vital source of food security for the nation [1]. Maize is cultivated by approximately 90% of smallholder farmers, making it a critical factor in shaping the livelihoods of rural households [2, 3]. Smallholder maize farmers are essential to national food security, job creation, rural livelihoods, and overall economic development [4]. This underscores why a significant portion of Zambia's agricultural budget is allocated to supporting smallholder maize farming.

Smallholder maize farmers in Zambia receive significant support from the government through initiatives such as the Farmer Input Subsidy Programme (FISP) and the Food Reserve Agency (FRA) [5, 6]. The FRA is government's maize trading arm which plays a crucial role in smallholder maize farming by offering a guaranteed market for surplus maize, especially in remote areas with limited private trader activity [2, 7]. On the other hand, the FISP program was designed to provide smallholder maize farmers with essential inputs, such as fertilizers and seeds, at subsidized rates. This subsidy program aims to boost maize production and enhance food security among smallholder maize farmers [8].

Despite the ongoing support provided to smallholder maize farmers, their performance has remained sub-optimal in recent years [9]. These farmers encounter numerous challenges that hinder their growth and sustainability. Continuously highlighting these challenges and identifying how to capitalize on available opportunities is crucial, not only for the smallholder maize farmers themselves but also for achieving food security in Zambia.

This paper seeks to explore the challenges and opportunities faced by smallholder maize farmers in Zambia, utilizing existing literature. The study employed NVivo software to analyse the data thematically, enabling the identification of key patterns and insights related to the topic. Through a review of literature, agricultural reports, and policy documents related to agriculture, this study highlights the challenges and opportunities faced by smallholder maize farmers in Zambia, providing insights for practitioners, policymakers, and stakeholders.

## MATERIALS AND METHODS

This study employed a systematic approach to address the research objective. Systematic reviews are defined by a planned and structured approach to reviewing published material, utilizing organized and replicable methods to identify, select, and assess literature [10]. The systematic literature review employed academic literature, agricultural reports, and publications from research institutes and private



organizations, with data analysed using thematic analysis in NVivo software. To conduct this study, we followed the five steps outlined in Di Domenico *et al.* [11] research which are: question formulation, locating studies, study selection/evaluation, analysis/synthesis, and reporting/using results.

### Question Formulation

The first step in this study involved formulating the research question: What are the challenges and opportunities for smallholder maize farmers in Zambia? This question guided the subsequent stages of the research, helping to focus our analysis on the issues faced by this group and the potential avenues for improvement.

### Locating Studies: Search strategy

A search was conducted using Scopus and Google Scholar to gather relevant research articles, as these platforms provide access to a wide range of peer-reviewed journals and diverse sources [11]. Scopus was chosen because it provides a large collection of high-quality, peer-reviewed journals, providing reliable and credible research. Google Scholar was selected due to its broad indexing of both peer-reviewed journal articles and grey literature which are important for capturing a wide range of studies relevant for the study at hand. Other studies, particularly within the agricultural field have similarly utilized Google Scholar as a resource when conducting their research [12, 13]. The search in both databases began with broad keywords such as "smallholder farmer," "agriculture," and "Zambia" targeting a period of 10 years from 2013 to 2023. The search employed three broad keywords to keep the research results as broad as possible [14].

### Study Selection Criteria: Inclusion, Exclusion, and Evaluation

The initial search in Scopus using broad keywords yielded 70 articles, from which 11 potential articles were identified after reviewing the titles and abstracts. In contrast, the search in Google Scholar generated a significantly larger volume of results, which is typical due to its limited filtering capabilities. The first 1,000 items were considered after being ranked by relevance in Google Scholar, ultimately culminating in a narrowed selection of 220 potential articles that aligned with the scope of our research. Mizik [13] used a similar approach, restricting his search results to the first 100 items on Google Scholar ranked by relevance before refining the selection. Subsequently, the search was refined using inclusion and exclusion criteria to exclude studies not directly aligned with the research focus, ensuring that only articles that help us meet our research objective on the challenges and opportunities of smallholder maize farming in Zambia were included. Table 1 presents the inclusion criteria applied in the study.

On the other hand, studies were excluded if: (i) they were conducted outside Zambia; (ii) did not help answer the research question; (iii) focused on other crops; (iv) were



conducted outside the selected time frame; (v) were review papers, working papers, dissertations. The screening process, guided by the criteria outlined above and after removing duplicates from the databases, resulted in the identification of 47 publications, which were then subjected to full text reading. Any publication that did not meet the criteria was excluded at this stage. Ultimately, only the papers that helped to answer the research question were included, resulting in 16 publications. In addition to the articles obtained from the two databases, 16 additional publications were sourced from other sources. These added grey literature was assessed based on the timeliness of the articles, their relevance to the study's scope, and the credibility of the sources [11]. Figure 1 depicts the sequential steps involved in the research process.

### Analysis

All the selected publications which made the final sample were imported into NVivo software for qualitative analysis. The data was analysed thematically, which involved familiarization of the collected publications, generating initial codes based on recurring patterns, and then developing broader themes related to the challenges and opportunities of maize farming in Zambia [15].

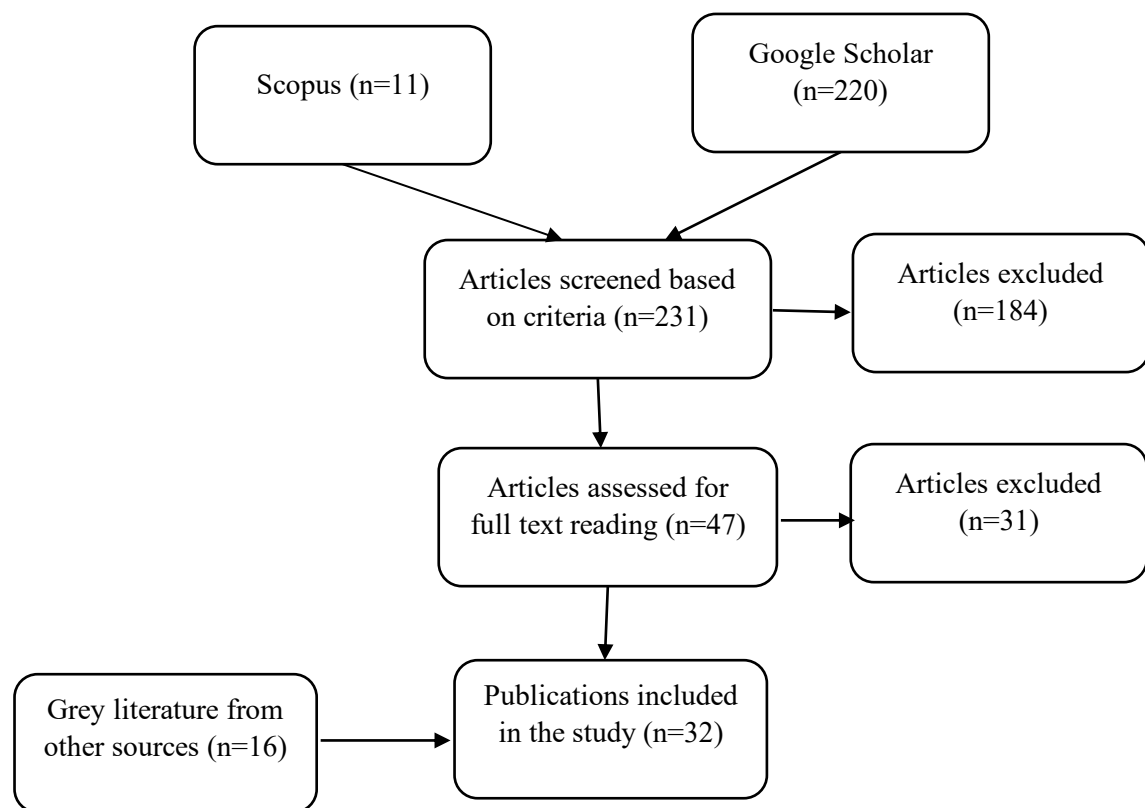


Figure 1: Flow diagram for the research process



## RESULTS AND DISCUSSION

This section discusses the challenges and opportunities related to smallholder maize farming drawing insights from literature focused on maize production in Zambia. This section begins by outlining the key challenges faced by smallholder maize farmers, followed by an exploration of the available opportunities.

### Challenges

Common themes that emerged from the study regarding smallholder maize farming challenges in Zambia include; impact of climate change, limited access to finance, limited access to markets, limited access to inputs, inadequate extension services, and poor road infrastructure.

### Impact of Climate Change

Climate change and variability represent one of the major challenges for smallholder maize farming in Zambia [16, 17, 18]. Over the recent years, Zambia has experienced frequent rainfall anomalies and droughts, particularly in the southern and central regions, leading to significant declines in maize yields [19]. Moreover, empirical evidence suggests that by 2050, rainfall in Zambia could decrease by 0.87%, with the southern and western regions being the hardest hit [5, 20]. Unfortunately, in Zambia, maize is predominantly grown under rainfed conditions from December to April, making it highly susceptible to climate change and variability [4, 16]. It is evident that rainfall variability has a profound impact on maize farming, as fluctuations in weather conditions directly affect maize yields and productivity. For example, the 2018/2019 maize farming season was significantly impacted by climate variability, leading to a significant decline in maize production [4]. Conversely, favourable rainfall patterns during the 2019/2020 agricultural season led to an increase in maize production, rising from 3,387,469 MT in 2019/2020 to 3,620,244 MT in 2020/2021, reflecting a 7% growth [16]. The annual fluctuations in maize yields reflects these climatic hazards of dry spells and floods experienced especially in the southern and northern parts of Zambia, respectively [4]. Unfortunately, smallholder maize farmers have limited access to irrigation technology making it difficult for them to mitigate the effects of climate change and sustain consistent production levels [16].

### Finance Factors

Financial factors represent significant obstacles for smallholder maize farmers in Zambia. The finance related factors can be explained as follows:

Limited access to finance remains a major hurdle for smallholder maize farmers in Zambia. These farmers face significant barriers in accessing formal financial services such as savings and credit. In 2017, only 8% of agricultural credit was



directed toward smallholder farmers, while 85% went to commercial farmers [22]. Since maize smallholders dominate the smallholder farmer category by 90% Zambia [1], it can be deduced that they represent a significant proportion of those affected by limited access to agricultural credit. Lending institutions cite the high risk associated with smallholder farming as a major concern, which has restricted their willingness to offer financial services to this category of farmers [22, 23]. Furthermore, smallholder maize farmers are often considered uncreditworthy, exacerbating their difficulties in accessing essential financial resources [24].

### Limited Farming Inputs

Linked to the lack of finance is limited access to farming inputs. Smallholder maize farmers in Zambia struggle to obtain essential inputs, such as maize seeds and fertilizers, due to their financial constraints. Rising costs of these inputs significantly increase the expenses associated with maize production [25]. Through the FISP program, smallholder maize farmers can access maize seeds and fertilizers at subsidized rates, improving their access to essential farming inputs. However, FISP faces its own challenges, including poor targeting and delays in government funding that hinder timely input distribution [9, 26]. While the program is beneficial, it has also contributed to a dependency syndrome among smallholder farmers, as few participants graduate from the program. Many farmers expect to receive inputs season after season, perpetuating this reliance [26]. Additionally, some smallholder maize farmers are excluded from accessing FISP due to the program's requirements, such as membership in a cooperative and the obligation to pay a percentage of the input costs [27].

### Market Factors

The study reveals that smallholder maize farmers in Zambia face market-related challenges, including limited market access and fluctuating maize prices.

### Limited Market Access

Smallholder maize farmers often face significant challenges in accessing markets for their produce [1]. A study conducted across six districts in Zambia by Makondo *et al.* [25] identified market accessibility as one of the obstacles for smallholder maize farmers trying to sell their surplus. Similarly, Umar *et al.* [9] found that low market participation among these farmers is primarily due to high transaction costs. The expenses involved in finding buyers, negotiating prices, and transporting their produce make market access difficult. Consequently, many farmers are forced to sell their maize at low prices to local middlemen. In some instances, they risk being defrauded, receiving no payment for their produce from dishonest buyers [25]. Conversely, some smallholder maize farmers choose to sell to local milling companies for better prices and immediate cash, avoiding the delayed payments often associated with the FRA, despite the FRA being the dominant buyer [2, 9].



### **Fluctuating Maize Prices**

In addition to limited market access, smallholder maize farmers often face significant uncertainties regarding maize prices [9, 28]. In many cases, the government, through the FRA, and millers determine the selling price of maize [25, 29]. For example, the FRA sets both the quantity and floor price at which maize will be purchased each season, and occasionally, the price is above market rates [4, 16, 29]. However, smallholder farmers have little to no influence over these prices, which are often insufficient to cover their production costs [25].

### **Inadequate Extension Services**

Inadequate extension services pose as another challenge for smallholder maize farmers in Zambia [25, 28]. A study by Umar [9] revealed that most smallholder maize farmers reported a lack of adequate extension services in their areas. While many extension programs target smallholder maize farming, these services often remain insufficient and difficult for the farmers to access. On average, smallholder maize farmers must travel approximately 14.2 km to reach extension workers, making it harder for them to seek timely advice [30]. The inadequacy of extension services can be attributed to consistently low budget allocations for agricultural extension over the past decade, which has significantly reduced both the quality and accessibility of these services [16].

### **Poor Road Infrastructure**

Smallholder maize farmers in Zambia encounter challenges related to the poor state of infrastructure in the rural areas where they primarily operate. Key maize production regions, particularly Agro-ecological Zones I and II, are plagued by poor road conditions, with many routes either impassable or, when passable, characterized by substandard bridges [25]. The poor state of infrastructure is further highlighted by the average distances of 30.2 km to reach a tarred road and 1.9 km to access a feeder road in rural areas [30]. This poor road infrastructure severely hampers the movement of both produce and essential inputs for smallholder maize farmers. This challenge not only increases transportation costs but also threatens the economic viability and sustainability of smallholder maize farming in Zambia.

### **Opportunities**

While smallholder maize farmers in Zambia encounter various challenges, there are also promising opportunities that can foster growth and sustainability in their farming practices. This section highlights the opportunities available to smallholder maize farming in Zambia, including increased government support, the adoption of climate-smart agriculture, and access to regional market opportunities.





## Climate-Smart Agriculture Practices

Climate-smart agriculture practices have been touted as playing a key role in climate change mitigation for smallholder maize farming. Kuntashula *et al.* [31] revealed that CSA practices such as minimum tillage and crop rotation mitigated the adverse effects of climate variability, increasing maize productivity by 26% and 21%, respectively. Similarly, Umar [18] found in a study conducted in Eastern Province that smallholder maize farmers practicing conservation agriculture experienced improved yields. Despite its benefits, the adoption of CSA among smallholder maize farmers remains low [31, 32]. This could be attributed to challenges cited by some smallholder maize farmers, including labour intensity, high weed pressure, and substantial time requirements [18, 33].

There is a need to enhance the adoption of CSA among smallholder maize farmers by offering continuous, targeted training and support to facilitate the transition to these practices. Additionally, subsidizing or enhancing access to small-scale mechanization tools can reduce labour demands, while offering financial incentives like grants or tax relief for the farmers who adopt CSA can be a motivation for them to implement CSA practices.

Furthermore, the promotion of cost-effective technologies, such as simple irrigation systems, can enhance the viability of CSA. Zambia has immense irrigation potential due to its significant share of surface and underground water resources [28, 34]. Effective irrigation allows smallholder maize farmers to mitigate the impacts of erratic rainfall and ensure consistent water supply for their maize production. With appropriate assistance, smallholder maize farmers could adopt affordable irrigation technologies that would enable them to increase their maize yields and reduce their dependency on rainfed maize farming. Ultimately, by fostering greater awareness and accessibility, promoting CSA not only presents opportunities to improve maize yields but also serves as a vital response to the pressing challenges posed by climate change.

## Government Supportive Initiatives

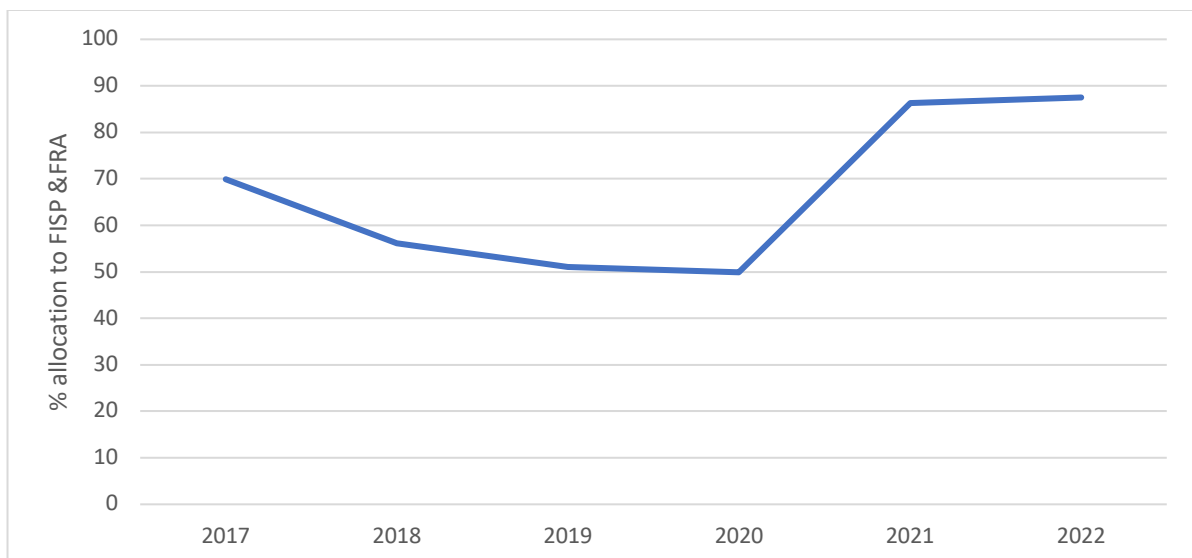
Government supportive initiatives such as various tax incentives, increased funding for maize production programs, and funding avenues available through the Constituency Development Fund (CDF) can be viewed as opportunities for smallholder maize farming. These initiatives can significantly enhance the productivity and financial stability of smallholder maize farmers, helping them overcome some of challenges they face.

## Increased Funding for Maize Production Initiatives

Despite facing numerous challenges, the government programs such as FISP and FRA can be considered among the largest agricultural support initiatives, particularly



for smallholder maize farming [28]. These programs offer an opportunity to boost the productivity and improve livelihoods of smallholder maize farmers by providing affordable inputs and reliable market access. The FISP assists smallholder farmers by providing subsidized farming inputs, such as maize seeds and fertilizers, while FRA ensures market access by purchasing their maize produce. The combined impact of FISP and FRA fosters increased maize production while offering smallholder maize farmers a platform to commercialize their produce [7]. The provision of subsidized inputs through FISP, coupled with FRA's guaranteed market access, creates an environment where smallholder maize farmers can move beyond subsistence farming, potentially transitioning to more commercialized, income-generating agriculture. It can be noted that there has been a significant increase in funding allocated to both the FRA and FISP, as illustrated in the figure below.



**Figure 2: Percentage allocation of agriculture budget for FISP & FRA (2017- 2022)**

This growing financial support reflects the government's commitment to bolstering maize productivity and market access for smallholder maize farmers. However, the challenges associated with FISP, such as delays in input distribution and the exclusion of some smallholder maize farmers due to eligibility requirements, need to be addressed. These obstacles limit the reach and effectiveness of the programs, highlighting the need for reforms to ensure more inclusive and timely support. Research indicates that smallholder maize farmers who received input support cultivated more land and achieved higher productivity than those without it [34]. However, some critics contend that the effectiveness of FISP is limited, arguing for the need to downsize the program and redirect the savings toward other initiatives such as extension services [27].

## Tax Incentives

The government's removal of customs duties on agricultural equipment and a 20% capital expenditure allowance for farm improvements provide an important opportunity to address challenges faced by smallholder maize farmers in Zambia [35]. Although these incentives are designed for the broader agricultural sector, they have the potential to directly benefit smallholder maize farmers, particularly in addressing limited access to irrigation. As most smallholder maize farmers rely on rain-fed agriculture, they remain vulnerable to erratic weather patterns exacerbated by climate change. The zero-rating of equipment like sprinklers and sprayers offers a critical chance for farmers to adopt irrigation technologies, reducing rainfall dependency and improving yields [16, 35].

## Constituency Development Fund

The Constituency Development Fund (CDF) offers an opportunity to tackle the challenge of limited financial resources experienced by smallholder maize farmers, especially given the dramatic increase in its funding. The CDF was first introduced in 1995 to promote local development in both rural and urban areas [36]. While the focus of the CDF is certainly broad and encompasses various developmental projects, it offers a valuable opportunity for smallholder maize farmers in Zambia to access funding and resources that can enhance their agricultural productivity and sustainability.

One component of the CDF is its empowerment programs, which provide seed grants or loans to individuals or cooperatives to stimulate growth [37]. This presents an opportunity to smallholder maize farmers to organize themselves into cooperatives, allowing them to access funding that can help them purchase essential farming inputs, such as maize seeds and fertilizers. Grants or loans obtained through the CDF can help alleviate the challenges of limited access to finance and insufficient farming inputs faced by smallholder maize farmers. Additionally, funds accessed via CDF can be used for initiatives such as irrigation systems and CSA practices, enabling them to effectively address the impacts of climate change. Furthermore, the increased allocation for the CDF can be expected to enhance rural infrastructure, such as roads, which will further benefit farmers such smallholder maize farmers by improving the transportation of inputs and produce to markets.

## Regional Market Opportunities

The growing demand for maize within the regional markets presents significant opportunities for smallholder farmers to expand their reach and enhance their profitability. It can be noted that many of Zambia's neighbouring countries frequently face deficits in maize production. This trend indicates a rapidly growing market for



maize in neighbouring countries, particularly in the Democratic Republic of Congo, where demand is on the rise [4, 9, 38].

Participation in cross-border markets involves the Zambian government regulating maize exports through a range of restrictions. While these export limitations are intended to safeguard the country's food security, they also carry an opportunity cost in terms of lost export revenue for both the government and smallholder maize farmers [17, 38]. Various authors agree that measures to protect national food security should not undermine Zambia's ability to export its surplus maize to neighbouring countries [24, 38]. They emphasize the need for a transparent and consistent export policy. It can be argued that, although smallholder maize farmers may lack the capacity to export individually, collective efforts through associations such as cooperatives could enable them to access international markets and benefit from increased revenue [35].

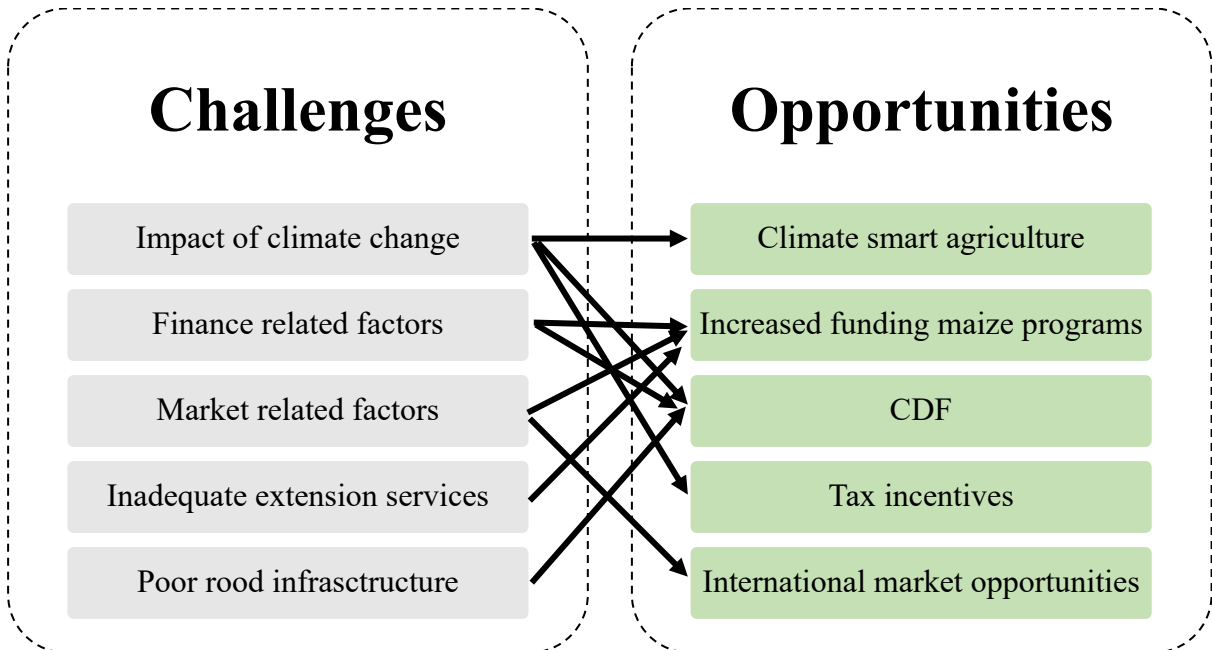
### Word Cloud Visualization of key Themes

The word cloud generated from the NVivo software provides a visual representation of the most frequently occurring terms in the dataset, emphasizing key themes related to the topic. As shown in figure 3 below, the prominence of terms "Zambia," "maize," and "smallholder" reflect the core focus of this research on smallholder maize farming in Zambia. Additionally, the prominence of words such as "irrigation," "FISP," "market," "price," "government," "fertilizer," "inputs," and "cooperative" in the word cloud can be linked to some of the key challenges and opportunities identified in the study. These terms reflect issues like limited access to farming inputs, government support programs, market access, and the role of cooperatives in strengthening smallholder maize farming. The inclusion of "irrigation" alongside these terms also emphasizes the importance of addressing climate change.



Figure 3: Word cloud generated from NVivo software

The figure below presents a summary of the challenges and opportunities and their interconnectedness.



**Figure 4: Summary of challenges, opportunities, and their interconnectedness**

## CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

Smallholder maize farming is vital to Zambia's agricultural sector, contributing significantly to food security, employment, and rural development. This study identifies challenges faced by smallholder maize farmers, including limited access to finance, limited market access, inadequate extension services, poor road infrastructure, and climate change impacts, which hinder productivity. However, it also highlights opportunities such as government initiatives through enhanced funding for the Farmer Input Support Program (FISP) and the Food Reserve Agency (FRA), Constituency Development Fund (CDF) opportunities, agricultural tax incentives, and regional market prospects.

Many challenges faced by smallholder maize farmers can be addressed by leveraging opportunities in their external environment. Increased funding through the CDF could alleviate financial constraints and enhance rural infrastructure. By allocating a portion of CDF resources to support smallholder maize farmers, access to affordable loans could be improved, enabling them to purchase essential inputs in a timely manner. This would reduce their reliance on the FISP. Additionally, CDF funds could be utilized to upgrade rural infrastructure, facilitating easier access to farming inputs and distant markets. Additionally, the government and stakeholders should prioritize the development of customized financial products that are



affordable and accessible to smallholder maize farmers, offering lower interest rates and reasonable collateral requirements.

To combat limited market access, smallholder maize farmers should be encouraged to engage in collective action, such as forming cooperatives, to enhance their bargaining power when selling produce. By pooling resources, they can reach larger markets even beyond their immediate environment and negotiate fair prices while sharing transportation costs. Furthermore, increasing the recruitment and training of extension officers is crucial for providing farmers with necessary guidance and technical knowledge, especially in the face of climate change challenges. Promoting climate-smart agricultural practices and adopting irrigation technology, can help mitigate the effects of climate change. Collaborating with development partners to invest in large-scale irrigation systems will support smallholder maize farmers who depend on rain-fed agriculture. Overall, a concerted effort among stakeholders is essential to develop targeted interventions that enhance the productivity and sustainability of smallholder maize farming in Zambia.

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### **CONFLICT OF INTEREST**

The authors of this paper declare that there is no conflict of interest in relation to this work.



**Table 1: Inclusion Criteria**

Criteria	Justification
Scopus; Google scholar	wide accessibility and extensive indexing of peer reviewed scholarly articles, policy papers, and reports
Published between 2013 and 2023	Include recent and relevant studies
Publications focused on smallholder maize farming in Zambia	Capture studies relevant to the local context
Were available in full-text and written in English	Language understood by the authors



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