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The Impact of Agricultural Input Subsidies (FISP) on Maize Productivity and Income of Women Farmers in Zambia's Southern Province: Comparative Analysis

MASTER'S THESIS

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Anthony Ofosu Danso

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To God be the Glory who makes all things beautiful in His time.

Abstract

This thesis examines the impact of the Farmer Input Support Programme (FISP) on the maize productivity and maize farm income of women farmers in Zambia's Southern Province, while also assessing whether women and men benefit equally from the programme. Introduced in 2002, FISP has remained a central agricultural support programme in Zambia, aimed at improving smallholder maize productivity, raising rural incomes, and strengthening food security, yet women farmers still face barriers to accessing subsidized inputs, productive resources, and output markets Using cross-sectional survey data from four districts in Southern Province; Choma, Monze, Kalomo, and Pemba, the study applies a non-experimental analytical design to two subsamples: 131 women farmers (76 beneficiaries and 55 non-beneficiaries) and a pooled beneficiary sample of 234 farmers (76 women and 158 men). Probit estimation is used to identify the determinants of women's participation in FISP, while propensity score matching and linear regression are employed to estimate programme effects and assess gender differences in maize productivity and maize farm income. The findings show that access to extension services significantly improves women's likelihood of participating in FISP. The results further indicate that participation in the programme has positive, statistically significant effects on women's maize productivity and farm income, suggesting that subsidy support can improve women's agricultural performance when barriers to land, credit, extension services and market access are reduced. Although male beneficiaries report higher maize income, the findings suggests this difference is largely associated with inequalities in access to productive resources, scale-related advantages, and stronger market participation rather than lower female productivity. The study, therefore, implies that the effectiveness of FISP depends not only on input provision but also on whether the structural constraints limiting women's access to land, livestock, and markets are fully addressed. The study recommends strengthening extension service delivery, improving women's access to productive resources, and promoting their integration into output markets. It also recommends that subsidy design pay closer attention to gender differences in resource control and commercialisation to achieve more equitable and sustainable gains from agricultural support programmes overall.

Keywords: FISP, input subsidies, women farmers, maize productivity, Zambia.

Contents

List of tables

List of figures

List of the abbreviations used in the thesis

AIC – Akaike Information Criterion

ATT – Average Treatment Effect on the Treated

ATU – Average Treatment Effect on the Untreated

BIC – Bayesian Information Criterion

e-FISP – Electronic Farmer Input Support Programme

FISP – Farmer Input Support Programme

GDP – Gross Domestic Product

ha – hectare

kg/ha – kilograms per hectare

LR – Likelihood Ratio

N – Sample size

PSM – Propensity Score Matching

R^2 – R-squared (coefficient of determination)

SACCO – Savings and Credit Cooperative

SD – Standard Deviation

VSLA – Village Savings and Loan Association

ZMW – Zambian Kwacha

χ^2 – Chi-square

1.1 Introduction

Agricultural input subsidies are widely recognized as important policy instruments for improving agricultural productivity, food security, and rural livelihoods, particularly in developing countries (Li et al., 2022; Alawode, 2025). By reducing the cost of fertilizer, improved seed, and other essential farm inputs, such programmes help smallholder farmers overcome liquidity constraints that often limit technology adoption and production efficiency (Dhillon & Moncur, 2023). Across Sub-Saharan Africa, input subsidy programmes have remained central to agricultural policy because of their potential to raise farm output and contribute to broader rural development (Kanza et al., 2022).

In Zambia, agriculture remains a major sector of the economy, employing about 70% of the population and contributing roughly one-fifth of gross domestic product (World Bank, 2020). Within this policy environment, the Farmer Input Support Programme (FISP) has become an important agricultural support instrument for improving smallholder maize productivity, raising rural incomes, and strengthening food security (Walls et al., 2023). Implemented through the Ministry of Agriculture, district agricultural offices, and farmer cooperatives, the programme provides subsidized maize seed and fertilizer to eligible farmers through a structured distribution system (Nguni & Haabazoka, 2024). Although previous studies suggest that FISP has contributed to higher maize production and income, concerns remain regarding targeting inefficiencies, implementation delays, and unequal access among farmers (Kuteya et al., 2025; Chirambo, 2024).

These concerns are particularly important for women farmers. In Zambia, women make a substantial contribution to agricultural production, yet they continue to face structural barriers in accessing land, credit, subsidized inputs, extension services, and output markets (Fredrick et al., 2025; Balas et al., 2022). Evidence cited in this study shows that 59% of employed women in Zambia are engaged in agriculture, and women account for more than 60% of female employment in the country (Sichoongwe, 2025). Despite this central role, women often have weaker control over productive resources and over decisions relating to agricultural production and income use. As a result, subsidy programmes intended to improve productivity may still reproduce existing inequalities if women are unable to participate on equal terms. This issue extends beyond production because women are more likely than men to direct agricultural income toward household welfare, child nutrition, and long-term family wellbeing (Soh Wenda et al., 2024).

Southern Province provides an important context for examining these issues. As Zambia's primary maize-growing region, it contributes over 40% of national maize output and plays a major role in food security and market supply (De Groote et al., 2023). Yet women remain underrepresented among programme beneficiaries in the province. Evidence cited in this thesis shows that only 14% of FISP beneficiary households in Southern Province were female-headed, compared with 86% that were male-headed, while national statistics place female-headed programme households at 20% (Mulungu & Kabwela, 2025; Umar, 2024). This pattern reflects broader structural constraints, including limited land rights, weaker access to credit, and reduced control over productive resources, which continue to restrict women's ability to benefit fully from subsidy support (Mwalupaso et al., 2025).

Despite the widespread implementation of FISP in Zambia, the literature still leaves three important issues insufficiently addressed. First, existing studies have focused more on programme participation, access to inputs, or general productivity effects than on the combined effects of subsidy support on both maize productivity and maize farm income (Alawode, 2025; Iyioku et al., 2025). Second, although gender disparities in agricultural support are increasingly acknowledged, gender is often treated as a background characteristic rather than as a central analytical dimension shaping programme outcome (Ng'ombe et al., 2024; Kalindi et al., 2023). Third, limited empirical evidence exists for Southern Province, even though it is Zambia's most important maize-producing region and a key setting for understanding how FISP operates in practice. Consequently, it remains unclear whether input subsidy programmes help reduce gender disparities or whether their benefits are mediated by deeper inequalities in access to land, livestock, markets, and institutional support (Chanda et al., 2025; Kuntashula & Mwelwa-Zgambo, 2022).

This study addresses these gaps by conducting a comparative analysis of the impacts of FISP on maize productivity and maize farm income in Southern Province, Zambia, with particular attention to women farmers. It compares women beneficiaries with women non-beneficiaries and also compares female and male beneficiaries in order to assess whether subsidy access translates into different outcomes across gender. In doing so, the study contributes to policy debate on how agricultural support programmes can be made more effective, inclusive, and equitable in Zambia and similar Sub-Saharan African contexts.

1.2 Literature Review

This chapter critically reviews the institutional foundations and empirical evidence relating to the Farmer Input Support Programme (FISP) and its effects on maize productivity and maize farm income in Zambia's Southern Province. For the purpose of ensuring consistency in the review, the meaning of the terms 'FISP beneficiaries' shall refer to the farmers who benefit from the programme, while 'maize farm income' shall refer to the income generated from the farming of maize.

The chapter uses a gender-differentiated analytical approach in assessing these relationships, given that the availability of productive resources, decision-making powers, and income control may differ among farmers. It begins by looking at the structure of FISP's governance and operation, the theoretical framework of the analysis, the empirical evidence from Zambia, justification of variables, and the construction of a conceptual framework to guide the study

1.2.1 The Farmer Input Support Programme (FISP) in Zambia: Mechanism and Governance

The Farmer Input Support Programme (FISP) is one of the main agricultural policy instruments used by the Zambian government to support smallholder production and strengthen food security. Introduced in 2002, the programme emerged in response to the decline in fertilizer use and smallholder productivity that followed the liberalisation of agricultural input markets in the 1990s (Ndhlovu & Muchapondwa, 2025; Pletcher, 2000). FISP was therefore designed as a targeted subsidy programme to improve access to fertilizer and certified seed for resource-constrained smallholder farmers, especially those engaged in maize production, which remains central to Zambia's food system (Iyioku et al., 2025; Alawode, 2025).

The policy rationale underlying FISP is that subsidized access to key production inputs can relax liquidity constraints, increase input use, and improve agricultural productivity among smallholder farmers. Within Zambia's agricultural policy framework, the programme is intended not only to raise maize output, but also to support rural incomes and broader food security objectives (Kaoma & Mpundu, 2023; Walls et al., 2023). Although the level of subsidy and the form of delivery have varied across implementation cycles, the core principle has remained the same: government absorbs a substantial share of the cost of fertilizer and improved seed, while beneficiaries contribute a smaller farmer share (Alawode, 2025). This

logic is consistent with the view that temporary input support can help farmers overcome credit and market constraints and build productive capacity over time (Dorward, 2009).

FISP is expected to influence outcomes through a relatively clear causal pathway. Access to subsidized fertilizer and seed reduces the cost of production inputs, which can increase input use and improve maize yields per hectare. Higher yields, in turn, may translate into higher maize farm income, depending on output prices, market access, and the household's ability to commercialize production (Degefie et al., 2025). However, this transmission process is not automatic. Its effectiveness depends on complementary conditions such as timely input delivery, extension support, labour availability, and access to land and markets. This means that the same subsidy package may generate different outcomes across farmers depending on their resource base and institutional environment (Malimi, 2023).

FISP should therefore be understood not simply as a subsidy programme, but as a governance-based agricultural support mechanism whose effects are shaped by how access is organized, how inputs are distributed, and how implementation is managed in practice. In this respect, the programme's productivity and income effects depend not only on the quantity of subsidized inputs provided, but also on the institutional arrangements through which those inputs reach farmers. The administrative structure through which FISP operates is discussed in the following subsection.

1.2.2 FISP Institutional Structure

The institutional arrangement of the Farmer Input Support Programme (FISP) in Zambia is vertically coordinated but decentralized in implementation (Minah, 2022). At the national level, the ministry responsible for agriculture provides the overall policy direction, budgetary allocation, procurement guidelines, and regulatory oversight for the programme (Walls et al., 2023). It also determines the composition of the input package, the level of cost-sharing between government and farmers, and the annual scale of programme coverage within the broader agricultural policy framework. In this way, the national level defines the formal rules that govern how FISP is financed and implemented.

Below the national level, provincial and district agricultural offices play the main administrative role in implementation. Provincial offices supervise programme execution across districts, monitor compliance with policy guidelines, and consolidate administrative reporting (Nyirongo, 2024). District agricultural offices are more directly involved in

operational management, including beneficiary registration, verification of cooperative submissions, coordination with input suppliers, and communication regarding input collection and distribution schedules (Wanyonyi et al., 2024). These district-level structures are particularly important because they translate national policy into actual access at community level. At the same time, differences in administrative capacity across districts may affect how consistently the programme is implemented.

At the local level, farmer cooperatives serve as the principal interface between the state and programme beneficiaries. Cooperative membership often functions as the formal entry point into the programme, and cooperatives are typically responsible for compiling beneficiary lists, validating farmer eligibility, and organizing the collective receipt of subsidized inputs (Mwiinga, 2017; Blekking et al., 2021). The use of cooperatives reduces transaction costs and embeds programme delivery within existing rural organizational structures. However, it also gives cooperative leadership significant influence over the practical allocation of programme benefits. Where demand exceeds available input quotas, this local discretion can shape which farmers gain access and under what conditions.

The importance of the institutional structure lies in the fact that access to FISP is mediated through several governance layers rather than through a direct relationship between the state and individual farmers. As a result, programme participation is influenced not only by formal eligibility criteria, but also by the functioning of provincial offices, district administrations, and cooperative leadership. This makes the institutional structure analytically important because it affects who is identified as a beneficiary, how efficiently inputs are delivered, and how equitably programme benefits are distributed. In this sense, the structure of FISP is not merely administrative; it is part of the mechanism through which programme outcomes are produced (Hemming et al., 2018).

1.2.3 FISP Beneficiary Selection Criteria

The selection criteria for FISP beneficiaries in Zambia are based on eligibility criteria set out in the national policy framework for agriculture in Zambia (Mwansabamba & Kaliba, 2025). The FISP framework targets smallholder farmers who have limited landholdings and liquidity constraints that prevent them from accessing commercial fertilizer and certified seed markets (Alawode, 2025). In theory, the selection criteria for FISP beneficiaries are supposed to be smallholder farmers who are actively engaged in farming activities, are members of registered cooperatives, and are able to cultivate a minimum land area for maize production. However,

the cost-sharing approach assumes that FISP beneficiaries have a limited level of financial capacity to contribute to it (Minah & Malvido Pérez Carletti, 2019).

Although the formal criteria are based on smallholder status and productive involvement, their implementation is mediated through cooperative structures and a district-level verification process (Nguni & Haabazoka, 2024). At the cooperative level, the beneficiaries are compiled based on membership criteria, size declarations, and perceptions of production capacity. This institutional structure implies discretion in the selection process, as the cooperative's leadership often plays a crucial role in determining priorities when demand for inputs exceeds allocated quotas (Mwiinga, 2017). In this sense, the difference between formal targeting criteria and actual practices in the selection process becomes relevant to the analysis of the actual beneficiaries of the input subsidies.

The policy guidelines have, at times, clearly outlined the objective of promoting inclusive participation, including consideration of identified categories of vulnerable farmers (Andrews, 2021). However, the basis of eligibility is still largely defined in terms of membership in the cooperative and production activity, which can be considered an indirect influencer of participation patterns. In some instances, the Southern Province could experience unequal participation rates due to an unequal distribution of membership in cooperatives or unequal access to land ownership (Kiwanuka & Machethe, 2016). To understand the beneficiary criteria, therefore, it is necessary to consider both the policy prescriptions and the institutional mechanisms that are used in verifying the eligibility of beneficiaries, as these mechanisms influence the composition of FISP beneficiaries and, consequently, the productivity and maize farm incomes in Southern Province (Mason et al., 2013).

1.2.4 FISP Distribution Mechanism

The distribution mechanism of the Farmer Input Support Programme (FISP) refers to the practical process through which subsidized fertilizer and certified seed are delivered from programme authorities to registered beneficiaries. In operational terms, the programme provides a standardized input package that typically includes basal fertilizer, top-dressing fertilizer, and certified maize seed intended for smallholder maize production (Nyirongo & Khataza, 2025). Once beneficiary lists have been finalized through the relevant administrative and cooperative processes, input quantities are allocated according to approved quotas and prepared for delivery to districts and local collection points.

The procurement of inputs is coordinated at the national level, while the physical distribution process is managed through district agricultural offices in collaboration with farmer cooperatives (Nguni & Haabazoka, 2024). After inputs reach the district level, beneficiaries are informed through local administrative and cooperative channels about collection arrangements and distribution schedules. In practice, cooperatives often serve as the final delivery interface through which farmers receive the subsidized input package. This makes the distribution stage a crucial link between formal programme approval and actual farmer access to subsidized inputs.

The timing of distribution is especially important in Southern Province because maize production is highly sensitive to the agricultural calendar. Fertilizer and seed must reach farmers early enough to allow timely land preparation, planting, and fertilizer application in line with rainfall patterns and recommended agronomic practices (Kaoma & Mpundu, 2023). Where inputs are delivered on time, the programme is more likely to support effective input use and improved maize production. Where delivery is delayed, however, the productivity benefits of the subsidy may be weakened even for farmers who are formally included in the programme (Walls et al., 2022).

The effectiveness of the distribution mechanism therefore depends not only on whether inputs are procured, but also on whether they reach intended beneficiaries in sufficient time and under workable local arrangements. In this sense, distribution is the operational stage through which formal programme access is translated into actual possession of inputs by smallholder farmers. Because maize production depends strongly on timely input application, the quality of this distribution process has direct implications for the productivity and income outcomes associated with FISP.

1.2.5 FISP Implementation Challenges

Despite its importance in Zambia's agricultural policy environment, implementation of the Farmer Input Support Programme (FISP) has been associated with structural and management issues that have a direct bearing on its effectiveness. One of the issues that have been a concern is that of targeting efficiency. Despite its focus on liquidity-constrained smallholder farmers, implementation of FISP has been associated with a risk of inclusion and exclusion errors due to its cooperative-based approach (Blekking et al., 2021). This is due to the fact that, in some cases, cooperative leaders have some degree of discretion in determining who will benefit

from the programme. This has resulted in some better-placed farmers benefiting from the programme while those who are more vulnerable are left out (Blekking et al., 2021).

Another constraint in the implementation of the input delivery is the timing or logistical considerations involved in the delivery. Maize is rain fed in the Southern Province, and fertilizer is a time dependent input (Namonje-Kapembwa et al., 2015). Therefore, if there is a delay in its procurement and transport to the district level, this will affect the farmers in that they will not have an early start, and this will impact the overall productivity that is realized in relation to the input subsidy (Mamun, 2024). Here, the farmers will not have an opportunity to realize the benefits as participants due to timing.

Another implementation concern is those of fiscal sustainability and budget concentration. FISP has over the years commanded a large percentage of Zambia's budget in agriculture; in some instances, a dominant percentage of sectoral budget allocations has gone towards FISP (Nguni & Haabazoka, 2024). This is understandable, considering that FISP is a priority intervention in Zambia's agriculture sector. The debate has been on issues of opportunity cost, especially regarding other investment areas such as extension services, irrigation facilities, and market development (Mwansabamba & Kaliba, 2025). When farmers are not provided with extension services or market linkages, the productivity-to-income transmission mechanism may not work as well, and therefore the ability of maize production to increase maize farm income may be compromised (Kuteya et al., 2025).

Finally, capacity constraints for institutions at the district and cooperative levels have implications for monitoring and transparency. These programme-related challenges are analytically important because they not only shape the identification of FISP beneficiaries but also determine how those beneficiaries access programme inputs (Nkhoma, 2018). These challenges are relevant for understanding programme outcomes due to the implications of differential constraints for programme implementation for various categories of programme beneficiaries in Southern Province (Minah, 2022).

1.3 Empirical Review

1.3.1 Impact of Input Subsidies on Maize Productivity and Maize Farm Income in Zambia

The empirical evidence on the impacts of input subsidy programs on productivity in Zambia has shown variability in the differences noted for implementation modalities and

methodologies for assessing these impacts. A quantitative study was conducted by Kuteya et al. (2025) on the impacts of the electronic farmer input support program (e-FISP) on the productivity of farmers in Zambia. A decline was noted for the maize crop's productivity for program beneficiaries compared to non-beneficiaries. For maize production in Zambia, program beneficiaries harvested 315 kg/ha less compared to non-beneficiaries. The study noted that for program beneficiaries, the yield reduced from 2,177 kg/ha to 1,712 kg/ha compared to non-beneficiaries after two years. These impacts can be attributed to the limitations experienced while implementing the electronic voucher program. These limitations include the delays experienced in the program and the lack of familiarity for the farmer to use the voucher system. This noted impact shows that productivity is not only a function of input provision but can also be a function of institutional efficiency.

In similar contexts, the results have shown variations in the impact of subsidies depending on the implementation mechanisms. For example, in the context of Ghana, the study by Tsiboe et al. (2021) indicated an increase in the yield of cereals by 24.5%, while Asante et al. (2025) indicated an improvement in the income levels in the context of fertilizer access in the country. Although the study is not specifically focused on Zambia, the findings have become an important reference point in the context of Zambia, highlighting the impact of input subsidies in terms of yield and income levels.

Apart from the yield effect, the exact relationship between the program and the farm income of the maize crop is not very clear. This is due to the fact that although the yield effect would lead to an increase in the market surplus, the exact effect of the program on the farm income would also depend on the prices received, the level of marketing, as well as the production costs incurred. Alawode (2025) observes that although the primary aim of the program was to enhance the technical efficiency of the farmers, the administration problems encountered in the program would have an impact on the benefits realized in terms of the net income received by the smallholder farmers. Irubuntu and Musenge (2025) observed in their study conducted in the Choma District that the distribution inefficiency would have an impact on the benefits realized in terms of the economic returns received by the smallholder farmers due to the availability of the subsidized inputs.

Efficiency, in turn, affects productivity and income levels. Karata (2024) and Gemessa (2021) offered empirical evidence that input subsidies are likely to favor better-endowed rather than the most resource-constrained households. As Gemessa (2021) pointed out, about 60% of the

fertilizer vouchers were allocated to the better-endowed households, i.e., those with wealth above the median. Therefore, there was substantial inclusion bias in the program. Blekking et al. (2021) pointed out cooperatives in their presentation of the options available for the enhancement of productivity gains, apart from the access to input subsidies. However, they also pointed out the possibility of excluding the poorer households through the use of cooperatives. These impacts of the program's targeting are theoretically important since they may have implications not only for the productivity gains but also for the distribution of maize farm income between the categories of the program's beneficiaries.

Lastly, the role of the complementary institutional factors in the effectiveness of the subsidized inputs is evaluated. For instance, the study by Malimi (2023) and the study by Chanda et al. (2025) evaluate the role of access to extension services in the technical efficiency of maize farming in the country. In addition, the study by Chanda et al. (2025) evaluates the role of the certification of title deeds in the enhancement of the mean technical efficiency of maize farming in the country. The study by Kayula et al. (2022) warns that the effectiveness of the subsidies will result in the crowding out of private finance in the maize sector of the country instead of promoting sustainable investments in the sector.

In general terms, the above empirical literature suggests that the effectiveness of the subsidies in the maize sector of Zambia cannot be evaluated without considering the institutional factors in the maize sector of the country, thereby providing a crucial foundation upon which the differentiated economic impacts of FISP in the Southern Province of Zambia can be evaluated.

1.3.2 Gender Differences in Subsidy Access, Productivity, and Income in Zambia

From an empirical perspective, it is evident that there is a gender gap in the utilization of agricultural subsidies in Zambia, as demonstrated in the study by Ng'ombe et al. (2024) through the application of Oaxaca Blinder Decomposition techniques, where it was evident that there was an increased probability of 9% in the utilization of input subsidies in male-headed households than in female-headed households. This was evident in the face of the fact that the study conducted in the districts of Choma indicated that there was an array of active farming people who were females, as demonstrated in the study by Irubuntu & Musenge (2025). This implies that the conditions of the cooperatives and the land would influence the participation of women in the program, considering their active role in farming.

Administrative factors can also play a role in influencing gender participation patterns. Alawode (2025) cites factors such as elite capture of programmes as influencing factors in the achievement of equitable access to target programmes in the agricultural sector. Such factors were also experienced in Phiri and Mahlangu (2025), who noted an increase in cases of administrative delays among female entrepreneurs. Pruce (2023) cited cases whereby some policy instruments were developed with a notion of farmer identity that may inadvertently create a niche for traditional farmers who own land. Financial factors can also play a role in influencing gender participation probabilities. Chulu and Kachamba (2025) cite cases whereby collateral demand and literacy impacted women's participation in formal support for their agricultural activities. The lack of women's representation in administration structures, as noted in Miti et al. (2025), may also play a role in influencing the design of allocation mechanisms. Such factors not only influence probabilities but can also determine the extent to which input acquisition occurs.

In addition to that, there are also dynamics in terms of targeting that can intersect with wealth inequalities, which are also distributed disproportionately to female-headed households. As Gemessa (2021) found that around 60% of fertilizer vouchers were allocated to households above the median wealth level, suggesting the presence of inclusion bias in subsidy allocation. Although this study did not focus on Zambia, it can also be used to understand the dynamics of smallholder farmers in general. Dedehouanou and Soumaila (2024) suggest that when subsidies are targeted at structurally disadvantaged farmers, the early productivity effects may appear limited because such support first addresses the underlying constraints these farmers face. Female-headed households are more likely to be found in lower wealth quintiles, which can affect how these farmers react to input subsidies because of constraints in terms of assets.

The existence of access to subsidized inputs does not necessarily mean that the farmer is capable of utilizing the generated income streams. Kalindi et al. (2023) cite the reality that the management of resources within farm households is mainly left to the male household heads, even when the plots of land are managed by women. In the study conducted by Mgalamadzi et al. (2024) in the neighboring districts, the authors cite the reality that the sales of the produced commodities and the management of revenue are mainly left to the men. In the study done by Musemvu and Chibomba (2025) in the district of Choma, the authors cite the reality that the experiences of the women were heterogeneous, with some experiencing increased production, while others experience minimal gains due to operational irregularities.

Collective institutions like cooperatives offer opportunities and challenges to women farmers. To exemplify this, while women's participation in subsidy-linked activities in agriculture is made possible through farmer organizations, as exemplified in Minah (2022), which could eventually increase their productivity, the lack of transparency in the allocation mechanisms of cooperatives, as discussed in Maluti and Kabwe (2025), could also become a hindrance to women, particularly in terms of the lack of transparent internal governance structures in these collective institutions. Although Blekking et al. (2021) found a positive relationship between cooperative membership and maize yield, lack of access to these types of collective institutions could become a hindrance to the productivity and income from maize farming of poor households, particularly those headed by women.

In general terms, the body of empirical evidence points to the significance of gender differences in terms of subsidy accessibility, resource control, and institutional positions in explaining the diversity of programme impacts. In this regard, although input subsidies may be effective in improving maize productivity, the probability of accessing these subsidies and intra-household allocation may result in diverse impacts of FISP on maize farm incomes of male and female farmers. In this respect, the body of evidence points to the need to consider a gender-differentiated analytical approach in assessing FISP impacts in the Southern Province.

2 Objectives

The primary aim of this study is to assess the impact of agricultural input subsidies on the maize productivity and maize farm income of women farmers in Zambia's Southern Province through comparative analysis.

Specific Objectives:

- To identify and analyze the determinants of women farmers' access to agricultural input subsidies in Southern Province, Zambia.
- To evaluate the differential impact of agricultural input subsidies on maize productivity and maize farm income between women farmers who received subsidies versus those who did not in Southern Province.
- To compare maize productivity and maize farm income outcomes between women and men farmers who received agricultural input subsidies in Southern Province.

2.1 Hypothesis

Based on the objectives of the study and the literature on agricultural input subsidies and disparities in agricultural outcomes among women, the following hypotheses were tested.

H_1: Socioeconomic characteristics, institutional factors, and farm resource endowments are significant factors influencing access by women farmers to the Farmer Input Support Programme in Southern Province, Zambia.

H_2: Women farmers who accessed agricultural input subsidies from the Farmer Input Support Programme had higher maize productivity and farm maize income than those women farmers who did not access agricultural input subsidies in Southern Province, Zambia

H_3: Male farmers had higher maize productivity and farm maize income than women farmers who accessed agricultural input subsidies from the Farmer Input Support Programme in Southern Province, Zambia.

2.2 Conceptual framework

The study seeks to examine the impact of agricultural input subsidies on the maize productivity and maize farm income of women farmers in Southern Province, Zambia. Based on this objective, specific objectives formulated include examining the key factors influencing

women farmers' access to agricultural input subsidies and comparing maize productivity and maize farm income levels of women and men farmers who received input subsidies. Figure 1 shows the relationships between these variables.

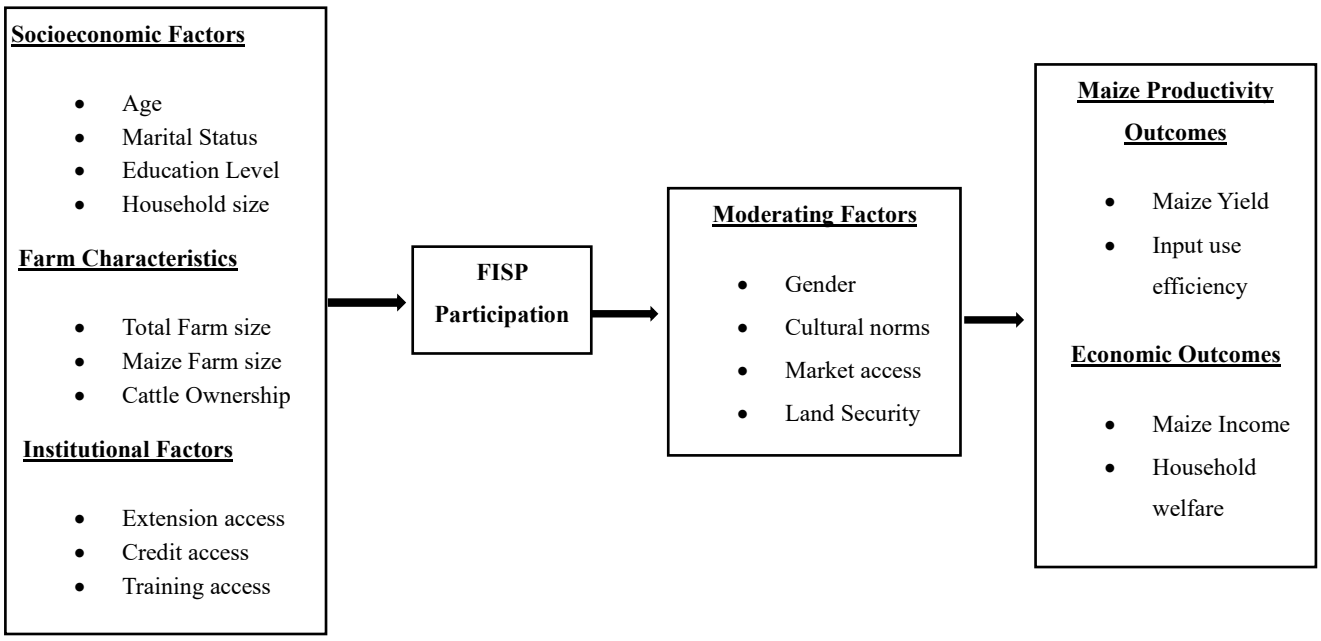

Figure 1: Conceptual Framework Linking Input Subsidy Participation to Maize Productivity and Income Outcomes in Southern Province, Zambia

Figure 1 presents the conceptual framework for analysing the impact of agricultural input subsidies on maize productivity and income among women farmers in Southern Province, Zambia. The conceptual framework is based on the agricultural household model proposed by Singh, Squire, and Strauss (1986), which suggests that output is a function of household characteristics, resource availability, and institutional factors. The model recognizes the role of household factors and farm factors in influencing output and income.

Socioeconomic factors such as age, marital status, education level, household size, and cattle ownership (as a proxy for household wealth); farm factors such as total farm size and maize cultivation area; and institutional factors such as access to extension services, access to credit, and access to training, jointly influence participation in the Farmer Input Support Programme. Research carried out in Zambia has shown that ownership of assets and access to institutions

play a significant role in influencing participation in input subsidy programs by women farmers (Ricker-Gilbert et al., 2013; Jayne et al., 2018).The participation in FISP is considered an intervention policy that is expected to result in improved access to fertilizers and improved quality of maize seeds, thus leading to an increase in the intensity of input usage, expected to result in improved output and efficiency in using inputs. Improved output is expected to result in improved maize income, thus leading to improved household welfare. Previous studies have shown that improved output results from fertilizer subsidies for smallholder farmers in Zambia (Mason et al., 2017).

A key feature of the framework is the inclusion of moderating variables, which are factors that condition the strength and direction of relationships between FISP participation, maize productivity, and farm income, but do not transmit those effects directly. Gender shapes differential access to land, labour, extension services, and control over income, meaning the same input package may produce different outcomes for male and female farmers (Udry, 1996; Ogolla et al., 2022). Cultural norms governing resource ownership and household decision-making authority influence whether women can independently allocate subsidized inputs to their plots and retain control over resulting income (Mohammed et al., 2023). Market access determines the degree to which productivity gains are converted into income through sales, with women facing greater barriers to market participation than men (Kaoma & Mpundu, 2023). Land security shapes incentives to invest in productivity-enhancing input use where tenure is insecure, the returns to input application are less certain, reducing the effectiveness of subsidy support (Chanda et al., 2025).

2.2.1 Justification of Variables

The variables of interest that were used in the study were informed by the theory that linked access to inputs, production decisions, and income, particularly in relation to smallholder maize farming in Zambia (Kuntashula & Mwelwa-Zgambo, 2022). The main variable of interest that the study sought to examine was the FISP participation, which represented the access to subsidized fertilizer and seed inputs. The FISP participation was hypothesized to have an impact on maize productivity via the price effect of fertilizer and seed inputs on the intensity of input use. The FISP participation was also hypothesized to have an impact on maize farm income via output and surplus response (Iyioku et al., 2025). The gender was the main variable of interest that the study sought to examine, which represented the differences in terms of access to resources such as land, labor, and capital, as well as differences in

decision-making powers (Ng'ombe et al., 2024). In the study, the gender difference formed the basis of the analytical framework, implying that the gender could have been the variable that impacts the FISP participation, productivity, and income.

The size of maize land is added to account for scale effects of production, since the area of land cultivated influences the level of output and income potential of the farm. The household labor availability is added to account for the impact of timely farm operations on the response of output to fertilizer applied (Namonje-Kapembwa et al., 2015). The extension service variable captures the impact of technical knowledge on efficiency in the use of inputs (Malimi, 2023; Chanda et al., 2025).

These variables capture the main economic and institutional channels through which input subsidies could impact maize productivity and farm income from maize farming.

2.3.1 Theoretical Framework

The analytical framework of the present study is based on the Agricultural Household Model and Gender and Intra-Household Bargaining Theory, that account for the explanation of the impact of access to subsidized input support on the production behavior and income creation of smallholder farming systems (Awunyo-Vitor, 2018). Instead of viewing the input support policy as a purely technological intervention, the analysis aims at conceptualizing it as an institutional tool that alters the relative input prices, the production incentives, and the decision-making structures at the household level (Bojic et al., 2022). The impact of the Farmer Input Support Programme on the productivity of maize and the farm incomes from maize is viewed as a process of structured behavioral response subject to market imperfections, resource constraints, and household allocation processes (Kuntashula & Mwelwa-Zgambo, 2022). A theoretical foundation is required to account for the expected productivity impact of the input support policy on the farmers and the potential variation in the impact among the beneficiaries (Kuntashula & Mwelwa-Zgambo, 2022).

The study employs the Agricultural Household Model in explaining the joint determination of production and income decisions in the face of imperfect markets. Under imperfect markets, the farm household maximizes utility with respect to land, labor, and purchase inputs. However, the production decision is limited in the face of imperfect credit and input markets (Madsen, 2022). Liquidity and risk factors become limiting factors in production. The subsidy policy decreases the acquisition cost of fertilizers and improved seeds, which

therefore, changes the household's feasible input bundle and the marginal product relationship with respect to the utilized inputs, which in turn influences the level of output and income from the production of maize (Ricker-Gilbert & Jayne, 2016). However, this assumption of a unitary household decision-maker limits the scope of this model in the case of differentiated control of productive resources. Hence, this framework is complemented by gender-sensitive theoretical approaches that perceive households as arenas of negotiated resource allocation, where relations of authority, access to land, and control over income could vary between individuals (Udry, 1996). This integration will enable a systematic analysis of the potential for differentiated productivity and maize farm income of both male and female farmers in Southern Province in response to similar policy interventions (Singbo & Lokossou, 2024).

2.3.2 Agricultural Household Model

The Agricultural Household Model is the primary framework used for the analysis of the impact of subsidized input use on the results related to agricultural production and income in small-scale farming systems (Yassini et al., 2025). It is assumed that the farm household is the primary decision-making unit, which makes decisions related to agricultural production, labor, and consumption, considering imperfect or incomplete market conditions (Kutangila, 2024). In the case of the rural economy, where credit constraints, transaction costs, and incomplete insurance markets are prevalent, the decisions related to agricultural production cannot be separated from the household's resource availability (Li et al., 2023). Hence, the decisions related to input use are not entirely dependent on the profit maximization conditions.

Within this context, the production of maize is assumed to be a function of land, labour, fertilizer, quality seed, and other complementary factors (Asfaw et al., 2024). The provision of subsidized fertilizer and certified seed under the FISP essentially changes the relative price at which these complementary factors are acquired (Alawode, 2025). The end result is that the household's production possibilities are altered. Theoretically, the effect is an upward shift in the production possibility curve for the quantity of maize produced, provided that the fertilizer is properly applied to the land cultivated for the production of maize (Rehman et al., 2024). The actual effect would depend on the household's ability to acquire the required labour for the cultivation of land for the production of maize.

The Agricultural Household Model can also be used to establish the link between productivity increases and the income earned from maize farms (Akhtar et al., 2023). Indeed, the productivity increases can be used to enhance the marketable surplus, which can then be used

to generate income depending on the output prices that prevail in the market as well as the consumption needs of the household (Melkani et al., 2025). However, it is worth noting that the link between productivity increases and the income earned from maize farms can be subject to the stability of output prices as well as the consumption needs of the household (Suryani et al., 2022). Though the model assumes household preferences that are unified, the model structure can be used to establish the link between the provision of subsidized inputs and the productivity increases in maize as well as the income earned from maize farms in the country, thereby creating a foundation that can be improved upon by using the theoretical extensions that are gender-sensitive (Malimi, 2023).

2.3.3 Gender and Intra-Household Bargaining Theory

Although the Agricultural Household Model offers a systematic approach to understanding the responses of agricultural producers to subsidized input access, its underlying assumption of a single household agent overlooks the complexity of household resources control (Lal et al., 2023). Gender and intra-household bargaining approaches offer alternative explanations for this model's shortcoming, offering a new way of understanding the household as a site of negotiation of resources control, as opposed to viewing the household as a single economic agent (Gupta et al., 2022). From this perspective, household members have different preferences, control over resources, and bargaining power, which jointly determine agricultural production decisions and income distribution (Mohammed et al., 2023). It is, therefore, not tenable to treat the impacts of input subsidies as uniform for both male and female farmers, even if both are classified as FISP program beneficiaries (Chirambo, 2024).

In many smallholder farming systems, the distribution of land ownership, control over labor, and control over input use are distinguished according to gender (Kang et al., 2020). Women may own smaller pieces of land, enjoy lower tenure security, or enjoy lower access to complementary inputs such as hired labor and extension services. The intra-household bargaining theory argues that the decision-making authority of an individual is affected by their authority over assets, access to non-household income sources, and societal attitudes towards decision-making authority in the household (Ogolla et al., 2022). When there is unequal bargaining power, the distribution of subsidized fertilizer or improved seeds may be driven by existing gender hierarchies rather than productivity objectives (Cohen et al., 2022). This leads to the same input set producing different productivity levels based on who has authority over land allocation and input use.

From an income viewpoint, the gender dimension in the control of output and revenue further shapes the linkage between gains in maize productivity and gains in farm income from maize (Gebre et al., 2021). Even in the event that gains in productivity are achieved, the person in command of the sale of the maize crop as well as the use of the generated income may not be the same as the person who offered the labour or commanded the activities in the production process (Erenstein et al., 2022). Gender-specific conceptual frameworks that are sensitive to gender relations highlight the difference between the production effect as well as the income control effect in the context of welfare gains (Perera et al., 2022). By including intra-household bargaining theory in the conceptual framework, this study is able to investigate the mediating effect of the difference in resource access, decision-making authority, as well as control over economic returns between male and female farmers in the effect of FISP on maize productivity as well as farm income from maize in Southern Province (Alavo et al., 2019).

3 Methodology

3.1 Study Area

The study was conducted in the Southern Province, which is one of the most important areas for agriculture in Zambia and also one of the major production hubs for maize. The province is strategically situated at the southern part of Zambia, covering approximately an area of 85,823 square kilometres, representing 11.4% of Zambia's total land area. The province borders other international boundaries, such as Botswana to its south and Zimbabwe to its southeast. It borders other domestic boundaries, such as the Central, Western, and Lusaka provinces.

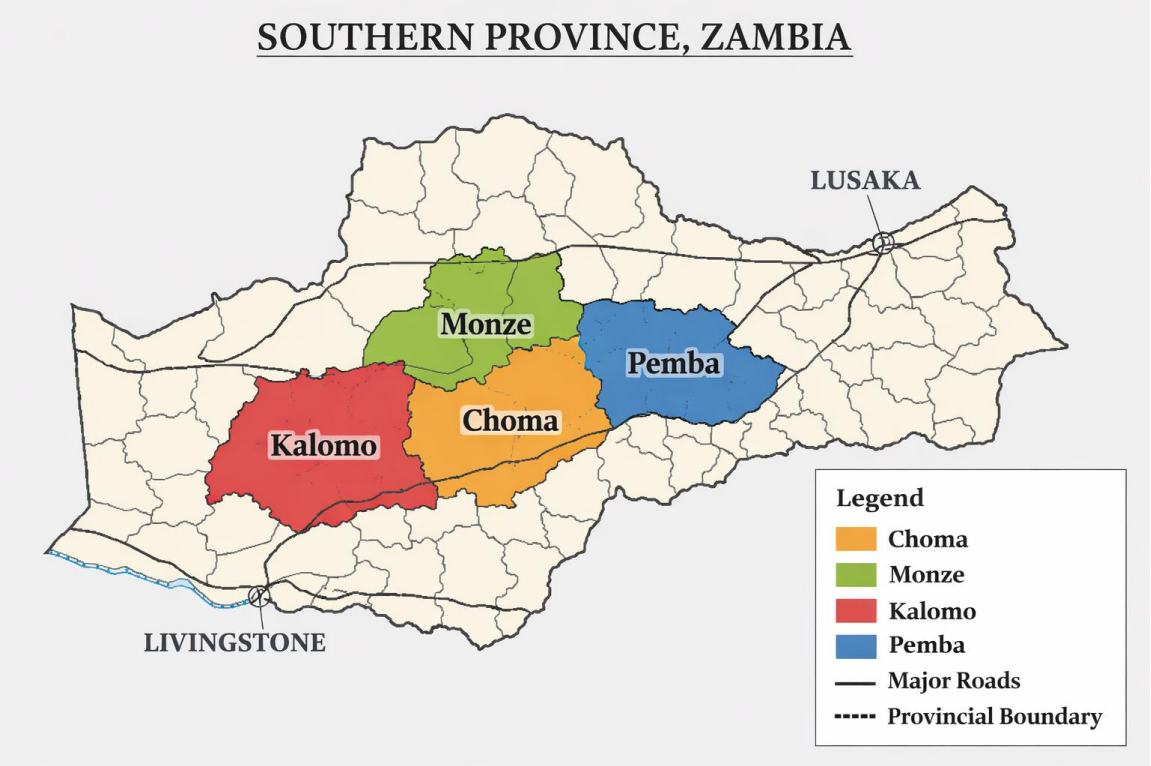

Figure 2: Map of Southern Province, Zambia, showing the four study districts: Choma, Monze, Kalomo, and Pemba (Author's own construction)

The Southern Province is strategically located as part of Zambia's agricultural landscape, which enjoys favourable agro-ecological conditions. These are characterized by good rainfall patterns, with an average of between 800 and 1,200 mm on an annual basis. In addition, the soils and topography of the Southern Province are suitable for intensive maize farming

systems. The Southern Province's agro-ecology is characterized by a sub-tropical climate with wet and dry seasons. The wet season occurs from November to April, and the dry season occurs from May to October. These climatic conditions are suitable for rain-fed farming systems. The elevation of the Southern Province ranges from 1,000 to 1,300 meters above sea level, which is considered moderate and suitable for maize farming. The soils of the Southern Province, which are suitable for intensive maize farming, are relatively fertile and comprise Ferric Luvisols and Haplic Lixisols soils. The Southern Province is ranked among the top three maize-producing provinces, often in combination with the Central and Eastern Provinces. In addition, the Southern Province is ranked as the surplus-producing province, which provides maize for the rest of the regions. The importance of the Southern Province as an agriculturally significant zone and the high level of participation of the Southern Province in the FISP program, as opposed to the participation of other regions, make the Southern Province the most suitable zone for the study.

Table 1. Study Districts and Their Characteristics

District	Population (2022)	Maize Productivity	Farmer typology	Men beneficiaries (n)	Female beneficiaries (n)	Female non-beneficiaries (n)	Total sample (n)
Choma	269,168 *(Zambia Statistics Agency, 2024)*	Important maize-producing district; maize is both a staple food and a cash crop in the district *(Choma Municipal Council, 2023)*	Predominantly small-scale farmers, with broader crop and livestock activity in the district *(Choma Municipal Council, 2023)*	21	28	27	76
Kalomo	274,943 *(Zambia Statistics Agency, 2024)*	Major maize-producing mixed-farming district; maize accounts for about **61%** of cultivated area *(Kalinda et al., 2010; Kalomo Town Council, 2023)*	Mostly smallholders, with some semi-commercial and commercial farmers *(Kalinda et al., 2010)*	43	14	16	73

Monze	267,840 *(Zambia Statistics Agency, 2024)*	Major maize-growing district; maize accounts for about **60%** of cultivated area *(Kalinda et al., 2010)*	Mostly smallholders, with some semi-commercial and commercial farmers *(Kalinda et al., 2010)*	51	23	5	79
Pemba	101,107 *(Zambia Statistics Agency, 2024)*	Maize-producing smallholder district; district planning documents track maize production trends explicitly *(Pemba Town Council, 2023)*	Predominantly smallholder farmers *(Mwale et al., 2024)*	43	11	7	61

Table 1 presents the selected study districts and their characteristics relevant to the analysis. Choma, Kalomo, Monze, and Pemba were included because they represent important maize-producing areas within Southern Province and capture variation in local farming systems and farmer typologies. Choma is described as an important maize-producing district where maize serves both as a staple food and a cash crop, with production dominated mainly by small-scale farmers. Kalomo and Monze are characterized as major maize-producing mixed-farming districts, where maize occupies a substantial share of cultivated land and where smallholders coexist with some semi-commercial and commercial farmers. Pemba is similarly identified as a maize-producing district, but with a more distinctly smallholder orientation. The table also shows the sampling structure used in the study, covering male beneficiaries, female beneficiaries, and female non-beneficiaries across the four districts. This distribution supports the comparative design of the study by providing district-level coverage for both the women-only access comparison and the gender comparison among FISP beneficiaries. Overall, the selected districts provide an appropriate setting for examining how FISP relates to maize productivity and maize farm income within predominantly smallholder farming systems in Southern Province.

3.2 Study Design

This study adopts a cross-sectional, non-experimental comparative design using survey data collected in 2022. Because participation in the Farmer Input Support Programme (FISP) is not randomly assigned, an experimental design was not feasible. The study therefore applies a counterfactual analytical approach using observational data to assess programme effects and gender differences in maize productivity and maize farm income.

The design is structured around two main comparisons that reflect the study objectives. First, it compares female FISP beneficiaries with female non-beneficiaries in order to estimate the effect of subsidy access on women's maize productivity and maize farm income. Second, it compares female beneficiaries with male beneficiaries in order to assess whether programme outcomes differ by gender among farmers who received support. This comparative structure makes it possible to examine both the impact of programme participation on women and the extent to which male and female beneficiaries experience different outcomes under broadly similar conditions.

Given the non-random nature of programme participation, the study employs propensity score matching (PSM) to construct comparable groups based on observable characteristics and reduce selection bias. Linear regression is then used as a robustness check to test whether the main relationships remain after controlling for other relevant covariates. In this way, the study design combines comparative analysis with quasi-experimental techniques to provide a more credible assessment of FISP's effects on maize productivity and maize farm income in Southern Province, Zambia.

3.3 Data Collection and Sampling

A mixed sampling method was used to obtain a sample of FISP beneficiaries and non-beneficiaries from the four districts of Southern Province in Zambia. These four districts are Choma, Monze, Kalomo, and Pemba. The data analyzed in this study was collected in 2022 in the course of a larger research work on the evaluation of the impact of the Farmer Input Support Programme (FISP) on maize farmers in Zambia. The original research work involved male and female farmers from different districts in Zambia and examined the impact of FISP on maize yields and maize farm income.

For the FISP beneficiaries, the random sampling method was used to obtain the lists of subsidy recipients obtained from the local Agricultural Offices. These offices are responsible for keeping records of farmers who receive input subsidies from the government. This method ensured that the sample of FISP farmers obtained in the original research work was randomly and unbiased. For non-beneficiaries, purposive sampling was used to obtain farmers from the same areas as the sample of FISP farmers. This method was necessary because in the original research work no list of non-beneficiaries existed and ensured that the comparison group came from the same local context, supporting a balanced analysis.

For this thesis, three samples of farmers are used from the original research work. The three samples are composed of 76 women FISP beneficiaries who are the sample of women farmers from the original research work, 55 women non-beneficiaries who are the control sample of women farmers in the original research work, and 158 male FISP farmers. It is important to note that the sample of male farmers is larger than the sample of women farmers in the original research work and in this thesis. This is because more men are involved in the FISP programme in Zambia than women.

All the farmers in the sample are active maize farmers who own and control their farms customary or registered arrangements in Zambia. This means that they are in full control of the farm and farm activities and not that they are formally owners of the farm.

This sampling structure allows focused analysis of FISP impacts on women using the women-only subsample, while also enabling direct gender comparisons among beneficiaries using the pooled male and female sample.

3.4 Data Analysis

Descriptive statistics such as means and percentages were used to describe the data set and give a general description of the characteristics of the farmers. The summaries were done for the unmatched (before matching) and matched (after matching), showing how the data is distributed for the major variables of interest.

The distribution of the major outcome variables, such as maize yield and income, was checked using the Shapiro-Wilk test for normality, which confirmed that the data were normally distributed. Therefore, independent sample t-tests were used to compare the mean outcomes for the female FISP recipients with those of the non-receiving females, as well as with those of the male FISP recipients.

3.4.1 Sample Composition and Treatment of Gender across Models

This study uses two main analytical subsamples to align with the research objectives and the available data structure, divided into three groups: (male beneficiaries, female beneficiaries, and female non-beneficiaries):

- Women-only subsample (N=131: 76 FISP beneficiaries + 55 non-beneficiaries). This subsample is used for: (1) the probit model on determinants of subsidy access among women, and (2) estimating the impact of FISP on women's productivity and income (Specific Objective 2: beneficiaries vs. non-beneficiaries). In these models, a gender variable is excluded because the subsample contains only women farmers, providing no variation in gender.
- Pooled subsample of FISP beneficiaries (N=234: 76 female beneficiaries + 158 male beneficiaries). This subsample is used for: (3) comparing outcomes across gender among program participants (Specific Objective 3: female vs. male beneficiaries), via PSM matching of female to male beneficiaries and linear regression with gender as the key explanatory variable. Here, gender is included (coded 1 = male, 0 = female) to directly estimate the conditional gender gap in productivity and income after controlling for observable covariates.

This stratified approach ensures that models focused on women's experiences do not include a redundant gender variable, while models designed to test gender differences use the appropriate pooled data to quantify disparities among comparable beneficiaries.

3.4.2 Determinants of Women's Access to Input Subsidy

To address the first research objective, which examined the determinants of women's access to the Farmer Input Support Programme, a Probit regression model was estimated using the women-only subsample of 131 farmers, comprising 76 beneficiaries and 55 non-beneficiaries. The dependent variable captures participation in the Farmer Input Support Programme and is defined as a binary indicator equal to 1 if the woman farmer received subsidized inputs under the programme and 0 otherwise. Given the dichotomous nature of the outcome variable, a limited dependent variable model was required. The Probit specification was selected because it assumes a cumulative normal distribution of the error term and is widely used in evaluating participation in agricultural subsidy and technology adoption programmes. Similar

approaches have been applied in studies analysing access to input subsidies and related agricultural interventions in Sub-Saharan Africa, including Ricker-Gilbert et al. (2013), Mason and Smale (2013), and Fisher and Kandiwa (2014).

The Probit model estimates the probability that a woman farmer participates in the programme as a function of socio-economic, farm, and institutional characteristics. These explanatory variables were selected based on the agricultural household model and prior empirical literature on programme participation. The agricultural household model suggests that access to subsidized inputs depends on resource endowments, human capital, and institutional linkages. Empirical studies further show that age, education, household size, landholding size, livestock ownership, access to extension services, credit, and training influence farmers' likelihood of accessing agricultural support programmes as shown in Table 2.

The empirical Probit model is specified as:

$$P(Y_i = 1) = \Phi(\beta_0 + \beta' X_i + \varepsilon_i)$$

Where:

- $P(Y_i = 1)$ is the probability that a woman farmer received input subsidy.
- Φ represents the cumulative distribution function of the standard normal distribution.
- β_0 is the intercept.
- β is a vector of coefficients.
- X_i is a vector of explanatory variables.
- ε_i is the error term.

$$\begin{aligned} P(\text{InputSubsidy}) &= \Phi(\beta^0 + \beta^1 \text{Age}_i + \beta^2 \text{MaritalStatus}_i + \beta^3 \text{MaizeFarmSize}_i \\ &+ \beta^4 \text{TotalFarmSize}_i + \beta^5 \text{HHSize}_i + \beta^6 \text{EducationYrs}_i + \beta^7 \text{NoofCattle}_i \\ &+ \beta^8 \text{Offfarmjob}_i + \beta^9 \text{Extensionaccess}_i + \beta^{10} \text{AccessCredit}_i \\ &+ \beta^{11} \text{AccessTraining}_i + \varepsilon_i) \end{aligned}$$

Where:

- Φ represents the cumulative distribution function of the standard normal distribution.
- ε_i is the error term.
- β_0 is the intercept, and $\beta_1 ... \beta_{10}$ are the coefficients of the explanatory variables.

To enhance interpretability, marginal effects were computed after estimation. The marginal effects indicate the change in the predicted probability of programme participation associated with a one-unit change in each explanatory variable, holding other factors constant. This provides a direct assessment of the magnitude and direction of each determinant influencing women's access to the subsidy.

Table 2: Definitions and measurements of the variables included in the model.

Variable	Unit	Type	Description	Expected Influence on Access to FISP	Key Reference
Input Subsidy	Dummy variable	Dependent, Binary	1 if the woman farmer received subsidized fertilizer and hybrid maize seed under the Farmer Input Support Programme during the 2021 to 2022 agricultural season, 0 otherwise	Not applicable	Mason and Smale (2013); Ricker-Gilbert et al. (2013)

Table 2.1: Definitions and measurements of the independent variables included in the model.

Independent Variable	Unit	Type	Description	Expected influence on access to FISP	Key reference
Household / Socio-economic					
Age	Years	Continuous	Age of the woman farmer at the time of survey	Positive. Older women farmers may have stronger social networks, more farming experience, and greater visibility in community and cooperative structures, which can increase the likelihood of accessing FISP	Fisher & Kandiwa (2014)
Marital status	Dummy variable	Binary	1 if married at time of survey, 0 otherwise	Positive. Married women may have stronger household and cooperative connections that support access to FISP	Minah (2022)
Household size	Number of persons	Continuous	Number of individuals residing in the household	Positive. Larger households may provide labour and increase demand for subsidized farm inputs	Ricker-Gilbert et al. (2013)

Education	Years	Continuous	Number of completed years of formal schooling	Positive. Education may improve awareness of programme procedures and ability to comply with participation requirements	Asfaw & Admassie (2004)
Number of cattle	Number of cattle	Continuous	Number of cattle owned by the household	Positive. Cattle ownership proxies wealth and resource capacity, which may support programme participation	Holden (2019)
Off-farm job involvement	Dummy variable	Binary	1 if the woman farmer engaged in any off-farm income-generating activity at the time of survey, 0 otherwise	Negative. Off-farm work may reduce time, attention, and dependence on farming-based support programmes, lowering the likelihood of participation in FISP	Musumba et al. (2022)
Farm-level					
Maize farm size	Hectares	Continuous	Area allocated to maize cultivation during the 2021–2022 season	Positive. Larger maize plots increase the incentive to obtain subsidized inputs	Mason et al. (2017)
Total farm size	Hectares	Continuous	Total cultivated land managed by the farmer	Positive. Greater landholding reflects higher production capacity and stronger eligibility prospects	Jayne & Rashid (2013)
Institutional					
Extension access	Dummy variable	Binary	1 if the farmer received at least one formal extension visit or maize production advisory during the 2021–2022 season, 0 otherwise	Positive. Extension increases information about programme procedures and access conditions	Fisher & Kandiwa (2014)
Access to credit	Dummy variable	Binary	1 if the farmer accessed formal or semi-formal agricultural credit during the 2021–2022 season, including bank loans, SACCOs, or village savings groups, 0 otherwise	Positive. Credit relaxes liquidity constraints and supports participation	Mason & Smale (2013)

Access to training	Dummy variable	Binary	1 if the farmer participated in organized agricultural training related to maize production or input use during the 2021–2022 season, 0 otherwise	Positive. Training improves awareness and compliance with recommended input use and programme requirements	Krishnan & Patnam (2014)

3.4.3 Measuring Impact of Input Subsidies on Agricultural Productivity and Income

To evaluate the impact of the Farm Input Subsidy Program (FISP) on women's agricultural productivity and maize farm income, as well as to compare outcomes between female and male FISP beneficiaries, this study employed Propensity Score Matching (PSM) followed by a linear regression model as a robustness check.

PSM is a quasi-experimental technique used to estimate the causal effect of a treatment by creating a comparable control group from observational data (Li, 2013). In this study, the treatment is receiving FISP, and the outcomes are maize productivity (yield per hectare) and maize farm income.

The PSM procedure was conducted in two steps:

1. Estimation of the Propensity Score:

The probability that a farmer receives FISP was estimated using a Probit regression model based on observed covariates (Rosett & Nelson, 1975):

$$P(Treatment = 1 \mid X_i) = \Phi(X_i'\beta) \quad (1)$$

Where:

- Treatment is 1 if the farmer received FISP, 0 otherwise
- X_i is vector of observed covariates
- β is vector of coefficients
- Φ is cumulative distribution function of the standard normal distribution

2. Matching and Estimation of Treatment Effects

The nearest neighbour matching was conducted using the appropriate subsamples;

- To address Specific Objective 2 (beneficiaries vs. non-beneficiaries among women): Female FISP beneficiaries (treated) were matched with female non-beneficiaries

(control) who had similar propensity scores, using the women-only subsample (N=131). This estimates the Average Treatment Effect on the Treated (ATT) and Average Treatment Effect on the Untreated (ATU) for productivity and income among women farmers.

- To address Specific Objective 3 (female vs male beneficiaries): Female FISP beneficiaries were matched with male FISP beneficiaries who had similar propensity scores, using the pooled subsample of beneficiaries (N = 234). This enables comparison of program outcomes across gender.

Empirically, the Average Treatment Effect on the Treated is represented as follows (Rosenbaum & Rubin, 1983; Caliendo & Kopeinig, 2008):

$$ATT = E[Y(1) - Y(0) \mid C = 1] \quad (2)$$

Under matching on the propensity score P(X), the estimator can be expressed as:

$$ATT = E\{E[Y \mid C = 1, P(X)] - E[Y \mid C = 0, P(X)] \mid C = 1\} \quad (3)$$

where Y(1) denotes the observed outcome for treated farmers and Y(0) denotes the counterfactual outcome in the absence of treatment. C represents treatment status, where C = 1 for the treated group and C = 0 for the comparison group. The ATT therefore measures the average difference in outcomes between treated farmers and matched control farmers who share similar observable characteristics.

For Specific Objective 3, female beneficiaries constitute the treated group, while matched male beneficiaries form the comparison group. The estimated ATT thus captures the average difference in maize productivity and maize farm income between women and men who participated in the programme and exhibit comparable observable characteristics. This allows assessment of whether programme benefits differ systematically by gender among participants.

In addition to the Average Treatment Effect on the Treated, this study estimated the Average Treatment Effect on the Untreated for the women only subsample. The ATU measures the expected change in outcomes if farmers who did not receive the Farmer Input Support Programme had participated in it. In this study, the untreated group consists solely of women farmers who did not receive subsidized inputs.

Formally, the ATU is defined as follows (Rosenbaum & Rubin, 1983; Caliendo & Kopeinig, 2008):

$$ATU = E[Y(1) - Y(0) \mid C = 0]$$

(4)

Under matching on the propensity score P(X), this can be expressed as:

$$ATU = E\{ E[Y \mid C = 1, P(X)] - E[Y \mid C = 0, P(X)] \mid C = 0 \}$$

(5)

where Y(1) denotes the potential outcome under treatment, Y(0) denotes the outcome without treatment, and C indicates treatment status. The ATU is computed over the distribution of propensity scores among untreated farmers, that is, C = 0.

In this study, the ATU is estimated only for the women subsample, since data on untreated male farmers were not collected. The ATU therefore captures the expected difference in maize productivity and maize farm income for women non beneficiaries if they had received the programme, compared with similar women beneficiaries.

The ATU complements the ATT by providing an estimate of the programme's potential impact among those who were excluded from participation (Imbens & Wooldridge, 2009). Given that access to the programme is conditional upon cooperative membership and administrative selection procedures, participation is not universal. The ATU therefore provides insight into the potential gains for eligible women farmers who did not receive support during the reference agricultural season.

For Specific Objective 3, which compares outcomes between female and male beneficiaries, only the ATT framework was applied. Since no untreated male farmers are included in the sample, ATU estimation for gender comparisons was not feasible. The gender analysis therefore focuses exclusively on outcome differences among programme participants.

In the propensity score estimation for Specific Objective 3 (matching female FISP beneficiaries to male FISP beneficiaries), the gender variable is intentionally excluded from the set of covariates used to calculate propensity scores. Including gender would bias the matching toward same-gender pairs and prevent meaningful cross-gender comparison. Instead, female and male beneficiaries are matched solely on other observable characteristics (age, education, farm size, household size, extension access, credit access, training, cattle ownership). This approach follows standard practice in gender-moderated propensity score matching analyses, where the subgroup variable of interest (gender) is omitted from the propensity score model to enable estimation of conditional differences across groups (e.g., as applied in recent evaluations of gender productivity using matched groups of male and female farmers). (Julien et al., 2023).

3.4.4 Linear Regression Robustness Check

Linear regression models were estimated as a robustness check to propensity score matching for both objectives, using the same covariates (Imbens & Wooldridge, 2009).

- **Women beneficiaries vs. non-beneficiaries (estimated on women-only subsample, N=131)**

To assess how access to the Farmer Input Support Programme (FISP) affects maize productivity among women farmers, the analysis compares female beneficiaries with female non-beneficiaries. This comparison isolates the effect of program participation while controlling for observable differences in farmer characteristics.

The productivity model is specified as:

$$Y_i^{Prod} = \beta_0 + \beta_1 T_i + \beta_2 X_i + \varepsilon_i \quad (6)$$

Income model:

$$Y_i^{inc} = \beta_0 + \beta_1 T_i + \beta_2 X_i + \varepsilon_i \quad (7)$$

where:

Y_i^{Prod} = maize productivity

Y_i^{inc} = maize income

T_i = 1 if farmer received FISP, 0 otherwise

X_i = vector of control variables (age, education, household size, farm size, extension, credit, training)

ε_i= error terms

- **Women beneficiaries vs. Men beneficiaries (estimated on pooled subsample of beneficiaries, N=234)**

Gender is treated as the main explanatory variable. Male farmers are coded as 1, and female farmers as 0.

Productivity model

$$Y_i^{Prod} = \beta_0 + \beta_1 G_i + \beta_2 X_i + \varepsilon_i$$

(8)

Income model:

$$Y_i^{inc} = \beta_0 + \beta_1 G_i + \beta_2 X_i + \varepsilon_i$$

(9)

where, β_1 measures the difference in productivity and income between comparable male and female beneficiaries, while controlling other covariates.

The variables included in the linear regression analysis of maize productivity and income are presented in Table 3. The choice of the covariates is based on their relevance in the literature and their potential impacts on FISP participation. The productivity and income indicators were collected through recall interviews from farmers in the field survey. This is a standard approach in most smallholder farming systems where formal records are scarce. Household and demographic characteristics are based on common features of rural households in Zambia.

Table 3. Variables used in the linear regression model

Variable	Type	Description	Units / Notes	Expected Influence on Y	Reference
Productivity	Continuous	Total maize output divided by cultivated maize area during the 2022 farming season	kg/ha (estimated by farmer recall)	+	Mason & Smale (2013)
Maize income	Continuous	Total income generated from maize during 2022 farming season	ZMW (estimated by farmer recall; smallholder reporting)	+	Jayne & Rashid (2013)
Input Subsidy	Binary	1 if the woman farmer received the FISP subsidy, 0 if not	—	+	Imbens & Wooldridge (2009)
Gender	Binary	1 for male, 0 for female	—	±	Julien et al. (2023)
Age	Continuous	Age of the woman farmer in years	Years	±	Asfaw & Admassie (2004)
Marital Status	Categorical/Binary	1 if married, 0 if not (includes single, widowed, or divorced)	—	±	Doss (2018)
Maize farm size	Continuous	Area of maize cultivated	Hectares	+	Mason & Smale (2013)

Variable	Type	Description	Units / Notes	Expected Influence on Y	Reference
Total farm size	Continuous	Total area of land cultivated	Hectares	+	Jayne & Rashid (2013)
Household size	Continuous	Number of individuals living in the household	Persons; household headship considered in interpretation (female heads mostly widowed or single)	±	Peterman et al. (2011)
Education	Continuous	Number of years of formal education completed	Years	+	Asfaw & Admassie (2004)
Number of cattle	Continuous	Number of cattle owned by the household	Heads	+	Smith (2008)
Off-farm job involvement	Binary	1 if the farmer engaged in any off-farm income-generating activity during 2022, 0 otherwise	—	±	Musumba et al. (2022)
Extension access	Binary	1 if the farmer received regular extension advice or technical visits during 2022, 0 if not	Visits / contacts with extension officers	+	Fisher & Kandiwa (2014)
Access to Credit	Binary	1 if the farmer had access to any formal or semi-formal credit facility (bank, VSLA, SACCO), 0 if not	—	+	Mulenga et al. (2021)
Access to Training	Binary	1 if the farmer participated in FISP-related or other maize production training in 2022, 0 if not	Training sessions attended	+	Krishnan & Patnam (2014)

3.5 Limitation of the Study

This study has several limitations that should be acknowledged. First, the analysis relies on self-reported data for key outcome and explanatory variables, including maize yield, farm income, landholding, and institutional service access. Self-reported agricultural data are subject to recall bias, particularly when farmers are asked to report production quantities and income from a completed season. To mitigate this risk, the survey instrument was administered by trained enumerators close to the post-harvest period, and standard probing techniques were used to assist respondents in accurately recalling seasonal production and

sales. Nevertheless, some degree of measurement error in the outcome variables is plausible and should be considered when interpreting the precision of the estimated programme effects.

Second, the sampling structure also presents some limitations. The study was based on 76 women beneficiaries, 55 women non-beneficiaries, and 158 male beneficiaries drawn from four districts in Southern Province. While this structure was useful for addressing the objectives of the study, the smaller number of women non-beneficiaries and the unequal group sizes may affect statistical balance and the broader generalizability of the findings. In addition, because no complete list of non-beneficiaries was available, the non-beneficiary group was selected purposively from the same local areas. Although this helped provide a relevant comparison group, it may still introduce some residual selection bias despite the matching procedures used.

Third, the geographic scope of the study is restricted to four districts in Zambia's Southern Province; Choma, Monze, Kalomo, and Pemba. Although these are among the most productive maize-growing districts in the country and are centrally important for understanding FISP's performance in a high-potential agricultural zone, the findings may not be directly generalisable to other provinces where farming systems, customary land tenure arrangements, market access conditions, and gender relations in agriculture differ substantially (Irubuntu & Musenge, 2025). Future research should extend this type of gender-differentiated impact analysis to other agro-ecological zones and provinces to build a more comprehensive national picture of FISP's gendered performance.

Despite these limitations, the study's design incorporates several features that strengthen the credibility of the findings. The use of comparable farmer groups drawn from the same agro-ecological districts, combined with propensity score matching and regression analysis, substantially reduces the influence of observed confounders and improves the reliability of the comparisons. The consistency of findings across matching and regression methods provides additional confidence in the direction and magnitude of the estimated effects.

4. Results

4.1 Descriptive Characteristics of Women beneficiaries and non-beneficiaries

From Table 4, before matching, farmers who accessed input subsidies had slightly higher education levels, averaging 8.34 years compared to 7.60 years for non-beneficiaries, and substantially greater access to extension services, with 98.7% of subsidy recipients having extension access versus 85.5% of non-recipients. After matching, differences in education and extension access were eliminated, while credit access increased among subsidy recipients (19.7%) compared to non-recipients (5.3%).

Table 4. Descriptive statistics of women farmers

	Unmatched				Matched			
Variables	Beneficiaries (N=76)	Non beneficiaries (N=55)	Mean Diff	T	Beneficiaries (N=76)	Non beneficiaries (N=55)	Mean Diff	T
Age (years)	45.553	45.636	-0.083	-0.04	45.553	45.053	0.500	0.25
Marital status (1=married, 0=not married/widow/divorced)	0.605	0.545	0.060	0.68	0.605	0.618	-0.013	-0.17
Total farm size (ha)	3.599	3.462	0.137	0.32	3.599	3.789	-0.190	-0.47
Maize farm size (ha)	2.076	1.991	0.085	0.45	2.076	2.171	-0.095	-0.52
Household size (persons)	6.355	6.927	-0.572	-1.23	6.355	6.408	-0.053	-0.15
Education (years)	**8.342**	**7.600**	**0.742**	**1.70***	8.342	8.290	0.052	0.15
Number of cattle (heads)	6.540	5.564	0.976	1.16	6.540	7.500	-0.960	-0.98
Off-farm job involvement (1=yes, 0=no)	0.750	0.818	-0.068	-0.92	0.750	0.789	-0.039	-0.57
Extension access (1=yes, 0=no)	**0.987**	**0.855**	**0.132**	**3.03*****	0.987	0.987	0.000	0.00
Access to credit (1=yes, 0=no)	0.197	0.109	0.088	1.36	**0.197**	**0.053**	**0.144**	**2.75*****
Access to training (number of sessions attended)	3.211	2.873	0.338	1.59	3.211	3.303	-0.092	-0.51

Note: *** *p<.01,* ** *p<.05,* * *p<.1*

Table 5. Matching quality test for women beneficiaries and non-beneficiaries.

Sample	R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	%Var
Unmatched	0.266	78.47	0	30	25.4	127.6*	0.26*	29
Matched	0.067	29.31	0.002	15.7	15.4	62.3*	1.14	14

Table 5 reports the balancing test for female farmers with input subsidy and those without input subsidy, before and after matching. The results indicate that there was significant improvement in the level of covariate balance after matching with the propensity score method. Specifically, the pseudo R^2 declined from 0.266 to 0.067, while the LR χ^2 declined from 78.47 ($p < 0.001$) to 29.31 ($p = 0.002$). This indicates that the explanatory power of the covariates in explaining the treatment status was greatly reduced after matching. The mean standardized bias dropped from 30% to 15.7%, while the median dropped from 25.4% to 15.4%. Furthermore, the variance explained by the treatment declined from 29% to 14%, while the variance ratio increased from 0.26 to 1.14. Although the results indicate that the matching was effective in balancing the difference between beneficiaries and non-beneficiaries women farmers, there is still bias between the two groups because the average standardized bias is slightly above the 10% threshold.

4.2 Descriptive Statistics of Men and Women FISP Beneficiaries

From Table 6, before matching, male farmers had a much higher likelihood of being married, with 97.5% married compared to 60.5% of female farmers, and they also cultivated larger farms overall, averaging 4.17 hectares compared to 3.60 hectares for women. Male farmers reported slightly higher education levels, at 8.95 years versus 8.34 years, and access to training was also higher among men, averaging 3.67 compared to 3.21 for women. In terms of wealth, measured through cattle ownership, men owned on average 7.85 cattle compared to 6.54 for women.

Table 6. Descriptive statistics of gender comparison

	Unmatched				Matched			
Variable	Male (N=158)	Female (N=76)	Mean Diff	T	Male (N=158)	Female (N=76)	Mean Diff	T
Age (years)	45.924	45.553	0.371	0.24	45.924	47.19	-1.266	-1.06
Marital status (1=married, 0=not married/widow/divorced)	**0.975**	**0.605**	**0.37**	**8.58*** **	0.975	0.968	0.007	0.34
Total farm size (ha)	**4.17**	**3.599**	**0.571**	**1.96****	**4.17**	**3.468**	**0.702**	**3.03*** **
Maize farm size (ha)	2.278	2.076	0.202	1.52	**2.278**	**2.006**	**0.272**	**2.68*** **
Household size (persons)	**8.006**	**6.355**	**1.651**	**4.34*** **	8.006	8.013	-0.007	-0.02
Education (years)	**8.949**	**8.342**	**0.607**	**1.96****	**8.949**	**8.335**	**0.614**	**2.51*** **
Number of cattle (heads)	**7.854**	**6.54**	**1.314**	**1.79***	**7.854**	**6.753**	**1.101**	**1.84***
Off-farm job involvement (1=yes, 0=no)	0.785	0.75	0.035	0.59	0.785	0.759	0.026	0.54
Extension access (1=yes, 0=no)	0.994	0.987	0.007	0.53	0.994	0.975	0.019	1.35
Access to credit (1=yes, 0=no)	0.228	0.197	0.031	0.53	0.228	0.19	0.038	0.83
Access to training (number of sessions attended)	**3.671**	**3.211**	**0.46**	**3.12*** **	3.671	3.842	-0.171	-1.55

After matching, differences in marital status, household size, and training were eliminated. However, men continued to cultivate larger farms, with an average of 4.17 hectares compared to 3.47 hectares for women, and devoted more land to maize, 2.28 hectares versus 2.01 hectares. Male farmers also maintained an advantage in education, with 8.95 years compared to 8.34 years, and in wealth, measured through cattle ownership, averaging 7.85 compared to 6.75.

Table 7. Matching quality test for male and female

Sample	R2	LR chi2	p>chi2	Mean Bias	Med Bias	B	R	%Var
Unmatched	0.129	23.06	0.017	19.8	20.7	84.3*	0.30*	0
Matched	0.055	11.5	0.402	9.6	7.8	54.7*	2.82*	57

Table 7 displays the balancing test for the sample prior to and after matching. It is evident that covariate balance has significantly improved for the sample after matching using the propensity score matching method. Specifically, the pseudo R^2 has fallen from 0.129 to 0.055, while the LR χ^2 has fallen from 23.06 ($p = 0.017$) to 11.5 ($p = 0.402$). These values show that the covariates have significantly lower explanatory power for predicting the treatment status than before matching. The mean and median standardized bias declined from 19.8% to 9.6% and 20.7% to 7.8%, respectively. In addition, the variance explained by treatment increased from 0% to 57%, while the variance ratio has risen from 0.30 to 2.82. Overall, these results demonstrate that matching was effective in reducing imbalance between the treated and control groups, although some residual differences remain.

4.3 Determinants of Women's Access to Input Subsidy

As shown in Table 8, the results suggest that the probability of participation increases with the provision of extension services, which is positive and statistically significant. Education has a positive influence on participation in input subsidies because the more educated are more likely to participate than the less educated. The household size has a negative impact on participation because the larger the household size, the lower the probability of participation.

Ownership of cattle, which is a proxy for wealth status, has a positive influence on participation in input subsidies, though the effect is only marginally significant.

Table 8. Probit regression estimate of the determinant of input subsidy

Variables	Coef.	Std.Err.	Marginal Effect (dy/dx)	Std.Err.
Age	0.002	0.011	0.001	0.004
Marital status	0.177	0.278	0.070	0.109
Maize farm size	-0.02	0.18	-0.008	0.070
Total Farm size	-0.058	0.09	-0.023	0.035
Household size	**-0.098**	**0.053**	**-0.038***	**0.021**
Education (years)	**0.093**	**0.051**	**0.036***	**0.020**
No of cattle	**0.062**	**0.038**	**0.024***	**0.015**
Off-farm job	-0.418	0.312	-0.158	0.112
Extension access	**1.484**	**0.622**	**0.499*****	**0.130**
Access to credit	0.287	0.355	0.109	0.130
Access to training	0.168	0.12	0.066	0.047
Constant	-1.85	0.93		
Pseudo r-squared	0.129	Number of obs	131	
Chi-square	23.063	Prob > chi2	0.017	

Note: *** *p<.01,* ** *p<.05,* * *p<.1*

4.4 Relationship Between Women's Access to Input Subsidy and Economic Outcomes.

The common support region shows that all the women farmers in the beneficiary and non-beneficiary groups are within the region of overlap in the propensity scores (Table 9). Of the total of 131 farmers, 76 beneficiaries and 55 non-beneficiaries are within the region of overlap in the propensity scores, representing 100% of the sample. This shows that the overlap in the distribution of propensity scores between the beneficiary and non-beneficiary groups is adequate to cover all farmers in the beneficiary group and their counterparts in the non-beneficiary group. Thus, the matching is valid, and the results are more reliable.

Table 9: Common support results for women beneficiaries and non-beneficiaries to input subsidy

	Common support	
Treatment assignment	On support	Total

Beneficiaries	76	76
Non-beneficiaries	55	55
Total	131	131

From the results of the analysis using the propensity score-matching method, it is evident that women's access to subsidies had a positive effect on farmers' maize yield and income (Table 10). This shows that the average treatment effect on the treated (ATT) of access to subsidies on farmers' yield is positive (536.63) and statistically significant at the 10% level. The average treatment effect on the untreated (ATU) of access to subsidies is even higher than the ATT at 730.45 and statistically significant. This shows that farmers who did not have access to subsidies would also have benefited from them.

For maize farm income, the results reveal that subsidy access increased earnings, with an ATT of 3,228.95, significant at the 5% level, showing that treated farmers gained considerably higher incomes than their matched counterparts. However, the ATU estimate of maize income was smaller and not statistically significant, suggesting that the income effect of subsidies was stronger among actual beneficiaries than among non-beneficiaries.

Table 10. Propensity score matching estimate of women's access to input subsidy

Variable	Matching Type	Beneficiaries	Non beneficiaries	Difference	S.E.	T-stat
Yield	Unmatched	2432.989	1699.173	733.816	224.289	3.27***
	ATT	2432.989	1896.355	536.633	325.941	1.65*
	ATU	2429.621	1699.173	730.448	239.435	5.15***
	Unmatched	11434.87	8828.182	2606.687	955.445	2.73***
Income	ATT	11434.87	8205.921	3228.947	1523.709	2.12**
	ATU	10027.27	8828.182	1199.09	1183.588	1.01

The results from Table 11 show that access to agricultural input subsidies has a strong positive and significant effect on maize yield, increasing average maize output by 685.7 units. This

supports the PSM results that showed that female farmers with access to subsidies had higher maize yields than those without access to such subsidies. Female farmers who were married had higher maize output, which might be partly due to its relationship with total farm size or access to household resources. Total farm size had a significant and positive effect on maize yield, while involvement in off-farm activities showed a positive marginally significant relationship with maize output, suggesting that access to other resources, such as income from other sources, could be used to improve maize production. Access to credit and training for farmers also had significant and marginal effects on maize output, while maize farm size had a negative and significant effect on maize output, suggesting that investing more resources in maize production might be counterproductive to efficiency and overall maize yield per unit of land for female farmers.

Table 11. Linear Regression Estimates of the Productivity Model for Female Farmers' Maize Yield

Yield	Coef.	St.Err.	t-value	p-value
Input subsidy	**685.744**	**231.753**	**2.96**	**0.00**
Age	-0.497	10.197	-0.05	0.96
Marital status	**581.711**	**248.266**	**2.34**	**0.02**
Total Farm size	**279.636**	**81.016**	**3.45**	**0.00**
Maize Farm size	**-382.212**	**160.171**	**-2.39**	**0.02**
Household size	-2.946	46.967	-0.06	0.95
Education years	-30.397	46.148	-0.66	0.51
No of Cattle	-32.84	33.827	-0.97	0.33
Off-farm job involvement	**596.51**	**278.121**	**2.14**	**0.03**
Extension access	-70.897	460.032	-0.15	0.88
Access to credit	**531.023**	**309.314**	**1.72**	**0.09**
Access to training	**187.837**	**106.935**	**1.76**	**0.08**
Constant	606.606	739.721	0.82	0.41
Mean dependent var	2124.898	SD dependent var	1313.388	
R-squared	0.244	Number of obs	131	
F-test	3.18	Prob > F	0.001	
Akaike crit. (AIC)	2241.307	Bayesian crit. (BIC)	2278.685	

**** p<.01, ** p<.05, * p<.1*

The results from Table 12 show that access to input subsidies had a positive and significant effect on maize income, increasing average income by 2,220 units, supporting the PSM results showing that female farmers with access to subsidies had higher income levels than those

without such access. Female farmers who were married had higher income levels, while those with larger total farm size had higher income levels, suggesting that these farmers had access to other resources that might be used to improve income levels. Female farmers with income from other sources had higher income levels, as did those with larger total farm size, suggesting that these farmers had access to other resources that could be used to improve income levels. Female farmers with income from other sources had higher income levels, while cattle ownership had a positive, marginal effect on income, suggesting that these farmers had access to other resources that could be used to improve income.

Table 12. Linear Regression Estimates of the Maize Income Model for Female Farmers

Maize income	Coef.	St.Err.	t-value	p-value
Input subsidy	**2219.967**	**899.813**	**2.47**	**0.02**
Age	-1.222	39.591	-0.03	0.98
Marital status	**2651.979**	**963.926**	**2.75**	**0.01**
Total Farm size Ha	**698.044**	**314.557**	**2.22**	**0.03**
Maize Farm size	-267.293	621.883	-0.43	0.67
Household size	-18.227	182.354	-0.1	0.92
Education years	147.774	179.174	0.82	0.41
No of Cattle	**223.662**	**131.339**	**1.7**	**0.09**
Off-farm job involvement	**2178.203**	**1079.84**	**2.02**	**0.05**
Extension access	-261.458	1786.133	-0.15	0.88
Access to credit	320.235	1200.953	0.27	0.79
Access to training	-84.053	415.189	-0.2	0.84
Constant	1959.681	2872.063	0.68	0.50
Mean dependent var	10340.46	SD dependent var	5529.203	
R-squared	0.357	Number of obs	131	
F-test	5.466	Prob > F	0	
Akaike crit. (AIC)	2596.714	Bayesian crit. (BIC)	2634.091	

**** p<.01, ** p<.05, * p<.1*

4.5 Gender Differences in Farm Outcomes Among FISP Beneficiaries

Table 13 shows that the propensity-score distributions of male and female FISP beneficiaries overlap fully, so no observations fall outside the region of common support, and none are dropped during matching. However, overlap alone does not guarantee good covariate balance; therefore, balance diagnostics (Table 7) and robustness checks are used to assess the credibility of the matched comparisons

Table 13: Common Support Results for Male and Female FISP Beneficiaries

	Common support	
Treatment assignment	On support	Total
Female	76	76
Male	158	158
Total	234	234

Table 14 propensity score-matching estimates of differences in outcomes between female and male FISP beneficiaries. The results show that male beneficiaries recorded higher maize yield than female beneficiaries in the matched comparison. The estimated ATT for maize yield is 557.71 kg/ha and is statistically significant at the 10% level. This indicates that, among comparable programme beneficiaries, male farmers achieved somewhat higher maize yield than female farmers. However, the ATU for yield is very small and not statistically significant, suggesting that this difference is not uniformly strong across all matched comparisons.

For maize farm income, the matched results show a larger gender difference. Male beneficiaries recorded higher maize income than female beneficiaries, with an ATT of ZMW 3,440.63, significant at the 5% level. This suggests that, among programme participants with similar observable characteristics, male farmers earned more income from maize than female farmers. Importantly, this result should be interpreted as a gender difference among beneficiaries rather than evidence that women did not benefit from FISP. The women-only analysis already shows that women beneficiaries performed better than women non-beneficiaries in both maize yield and maize income. The gender income gap therefore reflects differences among beneficiaries, not an absence of gains for women.

Table 14. Propensity score matching estimates of gender differences in maize yield and income

Variables	Matching type	Male	Female	Difference	S.E.	T-stat
Yield	Unmatched	2421.348	2014.677	406.67	231.816	1.75*
	ATT	2421.348	1863.634	557.714	329.396	1.69*
	ATU	2016.338	2014.677	1.661	124.3824	0.01
Income	Unmatched	13586.83	10099.34	3487.487	1107.424	3.15**
	ATT	13586.83	10146.2	3440.627	1692.593	2.03**
	ATU	11664.47	10099.34	1565.13	4033.564	0.39

The regression results in Table 15 provide a more cautious interpretation of the gender yield gap. While the matched comparison suggested that male beneficiaries obtained higher maize yield than female beneficiaries, the pooled regression shows that the gender coefficient is positive but not statistically significant. This indicates that the observed yield difference weakens once other factors such as total farm size, maize farm size, education, and cattle ownership, are controlled for. In substantive terms, the yield gap appears to be driven more by differences in productive resources than by gender itself. Total farm size and cattle ownership have positive and significant effects on yield, while maize farm size has a negative and significant effect, suggesting that expanding maize area without corresponding complementary resources may reduce productivity per hectare.

Table 15. Linear regression estimate of factors affecting the yield of male and female farmers

Yield	Coef.	St.Err.	t-value	p-value
Gender	355.857	249.192	1.43	0.16
Age	-6.557	10.307	-0.64	0.53
Marital status	-41.556	346.524	-0.12	0.91
Total farm size	**352.638**	**57.84**	**6.1**	**0**
Maize farm size	**-859.642**	**124.42**	**-6.91**	**0**
Household size	-15.349	41.286	-0.37	0.71
Education	**-107.855**	**45.645**	**-2.36**	**0.02**
Number of cattle	**54.684**	**22.241**	**2.46**	**0.02**
Off-farm job involvement	133.691	242.491	0.55	0.58
Extension access	459.328	1072.343	0.43	0.67
Access to credit	-44.984	240.625	-0.19	0.85
Access to training	116.408	99.157	1.17	0.24
Constant	**2575.101**	**1260.635**	**2.04**	**0.04**
Mean dependent var	2289.267	SD dependent var	1668.011	
R-squared	0.256	Number of obs.	234	
F-test	6.322	Prob > F	0	
Akaike crit. (AIC)	4092.282	Bayesian crit. (BIC)	4137.201	

**** p<.01, ** p<.05, * p<.1*

Table 16 shows that, after controlling for household, farm, and institutional characteristics, male FISP beneficiaries tended to earn higher maize income than female beneficiaries, although the effect is only weakly significant. This suggests that the gender difference in maize income persists more than the gender difference in maize yield, even after accounting for other observable factors. Among the explanatory variables, total farm size and cattle

ownership have positive and statistically significant effects on maize income, indicating that broader resource endowments and asset ownership play an important role in shaping income outcomes among beneficiaries. By contrast, age, marital status, maize farm size, household size, education, off-farm job involvement, extension access, access to credit, and access to training do not show statistically significant effects in this model. Overall, the results suggest that maize income differences among beneficiaries are influenced less by most demographic or institutional factors included in the model and more by resource-based advantages, particularly landholding and livestock ownership. The findings therefore imply that the observed income gap between male and female beneficiaries is likely linked to unequal access to productive assets and scale-related advantages rather than to gender alone.

Table 16. Linear regression estimate of factors affecting the maize income of male and female farmers

Maize income	Coef.	St.Err.	t-value	p-value
Gender	**2063.861**	**1261.191**	**1.64**	**0.10**
Age	30.317	52.163	0.58	0.56
Marital status	1924.52	1753.805	1.1	0.27
Total farm size	**668.023**	**292.733**	**2.28**	**0.02**
Maize farm size	428.093	629.704	0.68	0.50
Household size	-9.224	208.955	-0.04	0.97
Education (years)	203.422	231.017	0.88	0.40
Number cattle	**288.158**	**112.563**	**2.56**	**0.01**
Off-farm job involvement	751.208	1227.28	0.61	0.54
Extension access	4592.471	5427.265	0.85	0.40
Access to credit	-65.545	1217.836	-0.05	0.96
Access to training	-671.81	501.844	-1.34	0.18
Constant	-2187.472	6380.235	-0.34	0.73
Mean dependent var	12454.14	SD dependent var	8083.45	
R-squared	0.188	Number of obs.	234	
F-test	4.265	Prob > F	0	
Akaike crit. (AIC)	4851.186	Bayesian crit. (BIC)	4896.105	

5. Discussion

This study addressed three research objectives: first, to identify and analyse the determinants of women farmers' access to FISP in Southern Province; second, to evaluate the impact of input subsidy access on women's maize productivity and maize farm income relative to non-beneficiaries; and third, to compare maize productivity and maize farm income between male and female FISP beneficiaries. The following sections discuss the findings in relation to each objective, interpreting what the results mean in practice and what they imply for the future design and implementation of FISP. Propensity score matching combined with linear regression was used to estimate causal effects while accounting for observed selection bias, following established quasi-experimental approaches used in earlier studies of input subsidy programmes in Zambia and Malawi (Ricker-Gilbert et al., 2013; Mason et al., 2017).

Regarding the first objective, the probit analysis identifies extension service access as the most significant determinant of women's participation in FISP, with a large and statistically significant positive marginal effect. This finding has important structural implications. In Zambia's Southern Province, women's access to agricultural extension services is constrained by distance to extension offices, limited female extension agents, and the male-dominated structure of local cooperatives through which FISP is administered (Adebayo & Worth, 2024; Buehren et al., 2019). Since programme participation depends on knowing registration procedures, meeting eligibility requirements, and collecting inputs within specific timeframes, women who lack access to extension networks are effectively excluded even when formally eligible. This points to a structural gap in FISP's design: the programme relies on institutional channels that do not reach women equally. The finding raises a critical question for FISP programming if extension access is the key gateway to subsidy participation for women, and extension services remain systematically less accessible to women, then the programme risks reinforcing existing gender inequalities in input access rather than reducing them.

Education also has a positive and marginally significant effect on women's participation probability. More educated women are better positioned to navigate programme procedures, communicate with cooperative officials, and meet administrative requirements (Krishnan & Patnam, 2014; Asfaw & Admassie, 2004). However, the finding that household size negatively affects participation is equally significant. Larger households face higher food security needs and competing demands on women's time and labour. Women in large

households may find it difficult to engage with cooperative registration processes, attend input collection points, or advocate for inclusion within the cooperative structure. This suggests that FISP's current targeting criteria, which focus primarily on landholding and cooperative membership, do not adequately account for the intra-household constraints that limit participation for women in larger and more resource-stressed households.

Cattle ownership shows a positive marginal effect on participation, reinforcing evidence from the broader literature that wealthier households are better positioned to navigate programme entry requirements (Hemming et al., 2018). Since women in Zambia's Southern Province own significantly fewer cattle than men (O'Sullivan, 2017), this dynamic further compound women's access disadvantage. Taken together, the determinants analysis shows that FISP access for women is shaped not just by formal eligibility but by a set of institutional and household conditions that are systematically less favourable for women. These include limited connectivity to extension networks, constraints on time and mobility, and lower asset ownership. The current FISP framework does not address these structural barriers directly, which suggests that the programme is more likely to maintain existing patterns of gendered access than to transform them, unless complementary measures to strengthen women's institutional inclusion are introduced alongside input provision.

Regarding the second objective, the propensity score matching results consistently show that women who accessed FISP recorded significantly higher maize yields and maize farm income compared to comparable women non-beneficiaries. These results confirm that input subsidies can meaningfully improve women's agricultural performance when structural barriers to access are overcome. In terms of the mechanism, subsidised inputs, specifically certified maize seed and fertiliser reduce the liquidity and financial barriers that prevent smallholder women farmers from applying recommended input packages. The regression estimates further confirm a positive and strongly significant effect of subsidy access on both yield and income among women farmers, reinforcing the matching findings and indicating a robust, programme-specific effect (Ricker-Gilbert et al., 2013; Mason et al., 2017). For FISP programming, this is an important result: it shows the programme delivers measurable benefits for women when they can access it, which justifies continued investment in broadening women's participation and reducing barriers to entry.

However, the findings also show that the impact of FISP on women is conditional on the presence of complementary resources. Total farm size remains a significant positive predictor

of both yield and income in the regression models, and marital status is positively associated with income. This suggests that women with larger landholdings and greater household support are better placed to convert subsidy access into productive gains. Women with smaller plots who constitute a substantial proportion of female smallholders in Southern Province, appear less able to leverage the full productivity potential of subsidised inputs. Credit access and training participation are also associated with higher women's yields, indicating that the effectiveness of FISP is reinforced when complementary services accompany input provision (Buehren et al., 2019; Krishnan & Patnam, 2014). For future FISP programming, these findings imply that input subsidies alone are unlikely to be transformative for the most resource-constrained women farmers. Complementary investments in land access, credit, and extension services are needed to unlock the full productivity benefits of FISP, particularly for women who face cumulative resource deficits (Holden, 2019; Hemming et al., 2018).

The negative and significant coefficient for maize farm size in the women's yield model warrants specific attention. This result suggests that expanding maize cultivation area without corresponding increases in complementary resources; labour, fertiliser, and equipment reduces maize output per hectare. This pattern is consistent with evidence from other studies of female-managed plots in Sub-Saharan Africa, where factor intensity is lower and productivity per unit area falls as area expands without proportional resource increases (Gebre et al., 2021). For FISP programming, this implies that encouraging women to expand their maize area in response to subsidised input access, without simultaneously addressing labour and capital constraints, may not improve overall productivity efficiency and could inadvertently reduce per-hectare yields.

The positive association between off-farm income and women's maize yield is also instructive. Off-farm earnings relax household liquidity constraints and enable women to invest in complementary inputs and hired labour, improving on-farm productivity (Musumba et al., 2022). This finding highlights that women's agricultural performance is closely linked to their broader livelihood diversification and access to non-farm income. The negative relationship between education and maize yield observed in the gender comparison model most likely reflects the shift of more educated household members toward off-farm employment rather than a direct negative return to schooling (Musumba et al., 2022; Asfaw & Admassie, 2004). Rather than education directly improving farm management, it may facilitate household income diversification, with the on-farm productivity effect depending

on how the resulting income is reinvested. This has implications for FISP's mission: if more educated households shift labour away from maize cultivation, the programme's aggregate productivity targets may be harder to achieve among these groups under current programme conditions.

Regarding the third objective, it is important to clarify what maize farm income refers to in this study. The income variable captures revenues earned by farmers from selling their maize output, whether from plots managed independently or jointly within the household. In smallholder farming systems in Zambia, the extent to which women independently control maize production and retain proceeds from sales varies considerably. Where maize is grown on joint household fields, it is often men who oversee marketing decisions and handle the cash proceeds, even when women provide substantial labour (Mgalamadzi et al., 2024; Masamha et al., 2024). This distinction between productive contribution and income control is critical for interpreting the gender income gap observed in this study: the measured income gap between male and female beneficiaries may understate the deeper asymmetry in who actually controls and benefits from agricultural earnings.

The descriptive and matching results indicate that male beneficiaries achieve higher maize yields and substantially higher maize income than female beneficiaries. However, the regression analysis shows that the gender coefficient on maize yield becomes statistically insignificant once total farm size, maize area, cattle ownership, and other resource variables are controlled for. This finding has important analytical significance: it demonstrates that observed yield differences between male and female FISP beneficiaries are driven primarily by inequalities in productive resource endowments rather than by differences in farming ability or the technical efficiency of women farmers. Women matched to men with equivalent resources show comparable yields, confirming the widely-documented finding in gender and agricultural research that the gender yield gap in smallholder systems is largely resource-based rather than reflecting any inherent productivity disadvantage among women (Doss, 2025; Adeyeye, 2025; Adegbola & Singbo, 2025).

By contrast, the income gap between male and female beneficiaries is more persistent. The gender coefficient on maize income remains positive and marginally significant even after controlling for observable resource differences. This divergence between the yield and income patterns points to gendered differences in the commercialisation of maize production. Male beneficiaries in Southern Province tend to operate at larger scale, own more cattle that

facilitate transport and market access, and are more likely to engage with structured maize marketing channels (Siankwilimba et al., 2023). Women, by contrast, tend to allocate a higher share of their maize harvest to household consumption, with market sales representing a smaller proportion of output (Fischer & Qaim, 2014). Additionally, intra-household bargaining dynamics may limit the degree to which women control the decision to sell and retain the proceeds from sales, particularly where production is from jointly farmed plots (Masamha et al., 2024). This means that even where FISP increases women's maize output, the income benefit to women themselves may be partially captured by male household members.

These findings can be interpreted within Kabeer's (1999) framework of gender empowerment, which distinguishes between resources; the means of achieving goals, agency; the power to make strategic choices and achievements; the actual outcomes attained. The results suggest that FISP provides women with greater access to productive resources in the form of subsidised inputs but does not alter their agency within the household or strengthen their ability to control commercialisation and income decisions. The persistent income gap reflects this limitation: the programme improves women's productive capacity, but structural patterns of intra-household decision-making and market access mean that this capacity does not translate equally into income and economic security for women. For FISP to achieve genuinely transformative gender outcomes rather than merely improving aggregate output while leaving the distribution of benefits unchanged, programme design would need to go beyond input provision and explicitly address women's agency in selling decisions, their access to output markets independently of male household members, and their right to retain income derived from their own productive contributions (Soh Wenda et al., 2024).

The persistence of the gender income gap among FISP beneficiaries also raises broader questions about whether FISP can meet its stated mission of improving rural incomes equitably. The programme's performance targets are typically measured at household level, which can mask gender-differentiated distributions of benefits within the household. Given that women are more likely than men to allocate agricultural income towards household welfare, nutrition, and children's wellbeing (Soh Wenda et al., 2024), redirecting a larger share of programme benefits to women would have multiplier effects on household welfare outcomes. However, under current programme conditions where access barriers disadvantage women and where income from maize sales is not guaranteed to remain with women, it is

unclear whether FISP can fully meet these broader welfare objectives without complementary gender-responsive interventions.

The study's findings can be situated within the two theoretical frameworks that guided the research design. The Agricultural Household Model predicts that input subsidies relax liquidity constraints under imperfect input markets and thereby increase household productive activity (Singh, Squire & Strauss, 1986; Dorward, 2009). The observed positive impact of FISP access on women's maize yield and income aligns with this expectation, while the regression results further show that farm size, access to credit, and training strengthen productivity gains, indicating that these are complementary factors in household production decisions. However, the model's expected benefits are most fully achieved among women with stronger resource bases. Where structural constraints remain, such as small landholdings, low cattle ownership, and limited access to credit, the gains from subsidised inputs are still restricted. This underlines that improving the underlying conditions assumed by the model is essential, rather than viewing subsidy provision on its own as an adequate solution.

The findings are also consistent with the key propositions of Gender and Intra-Household Bargaining theory, which rejects unitary models of household decision-making and emphasises that outcomes depend on the relative bargaining positions of household members (Agarwal, 1997; Kabeer, 1999). The persistence of the income gap between male and female beneficiaries, even after controlling for observable resource differences, is consistent with the framework's proposition that women's ability to convert productive capacity into economic outcomes is constrained by intra-household power dynamics. The divergence between the yield and income patterns is particularly revealing women can match men's productivity given equivalent resources, but gendered patterns of market access and income control prevent this productive capacity from translating equally into income. This underscores that FISP's impacts on gender equity cannot be fully understood at the individual farmer level, they must be read through the lens of intra-household dynamics and structural inequalities that shape who benefits from programme participation.

Collectively, these findings show that FISP can meaningfully improve women's maize productivity and income when women are able to access the programme, but that the programme's potential for transformative gender impact is constrained by structural barriers at both the access and outcome levels. At the access level, women face institutional and household conditions; limited extension connectivity, large household size, low asset

ownership that reduce their programme participation compared to men. At the outcome level, even women who do participate face resource constraints and intra-household dynamics that limit how fully they can convert subsidy access into productive and income gains. These findings suggest that addressing the structural constraints facing women in land access, extension services, output market participation, and household bargaining is a prerequisite for FISP to achieve equitable and sustainable welfare impacts.

6. Conclusion and Recommendations

This study investigated the determinants of women's access to the Farmer Input Support Programme and evaluated the effects of input subsidies on maize productivity and farm income among smallholder farmers in Zambia's Southern Province. Three objectives guided the study: to identify the factors shaping women's FISP participation, to estimate the differential impact of subsidy access on women's maize productivity and income, and to compare outcomes between male and female beneficiaries. Propensity score matching and linear regression were applied to a survey dataset from four districts to estimate programme effects while controlling for observed selection bias.

The first objective found that extension service access is the strongest predictor of women's FISP participation, with education having a positive effect and household size a negative effect. Cattle ownership also marginally increases participation probability. These determinants reveal that women's access to the programme is constrained by a set of institutional and household conditions; limited connectivity to extension networks, larger household demands, and lower asset ownership that are not addressed by FISP's current targeting criteria, which focus primarily on landholding and cooperative membership.

The second objective found that women who accessed FISP recorded significantly higher maize yields and farm income compared to non-beneficiaries. The regression models confirm a strong positive effect of subsidy access on both outcome variables, which is reinforced by complementary factors including farm size, credit access, and training participation. These findings show that FISP delivers measurable productivity and income benefits for women when access barriers are overcome.

The third objective produced a more differentiated picture. Male beneficiaries recorded higher maize yields than female beneficiaries in matched comparisons, but the yield gap was not statistically significant in the regression model once productive resource variables were controlled for. This indicates that women are as productive as men under equivalent resource conditions, and that the observed yield gap reflects resource disparities rather than differences in farming ability. The income gap between male and female beneficiaries, however, remained significant even after controlling for resource differences, reflecting gendered differences in commercialisation scale, market access, and intra-household control over proceeds.

In relation to the study's three hypotheses, the first hypothesis that institutional and household factors shape women's FISP participation was supported, with extension access, education, household size, and cattle ownership all emerging as significant determinants. The second hypothesis that subsidy access improves women's maize productivity and income relative to non-beneficiaries was supported by both the matching and regression results. The third hypothesis that male and female beneficiaries differ in maize productivity and income was partially supported: the income gap is robust to controlling for resource differences, while the yield gap is largely explained by unequal resource endowments rather than gender per se.

Collectively, the findings demonstrate that FISP can improve women's agricultural performance, but that its effectiveness is conditional on women's access to complementary resources and on structural conditions that currently disadvantage women in programme participation and income retention. The structural inequalities in land access, extension connectivity, cattle ownership, and intra-household income control are not incidental to FISP's gender performance, they are built into the institutional and resource conditions through which the programme operates. Until these conditions are addressed, FISP risks reinforcing rather than reducing gender disparities in agricultural outcomes.

The findings have specific and actionable implications for FISP's design and implementation.

First, FISP's beneficiary outreach and registration processes should be redesigned to actively reach women through female extension agents, women's farmer groups, and community-based information channels, given that extension access is the most important predictor of women's participation (Buehren et al., 2019; Adebayo & Worth, 2024). Without deliberate outreach to women through accessible channels, the programme will continue to under-serve female smallholders despite their central role in agricultural production.

Second, FISP's targeting criteria should incorporate gender-sensitive inclusion criteria that account for women's structural disadvantages, including limited cooperative membership, restricted mobility, and lower asset ownership. The current criteria, based on landholding and cooperative membership are likely to exclude many of the most resource-constrained women farmers who would benefit most from subsidised input access (Hemming et al., 2018; Jayne et al., 2018). Quotas or reserved allocations for women within cooperative membership lists should be considered to ensure more equitable programme coverage.

Third, FISP should be complemented by investments in women's land tenure security and livestock ownership. Given that farm size and cattle ownership are significant determinants of both FISP participation and agricultural outcomes, policies that improve women's formal land rights and facilitate their access to productive assets would significantly enhance the programme's gender impact (Byamugisha & Dubosse, 2023; Chanda, Shen & Umetsu, 2025). Input subsidies alone cannot close the gender productivity gap in the absence of these complementary resource improvements.

Fourth, addressing the gender income gap requires interventions beyond input provision. FISP should be linked to structured market access programmes, savings and credit cooperatives (SACCOs), and women's agricultural producer groups that facilitate independent marketing of maize output by women (Mwalupaso, Geng & Yasin, 2025). Support for women's participation in maize markets including access to transport, storage, and market information would help translate productivity gains into income gains that women can control and reinvest in their own households. This would also strengthen the broader welfare effectiveness of FISP, given that women's income tends to be allocated more toward household nutrition and wellbeing than men's income (Soh Wenda et al., 2024).

Overall, the study contributes to the literature by providing rigorous, gender-differentiated evidence on FISP's impacts in Zambia's most productive maize region. The findings show that input subsidies can improve women's agricultural performance when access is secured, but that achieving sustainable and equitable programme benefits requires a more comprehensive approach that addresses the institutional barriers to women's participation, the structural resource disparities that condition programme impacts, and the intra-household dynamics that shape the distribution of income from agricultural production. Strengthening FISP's gender-responsiveness on all three dimensions is essential for the programme to contribute meaningfully to inclusive agricultural transformation in Zambia.

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Appendices

List of the Appendices:

Male Beneficiaries and Female Benefici

Female Beneficiaries and Nc