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EVALUATION OF THE SATISFACTION AND PERCEIVED IMPACTS OF THE FREE CERTIFIED MAIZE SEEDS DISTRIBUTION PROGRAM AMONG SMALL SCALE-FARMERS IN JUJA FARM, KENYA

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1. INTRODUCTION.

Agriculture remains a significant pillar of the Kenyan economy, contributing approximately 21.2% of the country's GDP (Gross Domestic Product) and employs close to 33% of the population. About half of the land (48.6%) in Kenya is used for agricultural purposes and of this; 77% is under permanent meadows and pastures, 21% is under arable land and 1.9% is used for permanent crops (INDUSTRIES & MARKETS Agriculture in Kenya, n.d.).

According to the 2019 Kenya Population and Housing Census, there were 6.4 million agricultural households; 76.0% were engaged in subsistence farming and 23.3% in commercial agriculture. It was also observed that 60.9% of the households practiced mixed farming. Kenya's food crops can be categorized into two main groups: pulses (beans, pigeon peas, cowpeas, and green grams) and cereals (maize, wheat, sorghum, rice, and millets). Roots and tubers (yams, cassava, sweet potatoes, arrow roots, and Irish potatoes). Most crops are cultivated as intercrops, single main crops like maize planted with a second crop like beans. Maize is the primary essential food, followed by beans, potatoes, and rice. The two primary growth seasons in Kenya are the October to November short rains and the March to May long rains (Kioko, n.d.).

The significance of maize in Kenya's diet cannot be overstated. It is a staple food consumed in various forms, such as ugali, and a crucial ingredient in animal feed, influencing human and livestock nutrition (Hoffmann et al., 2021, p. 4). Maize, as a staple food crop, plays a pivotal role in ensuring food security and livelihoods for millions of Kenyans. Many maize farmers are small-scale farmers who face challenges that hinder their production capacity and overall contribution to national food security. Among these challenges are the availability and access to high-quality agricultural inputs, notably certified seeds, which are crucial for improving crop yields and quality.

The County government of Kiambu, in collaboration with various non-governmental organizations (NGOs) and international partners, has initiated programs to distribute free certified maize seeds to small-scale farmers to bolster agricultural productivity, enhance food security, and reduce poverty. Juja Farm, located in Kiambu County, has been one of the beneficiaries of such programs. Despite these efforts, there is limited empirical evidence on the satisfaction levels of the farmers with the seed distribution programs and the perceived impacts of these programs on their agricultural productivity and food security.

Preliminary observations and informal evidence suggest mixed outcomes. While some farmers report improvements in yields and overall satisfaction with the quality of seeds provided, others raise concerns regarding the adequacy of the quantities distributed, the suitability of the seed varieties to local conditions, and the sustainability of the program. Furthermore, the effectiveness of these distribution programs in addressing the broader challenges faced by small-scale farmers, including market access, agricultural extension services, and climate change adaptation, remains poorly understood.

This gap in knowledge undermines the ability of policymakers, program designers, and stakeholders to make informed decisions aimed at enhancing the effectiveness of seed distribution programs and ensuring that they meet the needs of the target beneficiaries. It also limits the potential for scaling up successful interventions and applying lessons learned to similar contexts within Kenya and other parts of sub-Saharan Africa facing comparable challenges.

Therefore, this study seeks to fill this gap by systematically evaluating the satisfaction and perceived impacts of the free certified maize seeds distribution program among small-scale farmers in Juja Farm, Kiambu County. By doing so, it aims to provide evidence-based recommendations that can inform future agricultural interventions, contribute to the improvement of small-scale farming practices, enhance food security, and support the sustainable development goals (SDGs) related to poverty reduction, zero hunger, and sustainable agriculture in Kenya and beyond.

2. LITERATURE REVIEW

2.1 The Evolution of Rural Development Policies in Kenya: Focus on Agricultural Development

The evolution of rural development policies in Kenya, especially those related to agricultural development, reflects the broader socio-economic and political dynamics that have shaped the country's approach to rural and agricultural progress. Over the years, the sector has undergone various policy shifts aimed at enhancing productivity, sustainability, and rural livelihoods.

The rise of Kenyan supermarkets and the evolution of their procurement systems for fresh fruits and vegetables illustrate a significant shift towards modern retailing, which has implications for small farmers and rural development policies (Neven, n.d., p. 1). This change signifies the government's efforts to integrate agricultural producers into national and global markets, yet it also poses challenges for small-scale farmers who may struggle to meet the quality and volume demands of these markets.

The use of Information and Communication Technology (ICT) in agriculture and rural development in Sub-Saharan Africa, including Kenya, highlights a critical area of policy development aimed at improving agricultural productivity and rural livelihoods (Maumbe & Okello, 2010). ICT applications in agriculture offer the potential to enhance access to market information, agricultural training, and financial services, thus supporting rural development strategies.

Road infrastructure policies in Kenya also play a crucial role in facilitating agricultural development by improving access to markets, inputs, and services (Wasike, 2001, p. 1). The historical trends and current challenges in road infrastructure development underscore the importance of government investment in infrastructure to support agricultural growth and rural development.

The evolution of farm forestry in Kenya over the last 100 years provides insights into the changing land use practices and the role of policy in encouraging sustainable agricultural practices (Cheboiwo et al., 2016, p. 6). This evolution reflects the government's efforts to address deforestation, land degradation, and climate change through policies that promote tree planting and sustainable land management among rural communities.

Moreover, the politicization of structural adjustment policies in Kenya's sugar industry demonstrates the complex interplay between political economy and agricultural development policies (Akinyi et al., 2012, p. vi). The effects of these policies on pro-poor development outcomes highlight the need for careful consideration of the socio-economic impacts of policy reforms in the agricultural sector.

The evolution of collective land access regimes in pastoralist societies in East Africa, including Kenya, sheds light on the changes in land tenure systems and their impact on pastoral communities (Njagi et al., 2017). These changes have significant implications for agricultural development policies, particularly in terms of securing land rights and promoting sustainable pastoralism.

The evolution of rural development policies in Kenya, with a focus on agricultural development, reflects a multifaceted approach to addressing the needs of rural communities, enhancing agricultural productivity, and promoting sustainable development. These policies have evolved in response to changing socio-economic conditions, technological advancements, and global trends. However, challenges remain, including the need for inclusive policies that address the needs of small-scale farmers and pastoralists, the integration of sustainable practices, and the enhancement of infrastructure and ICT in rural areas. Addressing these challenges requires a comprehensive and participatory approach to policy formulation and implementation.

2.2 The Role of Small-Scale Farming in National Economy and Food Security

The agricultural sector in Kenya serves as a cornerstone of its economy, significantly contributing to the Gross Domestic Product (GDP) and providing employment to a substantial portion of the population. Within this sector, small-scale farming plays a pivotal role in ensuring food security and sustaining rural livelihoods. This literature review explores the contributions of small-scale farming to Kenya's national economy and food security, highlighting the challenges these farmers face and suggesting pathways for improvement.

Small-scale irrigation farming in Bondo District exemplifies the socio-economic factors crucial for adopting agricultural innovations, which directly impact household food security (Okello et al., 2014). Similarly, cash crop farming among small-scale tea farmers in Vihiga County reveals the complex interplay between agricultural practices and food security at the household level (Okello et al., 2014). Furthermore, the quality and contributions of food crops

harvested by households in Ugenya Sub-County, Siaya County, underscore the essential role of diversified crop production in enhancing food security (Owen Odinga et al., 2022).

Access to and use of agricultural information are critical for small-scale women farmers in Vihiga County, underlining the importance of information dissemination in achieving food security (Odini, 2014). The dynamics of small-scale milkfish farming in Kenya reveal the potential and challenges of aquaculture in contributing to food security and poverty alleviation (Mirera, 2019). Moreover, integrated small-scale agricultural production in Suwerwa Location, Transzoia East District, demonstrates the potential for achieving food security through diversified farming practices (Kimingi, 2014).

Aflatoxin contamination in maize from small-scale farms in Kitui, Kenya, highlights the challenges of ensuring food safety and its implications for health and food security (Kyalo et al., 2023). The impact of COVID-19 containment measures by the Government of Kenya on the agricultural sector reveals the vulnerability of farmers' socio-economic lives and food security (Mwende Kinuthia & Susanti, 2021)

Small-scale irrigation farming interventions in Turkana County highlight the importance of irrigation in enhancing food security in arid and semi-arid lands (Situma et al., 2019). The study on farmer decision profiles in Kenya by (Fleming et al., 2016) offers insights into how different farming strategies and decision-making processes affect food security outcomes.

In conclusion, small-scale farming is indispensable for Kenya's food security and economic development. However, the sector faces several challenges, including access to markets, information, and technology; environmental and health risks; and the impacts of global and local policies. Addressing these challenges requires a multifaceted approach involving policy support, technological innovation, and capacity building among small-scale farmers. Enhancing the productivity and sustainability of small-scale farming will significantly contribute to food security and economic stability in Kenya.

2.3 Role of Certified Seeds in Agricultural Productivity in Kenya

Certified seeds play a crucial role in the agricultural sector by guaranteeing that farmers plant high-quality seeds with improved yields, disease resistance, and adaptability to various climatic conditions. Studies have shown that certified seeds are among the significant factors influencing agricultural productivity. For instance, in the analysis of the technical efficiency of smallholder potato farmers in Koibatek, Baringo County, it was found that the type of seed potato used was statistically significant in explaining farmers' technical efficiency. This

underscores the potential of certified seeds to enhance productivity and food security (W.Kiplagat, 2016).

Adopting clean seed potato multiplication agri-enterprises in the Central Rift Valley, Kenya, is another testament to the benefits of certified seeds. (Ong'ayo et al., 2020) highlighted that networking capability, socio-economic, and institutional characteristics positively influence the adoption tendencies of these enterprises, leading to increased supply and access to clean seeds. This initiative significantly contributes to improving potato yields, highlighting certified seed boosting agricultural outputs.

However, the adoption and use of certified seeds among smallholder farmers face several challenges. Transaction costs, including seed search costs, are a significant barrier to the adoption of certified maize seeds (Munyua B, 2012). Reducing these transaction costs and improving farmers' access to certified seeds are crucial steps towards enhancing agricultural productivity.

Furthermore, the significance of agriculture and the use of certified seeds extend beyond productivity. They are integral to the socio-economic development of rural communities by providing employment opportunities, improving household incomes, and enhancing food security. The adoption of sustainable agricultural practices, including the use of certified seeds, contributes to environmental conservation and resilience against climate change.

Agriculture remains a vital sector for Kenya's economy and rural development. The use of certified seeds is pivotal in realizing the sector's full potential in terms of productivity, food security, and socio-economic development. To maximize these benefits, there is a need for concerted efforts from the government, private sector, and development partners to address the challenges hindering the adoption of certified seeds. Policies and programs that support the development, distribution, and adoption of certified seeds will be critical in unlocking the agricultural sector's potential to contribute more significantly to Kenya's economic development and rural livelihoods.

2.3.1 Importance of Certified Seeds in Agricultural Productivity

Certified seeds present many benefits over traditional seeds, including yield improvement, disease resistance, and adaptability to environmental changes. Certified seeds are produced under stringent quality control measures to ensure genetic purity, high germination rates, and freedom from seed-borne diseases, thus offering significant advantages to farmers and the agricultural sector at large. These benefits are critical for agricultural productivity, environmental sustainability, and economic viability of farming practices.

They are developed through advanced breeding techniques to enhance productivity. They are selected for their superior performance in terms of yield compared to traditional or farm-saved seeds. Studies have shown that the adoption of certified seeds can lead to a significant increase in crop yields. For instance, research in Northern Ghana indicated that farmers adopting certified groundnut seeds experienced considerable yield improvements, underscoring the potential of certified seeds to enhance food security and farmer incomes (Dominic et al., 2023).

Another critical advantage of certified seeds is their resistance to diseases. They undergo rigorous testing and are often bred for resistance to common pests and diseases that affect specific crops. This resistance reduces the reliance on chemical pesticides, promoting more sustainable farming practices and reducing production costs. For example, the biocontrol of Fusarium oxysporum with Bacillus spp. strains highlights the integration of disease resistance in certified seeds, contributing to healthier crops and higher yields (Montalvão et al., 2021).

The adoption of certified seeds is instrumental in achieving higher yields, ensuring disease resistance, enhancing adaptability to environmental changes, and economic benefits, improving soil health, and genetic uniformity. These seeds represent a vital component of modern agricultural practices, contributing to increased productivity, sustainability, and resilience in the face of challenges such as climate change and disease outbreaks. As such, encouraging the use of certified seeds among farmers, coupled with supportive agricultural policies and extension services, is essential for the continued growth and sustainability of the agricultural sector.

2.3.2 Disadvantages of Uncertified Seeds

Uncertified seeds, often referred to as traditional or farm-saved seeds, are widely used by smallholder farmers across various regions due to their accessibility and cost-effectiveness. However, the reliance on uncertified seeds comes with several disadvantages that can significantly impact crop yield, agricultural productivity, and overall food security. One of the most significant disadvantages of using uncertified seeds is the potential reduction in crop yield.

These seeds have not undergone the rigorous selection process that certified seeds go through, which means they might not possess the same level of genetic potential for high yields. Studies have shown that uncertified seeds can lead to lower productivity due to their variable genetic purity and potential for lower germination rates. The productivity of key crops such as common beans has been consistently below potential in regions like Machakos County,

Kenya, primarily due to the use of uncertified seeds. These seeds lack the genetic improvements necessary for drought tolerance and soil fertility adaptation, leading to crop failures and low production levels (Johnson et al., 2018).

Uncertified seeds are more susceptible to diseases and pests. Since these seeds are not bred for disease resistance or pest tolerance, their use can lead to increased incidence of crop losses due to infestations and infections. This vulnerability necessitates higher use of pesticides and fungicides, increasing production costs and potentially harming the environment (Araméndiz-Tatis et al., 2020). Compared to certified seeds, which are often developed to withstand specific environmental stresses such as drought, salinity, and extreme temperatures, uncertified seeds may lack adaptability. This can result in poor crop performance under adverse weather conditions or changing climate patterns, directly affecting food security and farmers' livelihoods.

The quality of uncertified seeds can vary significantly, leading to inconsistent crop performance. Factors such as seed age, storage conditions, and contamination with other seed varieties can affect germination rates and crop uniformity. This variability complicates planting and management practices, making it difficult for farmers to predict crop outcomes and plan accordingly. While uncertified seeds may appear cheaper in the short term, their use can lead to economic disadvantages over time. Lower yields, increased susceptibility to diseases and pests, and the need for more intensive management practices can result in higher overall production costs. Additionally, the lower quality and uniformity of crops grown from uncertified seeds may affect marketability and prices, reducing farmers' incomes.

The economic viability of small-scale farming is severely impacted by uncertified seeds. Lower yields translate to reduced income, while the increased cost of inputs such as fertilizers diminishes profit margins. Furthermore, the lack of certified seeds increases the vulnerability of farmers to market fluctuations and climate change, hindering their economic resilience (Dorcas et al., 2019). Utilizing uncertified seeds can lead to a significant loss of genetic diversity within crop populations. Genetic diversity is essential for crop resilience to pests, diseases, and environmental changes. Studies have shown that the use of uncertified seeds, which are often not subject to genetic improvement or conservation practices, can reduce the genetic pool available for future crop development and adaptation efforts (Barasa et al., 2014). This loss of genetic diversity not only undermines the potential for crop improvement but also jeopardizes food security by making crops more susceptible to emerging threats.

The use of uncertified seeds can also impact farmers' access to markets, especially those requiring specific quality standards or certification. Crops grown from uncertified seeds may

not meet the quality criteria set by formal market channels or export regulations, limiting farmers' ability to sell their produce at premium prices or access broader markets (Wosene Minwagaw & Gobie Ejigu, 2021). This restriction to local, often less lucrative markets can perpetuate cycles of poverty among smallholder farmers. Uncertified seeds lack quality assurance in terms of seed purity, germination rates, and freedom from seed-borne diseases. This uncertainty can lead to crop failures, reduced yields, and increased vulnerability to diseases and pests, as evidenced in the high incidence of viral diseases in potato crops propagated from uncertified seed tubers (Sierra et al., 2021). Such outcomes not only affect food security but also increase farmers' reliance on chemical inputs to manage preventable issues, further escalating production costs.

The production and use of uncertified seeds can have unintended environmental consequences. For instance, the lack of resistance traits in uncertified seeds often necessitates higher use of pesticides and herbicides, contributing to environmental degradation, including soil and water pollution, and harming non-target species (Johnson et al., 2018) (Araméndiz-Tatis et al., 2020). Moreover, the informal exchange and planting of uncertified seeds can facilitate the spread of invasive species and pests, exacerbating ecological imbalances.

While uncertified seeds may offer immediate accessibility and cost benefits to smallholder farmers, their disadvantages in genetic diversity, market access, quality assurance, and environmental sustainability present significant challenges, addressing these issues requires comprehensive strategies that enhance farmers' access to certified seeds, bolster extension services to educate farmers on the benefits of seed certification, and develop policies that support sustainable agricultural practices. By tackling the disadvantages associated with uncertified seeds, stakeholders can contribute to more resilient, productive, and sustainable agricultural systems.

2.3.3 Challenges Faced by Small-Scale Farmers in Adopting Certified Seeds

Small-scale farmers play a crucial role in the agricultural sector, particularly in developing countries. Despite the potential benefits of adopting certified seeds, including improved yields, disease resistance, and adaptability to environmental changes, small-scale farmers face significant challenges in adopting these seeds. One of the primary challenges is the lack of information and accessibility to certified seeds. Small-scale farmers often rely on informal seed distribution systems due to limited access to formal seed sectors. This situation is worsened by the high incidence of pests and diseases associated with uncertified seeds, which

further diminishes the quality and productivity of their crops (Mastenbroek et al., 2021). Moreover, in regions like Northern Uganda, the willingness to pay for certified seeds is hindered by information barriers, affecting the adoption rates of agricultural technologies (Mastenbroek et al., 2021).

In the context of sustainable rice production in the Mekong River Delta, farmers show significant adherence to practices like pesticide reduction and the use of certified seeds as part of the "One Must Do, Five Reductions" program. However, challenges in reducing fertilizer use, water use, and seed rate highlight the complexities of fully adopting integrated technology packages. These constraints are often due to perceived difficulties in implementation, unsuitability for farmers' cropping patterns, and adverse weather conditions (Connor et al., 2021).

Exploring strategies for households to adapt to climate change in arid and semi-arid East Africa reveals the importance of understanding local contexts and challenges in adopting certified seeds and other agricultural innovations. Factors such as the natural environment, market accessibility, and socio-economic conditions significantly influence the coping and adaptation strategies of pastoralists and agro-pastoralists (Karanja Ng'ang', 2018).

In Plateau State, Nigeria, the level of information accessibility significantly impacts the adoption of improved Irish Potato production technologies. The study highlights that the major sources of information for farmers include co-farmers, friends/relations, and extension agents. Despite elevated levels of adoption for certain technologies, challenges such as the high incidence of pests and diseases, lack of clean and certified seeds, and inflated costs of fertilizers and herbicides limit the broader adoption of recommended practices (Salau et al., 2020).

Small-scale farmers often face significant financial barriers to adopting certified seeds, which are typically more expensive than traditional or farm-saved seeds. The higher cost of certified seeds can deter farmers with limited resources, making it difficult for them to leverage the benefits of improved seed varieties. Financial support mechanisms and subsidies may be necessary to make certified seeds more accessible to these farmers (Kabunga et al., 2012).

A lack of awareness and understanding about the benefits and proper management of certified seeds contributes to their low adoption rates among small-scale farmers. This gap is exacerbated by insufficient extension services and limited access to agricultural education and training. Enhancing farmer education and extension services is essential to bridge this gap (Feder et al., 1985).

Cultural norms and traditional practices related to seed saving, sharing, and selection can also hinder the adoption of certified seeds. In many communities, there is a preference for using seeds that have been passed down through generations or obtained through local exchanges. Engaging with communities to understand and address these cultural preferences is necessary for encouraging the adoption of certified seeds (Cleveland et al., 1994).

To effectively address these challenges, a comprehensive approach involving policy interventions, financial support, educational programs, and improvements in seed distribution networks is required. Such strategies can help to reduce the barriers to certified seed adoption, thereby enabling small-scale farmers to benefit from the improved yields and resilience offered by these seeds.

2.4 Seed Distribution Programs in Various Countries: Objectives, Implementation Strategies, and Impacts

Seed distribution programs play a pivotal role in agricultural development, food security, and the adaptation to climate change across different countries. These programs are designed with the primary objectives of improving agricultural productivity, enhancing food security, and promoting sustainable farming practices. Implementation strategies vary by region, reflecting local agricultural practices, climatic conditions, and socioeconomic factors.

The core objectives of seed distribution programs are to enhance access to high-quality seeds of improved varieties, increase agricultural productivity, ensure food security, and foster resilience to climatic changes. These programs aim to distribute seeds that are better suited to local conditions, including drought tolerance, disease resistance, and higher nutritional value.

Implementation strategies encompass a broad spectrum of approaches, including public-private partnerships, community-based seed production, subsidies or financial incentives, and capacity building for local farmers. For instance, the Integrated Crop Management Field School (ICM-FS) in Indonesia focuses on addressing issues like centralized seed procurement, low seed quality, and lack of coordination through policy strategies and indicative programs to support national rice production (Agroekosistem et al., 2016). Similarly, the Village Seed Bank (VSB) program in Myanmar aims to develop and distribute improved varieties of pigeon pea, groundnut, and chickpea through a community-based model, significantly impacting the adoption of new cultivars and enhancing agricultural productivity (Charyulu et al., 2018).

The impacts of seed distribution programs are multifaceted, ranging from increased agricultural productivity and improved food security to the enhancement of biodiversity and the promotion of sustainable farming practices. In Laos, the introduction of community-based seed (CBS) systems within the Climate-Smart Village approach has shown significant potential in improving the efficiency of seed systems, demonstrating the benefits of integrating climate-smart agriculture (CSA) practices (Wassmann et al., 2022). Furthermore, the development of biofortified crops through crossbreeding or genetic engineering aims to combat malnutrition by increasing the nutritional value of food crops (Dwivedi et al., 2023).

In Uganda, a study on smallholder access to quality and diverse seeds emphasized the implications for food security, pointing out the challenges posed by weak seed production and distribution systems. The study called for engagement of private sector actors and international development agencies in seed research and production to overcome these barriers (Otieno et al., 2016). Research on sustainable wheat production in Tajikistan highlighted the implications of seed health and protein quality for food security. The study, which combined field surveys with lab analyses, investigated the presence of seed-borne diseases and bread-making quality in Tajik wheat, demonstrating the significance of improving seed health for enhancing crop yield and quality (Husenov et al., 2021).

An assessment of the impact of breeder seed multiplication and certified quality seed distribution on rice production in India revealed significant improvements in agricultural productivity and food security. The study highlighted the critical role of seed distribution in enhancing rice production, underscoring the importance of quality seed access for small-scale farmers (Prasad et al., 2022).

These studies collectively illustrate the critical role of seed distribution programs in improving agricultural productivity, ensuring food security, and promoting sustainable farming practices across different countries. The effectiveness of these programs depends on several factors, including financial support, educational programs, and improvements in seed distribution networks. As such, comprehensive strategies that address these aspects are essential for maximizing the benefits of seed distribution programs globally.

2.5 Seed Distribution Programs in Kenya: Objectives, Implementation Strategies, and Impacts

Seed distribution programs in Kenya are integral components of agricultural policy aimed at enhancing food security, improving agricultural productivity, and supporting smallholder

farmers' livelihoods. These programs are designed with various objectives, employ diverse implementation strategies, and have had significant impacts on the agricultural sector.

The primary objectives of seed distribution programs in Kenya include improving access to high-quality and improved seed varieties, enhancing agricultural productivity, ensuring food security, and promoting sustainable agricultural practices among smallholder farmers. These programs target crops critical for food security and income generation, such as sorghum, millet, and beans, focusing on semi-arid and arid areas where agricultural challenges are most acute (’Opiyo et al., 2020).

Implementation strategies for seed distribution programs in Kenya involve a combination of public-private partnerships, community engagement, and collaboration with development agencies. Efforts to disseminate improved varieties of sorghum in Eastern Kenya, for example, have involved partnerships between the government and several development agencies, emphasizing the need for adequate support services to increase adoption rates. However, challenges such as inadequate seed supply and unfavorable seed-to-grain price ratios have constrained adoption, underscoring the importance of addressing these barriers to enhance program effectiveness (’Opiyo et al., 2020).

In addition to partnerships, seed distribution programs often incorporate training and extension services to improve farmers' knowledge and perception of disease management practices, as seen in the case of finger millet blast disease in Western Kenya. Such initiatives aim to build farmers' capacity for managing crop diseases and adopting improved seed varieties (Mbinda et al., 2021).

The impacts of seed distribution programs in Kenya have been multifaceted. On the one hand, they have contributed to increased household income and productivity among smallholder farmers who adopt improved varieties. For instance, the adoption of improved sorghum varieties has led to significant increases in household income, demonstrating the potential of these programs to contribute to poverty reduction and food security (’Opiyo et al., 2020).

However, challenges such as inadequate seed supply, limited farmer knowledge, and disease pressure have highlighted the need for comprehensive approaches that address these issues. Programs that integrate agricultural, nutrition-specific, and nutrition-sensitive components have shown potential in improving child growth and enhancing dietary diversity in Western Kenya, indicating the benefits of an integrated approach to agricultural development (Wegmüller et al., 2022).

Expanding on the previous discussion, it is essential to delve deeper into the roles of government and non-governmental organizations (NGOs), program designs, and the

previously identified outcomes of seed distribution programs in Kenya. These elements are crucial for understanding the comprehensive approach taken towards agricultural development and food security in the region.

The government of Kenya, alongside various NGOs, plays a pivotal role in the conceptualization, funding, and execution of seed distribution programs. The government's involvement is primarily through the Ministry of Agriculture, which ensures the availability of certified seeds to farmers, aims to improve agricultural productivity, and achieve food security. NGOs complement these efforts by providing technical support, facilitating access to seeds, especially in remote areas, and offering training programs to enhance farmers' knowledge on modern farming techniques (Munene et al., 2022).

Seed distribution programs in Kenya are designed with a keen focus on inclusivity, ensuring that smallholder farmers, who form the bulk of the agricultural sector, are the primary beneficiaries. These programs often integrate aspects such as training on best agricultural practices, pest and disease management, and post-harvest handling to ensure that the distribution of seeds translates into improved productivity and livelihoods. The inclusion of community-based approaches, where local groups are involved in the distribution process, has been instrumental in enhancing the reach and impact of these programs (Munene et al., 2022).

The outcomes of seed distribution programs in Kenya have been significant, with notable improvements in agricultural productivity, food security, and farmers' incomes. The adoption of improved seed varieties has led to increased crop yields, resilience to pests and diseases, and better adaptability to changing climatic conditions. Furthermore, the programs have fostered a greater awareness among farmers about the importance of using certified seeds, contributing to a gradual shift from traditional seeds to improved varieties. These changes have had a positive impact on the overall agricultural sector, contributing to economic growth and stability in rural communities (Munene et al., 2022).

The collaborative efforts between the Kenyan government, NGOs, and other stakeholders in the agricultural sector have been pivotal in the success of seed distribution programs. These programs have not only addressed the immediate needs of farmers but have also laid the foundation for sustainable agricultural practices that are crucial for the country's long-term food security and economic development. Continued support and innovation in program designs, coupled with effective implementation strategies, are essential for building on the current successes and addressing the challenges that still exist.

Comparative analyses of seed distribution programs across various countries underscore the multifaceted nature of these initiatives, focusing on their efficiency, effectiveness, and farmer

satisfaction. Efficiency in seed distribution programs is often measured by the ability to reach targeted farmers with the appropriate quantities of seeds within the necessary periods to ensure optimal planting periods. The integration of information technology in seed distribution, such as the use of databases and mobile applications for tracking and delivery, has been highlighted to enhance efficiency. For instance, in India, the deployment of ICT tools in the seed supply chain has shown promise in reducing distribution costs and improving the timeliness of seed deliveries to farmers (Prasad et al., 2022).

The effectiveness of seed distribution programs is evaluated based on their impact on agricultural productivity, adoption of improved seed varieties, and resilience to climatic stresses. Programs that incorporate training and capacity building for farmers, alongside the provision of high-quality seeds, tend to report higher levels of effectiveness. In Malawi, community seed banks and farmer-to-farmer extension approaches have significantly contributed to the diffusion of knowledge and technology, demonstrating the potential to improve agricultural productivity and food security (Okori et al., 2022).

Farmer satisfaction is crucial for the success of seed distribution programs and is influenced by factors such as the relevance of seed varieties to local conditions, the quality of seeds distributed, and the support services provided. Surveys and studies often reveal that farmers value programs that offer comprehensive support, including access to finance, market information, and post-distribution follow-up. In South Kalimantan, Indonesia, farmer satisfaction was intricately linked to the performance of farmer groups in managing seed distribution and providing agricultural extension services (Marhamah et al., 2020).

Comparative analyses of seed distribution programs reveal a complex interplay between efficiency, effectiveness, and farmer satisfaction. Programs that leverage technology for streamlined distribution, integrate capacity building, and are responsive to farmer needs tend to perform better across these dimensions. Future research could benefit from more detailed comparative studies that directly examine these aspects across different countries and agricultural contexts.

2.6 Methodologies, Indicators, and Scales for Measuring Farmer Satisfaction with Agricultural Interventions

The evaluation of farmer satisfaction with agricultural interventions, including seed distribution programs, is critical for understanding the impact of these initiatives on agricultural productivity and sustainability. Many methods have been used to assess farmer

satisfaction, ranging from quantitative surveys and qualitative interviews to mixed methods. Surveys often utilize structured questionnaires to gather data on farmers' perceptions and satisfaction levels with specific aspects of agricultural interventions (Aydoğdu et al., 2021). Qualitative methods, such as focus group discussions and in-depth interviews, provide deeper insights into the factors influencing farmer satisfaction and the contextual nuances of their experiences (Gorai et al., 2022).

Key indicators of farmer satisfaction include access to quality seeds, effectiveness of extension services, perceived benefits of interventions, and the impact on agricultural productivity and income. For example, irrigation area, education level, income, and farming experience are significant indicators of farmer happiness and satisfaction in the Southeastern Anatolia Project (GAP)-Şanlıurfa region of Türkiye (Aydoğdu et al., 2021). Several scales have been developed to quantify farmer satisfaction, often incorporating Likert-type items to measure agreement or satisfaction with various components of agricultural interventions. The Customer Satisfaction Index (CSI) and Importance-Performance Analysis (IPA) are commonly used tools for evaluating the performance of agricultural services and identifying areas for improvement (Nuraina et al., 2022).

Studies consistently show that farmer satisfaction is influenced by a complex interplay of factors, including the quality of agricultural inputs, the availability and effectiveness of extension services, and the economic benefits of adopting modern technologies or practices. Farmer satisfaction is also affected by socio-demographic factors, such as education level and farming experience, which can influence perceptions and expectations of agricultural interventions (Aydoğdu et al., 2021).

Improving farmer satisfaction requires attention to both the technical and socio-economic aspects of agricultural interventions. Enhancing access to quality seeds, providing effective extension services, and ensuring that interventions are aligned with farmers' needs and contexts are essential for increasing satisfaction and promoting sustainable agricultural practices.

Measuring farmer satisfaction with agricultural interventions is crucial for assessing the effectiveness of these programs and identifying opportunities for improvement. Future research should continue to develop and refine methodologies, indicators, and scales for measuring farmer satisfaction, with a focus on integrating socio-demographic factors and contextual variations to better understand and address the needs of farmers.

2.6.1 Perceived Impacts of Seed Distribution Programs on Farmers

Seed distribution programs have been widely implemented across various regions with the primary goals of enhancing agricultural productivity, ensuring food security, and improving farmers' livelihoods. Economic benefits are among the most significant impacts of seed distribution programs. These benefits include increased income for farmers due to higher productivity and better market prices for improved crop varieties. An economic impact assessment of a broad-bed furrow seed drill for soybeans highlighted the cost-effectiveness and increased profitability for farmers adopting the innovative technology (Sharma et al., 2020). Similarly, the economic benefits of hermetic storage for wheat in Afghanistan, show how improved storage techniques, facilitated by seed distribution programs, can enhance farmers' incomes by reducing post-harvest losses (Ameri et al., 2018).

Yield improvements are a direct outcome of seed distribution programs, primarily through the provision of high-yielding, disease-resistant, and climate-adapted seed varieties. In assessing the impact of the Village Seed Bank (VSB) program in Myanmar, focusing on chickpeas, groundnut, and pigeon pigeonpeas a study found significant yield improvements among farmers participating in the program, attributing these gains to the adoption of improved cultivars distributed through the VSB (Charyulu et al., 2018).

Seed distribution programs also have various social effects, including increased knowledge and skills among farmers, enhanced community resilience, and empowerment of marginalized groups. The programs often include training components that improve farmers' capacities in crop management, pest control, and post-harvest handling. For instance, the role of community-based seed systems in Climate-Smart Villages in Southeast Asia emphasized the social benefits of improved seed access and agricultural knowledge dissemination (Wassmann et al., 2022).

Seed distribution programs have been shown to foster social cohesion and community development. In Togo, Africa, cooperative development through agricultural programs has emphasized the importance of member engagement and cohesion, which are vital for addressing market failures and enhancing economic, environmental, and social sustainability. The Cooperative Management Equilibrium Theory suggests that cohesive social action within cooperatives can lead to a greater emphasis on social and environmental sustainability, demonstrating the potential for agricultural programs to contribute to more cohesive and resilient communities (Berge et al., 2021).

Programs focused on seed distribution often incorporate elements of empowerment and capacity building for farmers. Collective action and community development evidence from self-help groups in rural India highlight how membership-based organizations promote social cohesion through education, access to finance, and linkages to wider development programs. Such initiatives have increased women's participation in group savings programs, household decision-making, and civic activities, though without a direct impact on income or socio-economic status (Desai & Joshi, 2013).

The impact of seed distribution programs on protecting and promoting cultural and social values should not be underestimated. In Vanuatu, the circulation of seeds among farmers, embedded in complex social networks, illustrated how farmer social status and plant biocultural value influence plant circulation patterns. This suggests that agricultural programs can play a role in preserving traditional knowledge and practices while fostering community solidarity (Thomas & Caillon, 2016).

While the social effects of seed distribution programs are positive, challenges remain. The success of these programs in enhancing social cohesion and empowerment can be influenced by several factors, including program design, implementation strategies, and the extent of community involvement. Ensuring that programs are culturally sensitive and aligned with the needs and values of the community is crucial for maximizing their social benefits.

The literature reveals that seed distribution programs have multifaceted impacts on farmers, including economic benefits, yield improvements, and positive social effects. These programs contribute to sustainable agricultural development, food security, and the enhancement of farmers' livelihoods. However, the success of these initiatives depends on careful program design, effective implementation strategies, and ongoing support and training for farmers.

2.7 Theoretical frameworks relevant to understanding the impacts of agricultural interventions on rural communities

The impacts of agricultural interventions on rural communities are complex and multifaceted, encompassing economic, social, and environmental dimensions. Various theoretical frameworks have been employed to understand and assess these impacts, providing insights into the pathways through which interventions can influence rural livelihoods, community dynamics, and socio-economic development.

2.7.1 Sustainable Livelihoods Approach

The SLA (Sustainable Livelihoods Approach) is a comprehensive framework that emphasizes the importance of multiple livelihood assets (human, social, natural, physical, and financial capitals) in determining rural livelihood outcomes. It suggests that agricultural interventions should enhance these assets to improve food security, income, and resilience among rural populations.

For instance, a participatory assessment in rural Ethiopia highlighted how agricultural interventions adapted to local contexts and engaging multiple sectors could effectively improve nutrition and livelihoods by enhancing various SLA capitals (Busse et al., 2017). Çakir et al. (2017) explored the impacts of tourism development, as a form of agricultural diversification, on rural livelihoods in Cappadocia, Türkiye, through the lens of SLA. Their findings highlighted how tourism development transformed local livelihoods and emphasized the importance of supporting small local establishments and protecting the environment to achieve sustainable outcomes. This research underscores the applicability of SLA in assessing non-traditional agricultural interventions and their broader impacts on rural communities.

In the context of climate variability and change, Hasan et al. (2015) applied SLA to assess the impacts on fisher livelihoods in coastal communities of Bangladesh. This study highlighted how climate-induced changes affect occupational activities and the broader spectrum of rural livelihoods, advocating for community-based development and capacity building as effective measures for enhancing climate resilience among fishing communities.

Murray (2023) used SLA to examine the role of self-help women's groups in disaster risk reduction and community resilience in Nepal. They identified economic, social, socio-political, and public-health support as critical for building safer and more resilient communities. This research illustrates the strength of SLA in capturing the gendered dimensions of agricultural and environmental interventions and their impacts on rural livelihoods. By focusing on the assets and capabilities of rural households, SLA provides valuable insights into the pathways through which agricultural interventions can enhance or undermine rural livelihoods.

2.7.2 Community Capitals Framework

The CCF (Community Capitals Framework) focuses on the accumulation and interaction of seven types of capital assets (natural, cultural, human, social, political, financial, and built) in community development processes. It provides a lens to examine how agricultural

interventions can contribute to building these capitals, thereby fostering community development and resilience.

For example, a study on women's empowerment through agricultural interventions in Ethiopia used the CCF to map the process of empowerment, illustrating how investing in various capitals resulted in increased assets and empowerment among rural women (Mulema et al., 2021a). Solis (2012) examined the participatory learning and experimentation process based on the livestock Farmer Field Schools (FFS) approach in Central America. Utilizing CCF, the study identified the strengthening of human capital as the main effect of the program. The FFS approach enhanced technical knowledge about intensive and silvopastoral technologies and improved methodological skills for organizing FFS. This underscores the importance of focusing on social and political capital to facilitate sustainable livestock production systems.

Kline (2017) applied CCF to the craft heritage trails of western North Carolina to illustrate how tourism development as an agricultural diversification strategy impacted multiple forms of community capital. The study demonstrates the ripple effect of impacts, highlighting the interconnectedness of different capitals in promoting rural development and enhancing the sustainability of community interventions.

Thompson & Lopez Barrera (2019) used CCF to explore community resilience and collective agency under significant environmental and built environment changes in southwestern Uruguay. Their findings indicate that structural changes and sociopolitical contexts influenced local responses, stressing the need for incorporating socio-spatial dimensions of inequality in community resilience studies.

Mulema et al. (2021b) drew on CCF to frame and analyze the process of rural women's empowerment through agricultural interventions in Ethiopia. The study found that investments in various capitals resulted in increased assets, fostering empowerment. Specifically, the interaction between social, human, and financial capitals emerged as a key entry point to rural women's empowerment, mediated by cultural capital.

2.7.3 Theory of Planned Behavior

The TPB (Theory of Planned Behavior) has been applied to understand farmers' decision-making processes regarding the adoption of agricultural technologies and practices. It postulates that attitudes, subjective norms, and perceived behavioral control influence individuals' intentions and behaviors. This framework can help in designing agricultural

interventions that effectively address farmers' attitudes and perceived barriers to adoption, thereby enhancing the uptake of improved practices and technologies.

Zubair et al. (2023) applied TPB to understand the performance of agroforestry in Southern Punjab, Pakistan. Their study indicated that the constructs of TPB explained why farmers practicing Agroforestry (AF) showed positive attitudes, valued opinions of relevant referents, and felt more at ease planting trees compared to non-agroforestry farmers (NAF). This suggests that TPB can effectively capture the motivations behind adopting agroforestry practices, highlighting its potential to guide the promotion of agroforestry in similar contexts.

Schrieks et al. (2023) assessed various behavioral theories, including TPB, to understand drought risk adaptation behavior in rural Kenya. Their findings emphasized the significance of economic theories like Expected Utility Theory (EUT) and Rank Dependent Utility Theory (RDU) over TPB in this context. However, elements of TPB, such as perceived self-efficacy and adaptation by family and friends, were important in explaining adaptation decisions. This mixed outcome underscores the complexity of applying TPB in varied agricultural contexts.

Huang et al. (2022) explored the influence of public environmental education and advocacy on conservation behavior value in rural Southwest China, applying TPB to examine villagers' willingness to engage in conservation. Their study highlighted that external factor, mainly policy advocacy and environmental education, significantly influenced villagers' conservation intentions. This indicates the utility of TPB in designing interventions to foster pro-environmental behaviors in rural communities.

Savari et al. (2023) integrated TPB with the Norm Activation Model to investigate farmers' pro-environmental behavioral intentions. This approach emphasizes the importance of social norms and attitudes, supported by an individual's identity, in shaping conservation intentions. It suggests that TPB, especially when combined with other theoretical frameworks, can provide deeper insights into the factors driving environmentally sustainable behaviors among farmers.

The application of the Theory of Planned Behavior in agricultural contexts offers valuable insights into how and why rural communities adopt specific agricultural interventions. While the predictive power of TPB may vary across different settings and types of behaviors, its emphasis on attitudes, subjective norms, and perceived behavioral control remains relevant. These studies collectively underscore the potential of TPB to inform the design and implementation of agricultural policies and programs that effectively address the needs, motivations, and constraints of rural communities.

2.7.4 Diffusion Innovation Theory

The Diffusion of Innovations (DOI) theory, originally proposed by Everett Rogers in 1962, has been a cornerstone for understanding how new ideas and technologies spread through cultures and societies. Its application in the agricultural sector, particularly in the analysis of agricultural interventions and their impact on rural communities, provides valuable insights into the factors influencing the adoption of new farming practices and technologies.

The DOI theory identifies several key factors influencing the adoption of innovations, including the perceived attributes of the innovation, the communication channels used, the time dimension of the adoption process, and the social system context. These factors are critical in understanding how agricultural interventions are received and implemented by rural communities, affecting outcomes related to productivity, sustainability, and socioeconomic development (Dearing & Cox, 2018).

Recent studies have utilized the DOI theory to explore various aspects of agricultural interventions, like the adoption of environmentally friendly innovations in rural Chinese society (Sereenonchai et al., 2017) These studies underscore the importance of social influence, innovation attributes, and communication strategies in fostering the adoption of agricultural innovations.

For instance, Lavoie et al. (2021) applied the DOI theory to understand agricultural producers' perspectives on cover cropping in the USA's inland Pacific Northwest. Their findings revealed that perceptions of low relative advantage, complexity, and lack of observability acted as barriers to adoption, emphasizing the need for tailored outreach and support strategies to improve the integration of cover crops into existing farming systems.

In Brazil, the adoption of integrated systems by cattle farmers was analyzed through the lens of the DOI theory, highlighting the determinants of adoption and the critical role of institutional support in facilitating innovation diffusion within the agricultural sector (de Souza Filho et al., 2021).

The application of the DOI theory in analyzing agricultural interventions offers several implications for policy and practice. Firstly, it highlights the necessity of considering the social context and communication strategies in the design and implementation of interventions. Secondly, it underscores the importance of addressing the perceived attributes of innovations, such as relative advantage and compatibility with existing practices, to enhance adoption rates. Finally, it suggests that fostering networks of early adopters and

opinion leaders within rural communities can significantly influence the diffusion process, driving broader adoption of beneficial agricultural technologies and practices.

Theoretical frameworks play a crucial role in guiding the design, implementation, and evaluation of agricultural interventions. By applying these frameworks, researchers and practitioners can better understand the complex interactions between agricultural interventions and rural community dynamics. This, in turn, can inform the development of more effective and sustainable intervention strategies that address the diverse needs and challenges of rural populations

2.8 Application of Theoretical Frameworks in Analyzing Seed Distribution Programs' Effects

The examination of seed distribution programs through various theoretical frameworks offers insightful perspectives on the impacts of these interventions on rural communities. These frameworks provide a structured approach to understanding the complex interactions between agricultural interventions and socio-economic, environmental, and behavioral aspects within rural settings.

The SLA (Sustainable Livelihoods Approach) has been instrumental in assessing how seed distribution programs enhance the livelihood assets of rural communities. For instance, a study focusing on the rice crop innovations and natural resource management presented a glimpse into future demands for food security and environmental conservation, underlining the necessity for collaborative efforts across scientific disciplines and stakeholders, including seed distribution strategies (Asch & Brueck, 2011).

The CCF (Community Capitals Framework) has been applied to understand how seed distribution programs contribute to building various capital assets within communities, thereby fostering community development and resilience. A study on mobilizing community capitals to support biodiversity highlighted the interconnectedness of natural, cultural, human, social, political, financial, and built capitals in enhancing ecosystem health and biodiversity through agricultural interventions (Flora, 2011).

The theories of Planned Behavior and Diffusion of Innovations have been extensively used to examine behavioral intentions and adoption rates of agricultural technologies among farmers. For example, research on the adoption of smart agriculture technology behavior utilized the TPB to explore the influence mechanism of adoption, highlighting the importance of attitudes,

subjective norms, and perceived behavioral control in farmers' decision-making processes (Li et al., 2023).

The application of these theoretical frameworks in analyzing seed distribution programs reveals a multifaceted understanding of the interventions' impacts on rural communities. It is evident that these programs not only influence agricultural productivity and environmental conservation but also significantly affect social dynamics, community development, and farmers' behavioral intentions towards adoption. Future research should continue to explore these dimensions, employing these frameworks to develop more effective and sustainable agricultural interventions.

2.9 Summary

The main themes and findings from the literature review highlight the pivotal role of certified seeds in enhancing agricultural productivity and food security, underscored by the benefits and challenges of seed distribution programs. These themes include the economic benefits of increased yield and income for small-scale farmers, the yield improvements from high-quality, disease-resistant seeds, and the social effects of such programs in terms of knowledge enhancement and community resilience. These findings are particularly relevant to my research objectives and questions, as they provide a foundational understanding of the context within which the free certified maize seeds distribution program operates in Juja Farm, Kiambu County. The study aims to dig deeper into these themes by evaluating the satisfaction and perceived impacts of the program, thereby contributing to a more distinct understanding of its effectiveness and suggesting areas for future improvement.

3. RESEARCH METHODOLOGY

3.1 Study Area

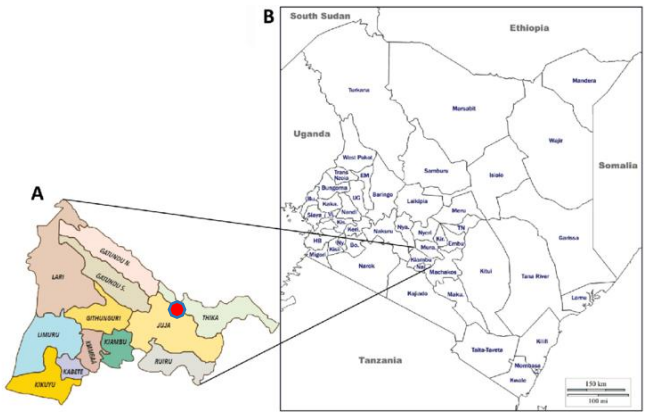

Image 1: A map of Kenya showing Kiambu County and Juja farm (represented by the red dot)

Source: Research gate

The study area I have chosen is Juja Farm, a rural village located in Juja Constituency in Kiambu County. According to history, the area was initially called 'Weru wa Ndarugu' (the Ndarugu plains) but after the arrival of Lord William Northrop Macmillan in the 1900s he bought 19,000 acres of land which were way above the maximum threshold of 5,000 acres an individual was allowed to own. He attributed this success to his two idols Ju and Ja, hence the name Juja Farm.

The area was known majorly for sisal growing but as more people began buying land in the region, the sisal farms decreased, and people began planting other crops mainly maize and beans. Due to the climate change crisis, Kiambu County since 2021 has been distributing among farmers free certified maize seeds that are drought resistant especially the SC DUMA 43 variety to ensure food security in this dry area. The variety has a maturity rate of 75-90 days with an expected yield of 30 bags per acre using a seed rate of 10kg/acre. However, the attainment of this optimal yield is dependent on many factors such as individual agronomic practices of the farmer and the prevailing climatic conditions. Each farmer usually receives a 2kg packet of the certified maize seed variety.

From 2021-2022, the County carried out the program with the help of agri-extension officers and Village Based Advisors who were critical in identifying actual maize farmers thus

ensuring the seeds reached the intended people. Since 2023, after a new Governor was elected, the VBAs and agri-extension officers were no longer part of the distribution system. The distribution of the seeds to the local farmers has been politicized and every politician wants to use the program as a campaign tool, and this has resulted to many local farmers not getting the seeds since the politicians just distribute the seeds to everybody.

3.2 Objectives

Therefore, the objectives of my research are:

- To assess the level of satisfaction among small-scale farmers with the free certified maize seeds distribution program in Juja Farm.
- To determine the perceived impacts (increased income, increased yield, agricultural sustainability) of the maize seeds' distribution program on agricultural productivity among small-scale farmers in Juja Farm.
- To identify factors influencing the satisfaction and perceived impacts of the maize seed program.
- To provide recommendations for improving future seed distribution programs based on the findings.

3.3 Research Questions

The research questions that will guide this study include:

- What is the level of satisfaction among small-scale farmers with the maize seeds' distribution program in Juja Farm?
- What are the perceived impacts of the free certified maize seeds on the productivity of small-scale farmers in Juja Farm?
- Which factors are most influential in shaping the farmers' satisfaction with the maize seeds' distribution program?
- How do farmers suggest the seed distribution program be improved?

3.4 Hypotheses

The hypotheses to be tested out are:

- H1: Farmers who have participated in the maize seed distribution program have a higher crop yield compared to previous years without the program.
- H2: Satisfaction levels among farmers with the maize seed distribution program are significantly influenced by factors such as seed quality and impact on crop yield,
- H3: Farmers who have participated in the maize seed distribution program have a higher income compared to previous years without the program.

3.5 Data Collection

Given the specific challenges associated with identifying and accessing a comprehensive list of all small-scale farmers in the region, I decided to use the snowball sampling technique to reach the targeted participants who are farmers who have been receiving the free certified seeds from the County Government. In the context of Juja Farm, the farmers are part of a close-knit community where everybody knows each other directly or indirectly. The use of these networks will enable the identification and recruitment of participants who have experienced the program firsthand. To prevent over-representation of more socially connected individuals, the study will aim to survey participants from the different parts of Juja Farm.
I used a question to survey the respondents. It was divided into five sections. The first section covered the demographics such as age, gender, farm size, and years of farming experience. The second section covered program participation with questions on the year the respondents began participating in the program, how they learned about the program, and for how many seasons they received the seeds. The third section looked at satisfaction with the program in terms of seed quality, quantity, crop yield, method of distribution, etc. The fourth section was on the perceived impacts such as yield, income, and agricultural sustainability while the last section was on suggestions that the respondents had that would improve the program. 102 respondents were sampled.

3.6 Data Analysis

The responses of the respondents were recorded in a Google form and imported to Excel and JASP statistical software for analysis.

3.7 Challenges

The data collection was challenging since there were no actual records of the number of farmers in the area, especially those that have been participating in the program and when I inquired from the County government offices no response was forthcoming. Due to the ongoing heavy rains data collection was also hampered.

4. RESULTS AND DISCUSSIONS

This chapter contains the results of the analysis and their interpretations.

4.1 Demographic statistics

The table below provides a summary of the demographic statistics of the respondents.

Table 1: Summary table of the socio-demographic statistics of the respondents

Category	Frequency	Percentage
Gender		
Male	53	51.96%
Female	49	48.04%
Age		
35-44	42	41.18%
25-34	24	23.53%
45-54	19	18.63%
54+	12	11.76%
18-24	5	4.90%
Farm Size		
1-5 acres	91	89.22%
More than 5 acres	6	5.88%
Less than 1 acre	5	4.90%
Years of Farming Experience		
5-10 years	51	50.00%
11-20 years	27	26.47%
Less than 5 years	18	17.65%
More than 20 years	6	5.88%
Previously Used Certified Seeds Before Program		
Yes	98	96.08%
No	4	3.92%

Source: Own analysis based on own research 2024

A total of 102 respondents participated in the survey, whereby, 53 were male and 49 females. The gender distribution is almost balanced indicating that any conclusions drawn from the research can potentially apply to both male and female farmers, reflecting a gender-neutral perspective on the impacts of the seed distribution program. The age ranges are spread across

five categories. 35-44 years old which is the largest group, comprising 41.18% of participants, indicating a mature and potentially experienced segment of the farming community.

25-34 years old which is 23.53%, representing younger farmers who might bring newer farming practices or have different expectations from the program. 45-54 years old which is 18.63%, also a sizable portion, likely to have substantial farming experience. 54+ years old making up 11.76%, are the older demographic, who are very experienced but may be less open to changing traditional farming practices.

18-24 years old represented by 4.90%, the smallest group, representing the youngest farmers, possibly the most dynamic in terms of adopting new technologies or farming methods. This diverse age range helps in understanding how different age groups perceive the benefits and challenges of the program, potentially influencing satisfaction and perceived impacts.

For the farm size of 1-5 acres, it dominated the sample with 89.22%, typical for small-scale farmers in the region. More than 5 acres which is a smaller group at 5.88%, could indicate farmers with a bit more resources and possibly different outcomes or perspectives on the program's effectiveness. Less than 1 acre making up 4.90%, is likely to be the most resource-constrained, potentially viewing the program differently in terms of its benefits or sufficiency. The predominance of small-scale farmers in the study is consistent with the target demographic of the seed distribution program, aiming to enhance agricultural productivity at a small scale.

Regarding the farming experience years, half of the participants fall into the category of 5-10 years of farming. 11-20 years comprise 26.47%, indicating deep-rooted experience and valuable insights into the long-term impacts of the program. Less than 5 years comprised 17.65%, possibly representing less experienced farmers who may have diverse needs and perceptions of the program's effectiveness. More than 20 years was at 5.88%, highly experienced, providing a depth of knowledge and perhaps higher expectations from agricultural interventions. An overwhelming 96.08% responded that they had previously used certified seeds before participating in the program indicating a general familiarity and acceptance of similar certified seeds. Only 3.92% responded to having not used certified seeds previously reflecting the possibility that either they were new entrants to farming or were unable to afford or access such seeds.

4.2 Program participation

Table 2: Frequency table for year of participation and number of seasons of receiving certified seeds

Year of Participation	2 Seasons	3 or More Seasons	This is My First Time
2021	2	40	1
2022	2	20	1
2023	32	0	3

Source: Own editing based on own findings

As mentioned earlier in the previous chapter on research methodology, this program is quite new and began in 2021. 40 farmers responded to having begun participating in the program in 2021, hence receiving the certified seeds for over three seasons because there are two planting seasons each year. In the same year, two farmers responded that they had received the certified seeds for two seasons, and this could be because probably they did not receive the seeds in the succeeding season. Only one farmer responded that it was their first time participating in the program and likely did not participate again in the successive seasons or did not receive the seeds. Those that began participating in 2023 and have received the certified seeds for two seasons were 32 farmers.

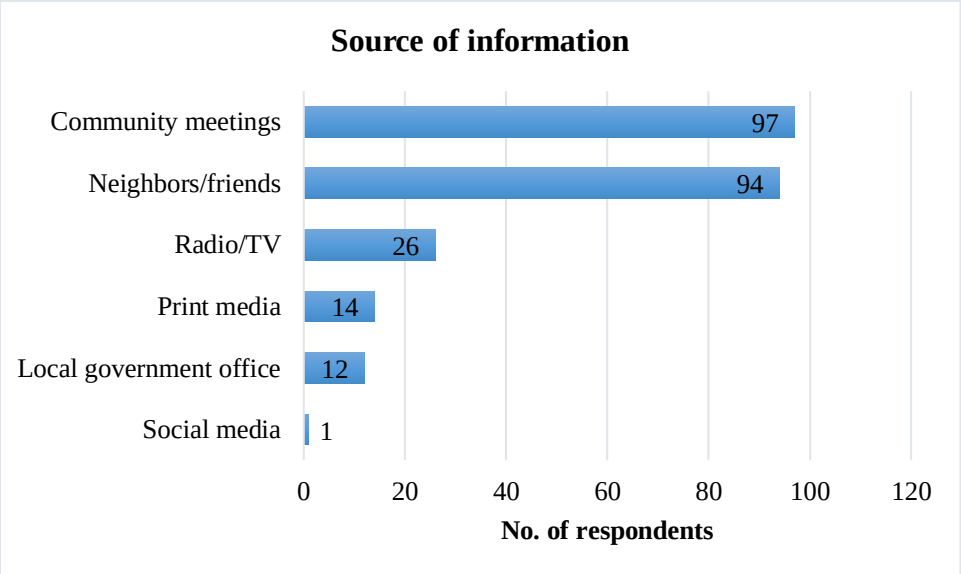

Figure 1: Information sources from which respondents learned about the program
Source: Own editing based on own findings

From the graph above, 95.1% of the farmers learned about the program from community meetings while 92.2% learned through neighbors and friends. This signifies the inter-connectedness of the community in this area and the prevalence of high social capital and

trust among the community members. The least used medium of communication is social media at 1% indicating that it is not a major channel for this program or participants.

4.3 Satisfaction with the program

The figure below represents the satisfaction level of farmers based on the quality of seeds they received. 1 represents the lowest level of satisfaction, which is strongly dissatisfied, 2= dissatisfied, 3= slightly dissatisfied, 4= slightly satisfied, 5= satisfied, and 6= strongly satisfied.

4.3.1 Seed Quality

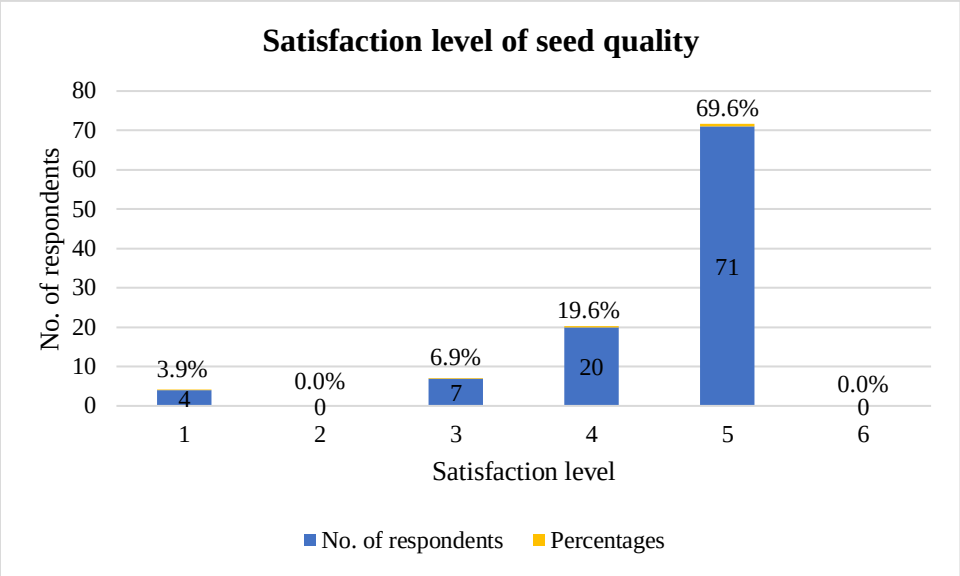

Figure 2: Satisfaction level of the quality of the seeds received

Source: Own editing based on own findings

The data suggests that 3.9% of the participants were strongly dissatisfied, 6.9% were slightly dissatisfied, 19.6% were slightly satisfied, 69.6% were satisfied while there were no responses for dissatisfied and strongly satisfied. This shows that a majority of the participants are satisfied with the quality of the seeds. The lack of responses on the highest satisfaction level and 4 responses indicating strongly dissatisfied shows that there is room for improvement.

4.3.2 Quantity of the seeds

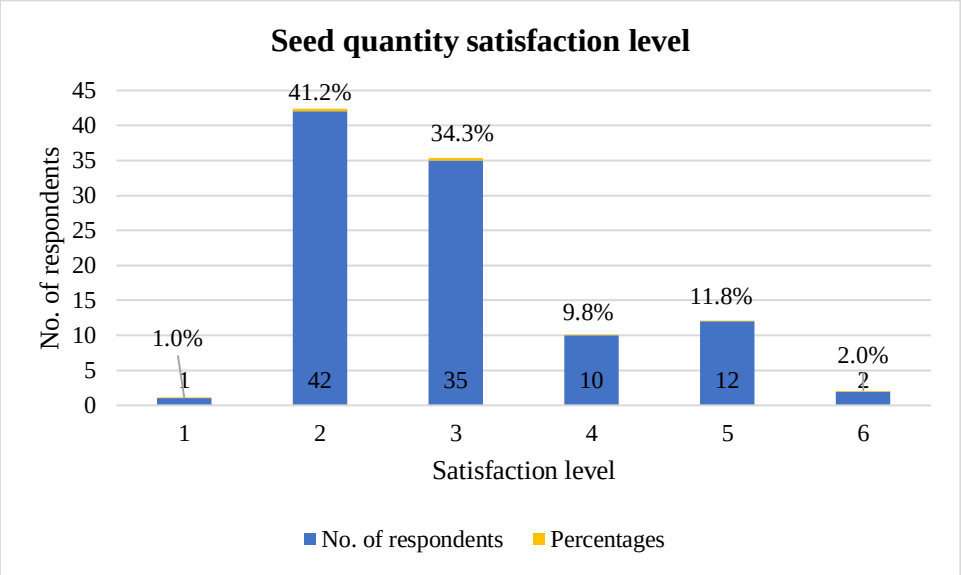

Figure 3: Satisfaction level of the seed quantity received

Source: Own editing based on own findings

From the figure above, 1% of the participants found the seed quantity completely unsatisfactory, 41.2% were dissatisfied, 34.3% were slightly dissatisfied, 9.8% were slightly satisfied, 11.8% were satisfied and 2% were strongly satisfied. The overall responses are skewed towards dissatisfaction with the quantity of the seeds. This can be attributed to farmers receiving only one 2kg packet of the certified seeds for planting against the recommended rate of 10kg/acre.

4.3.3 Agri-extension support and services

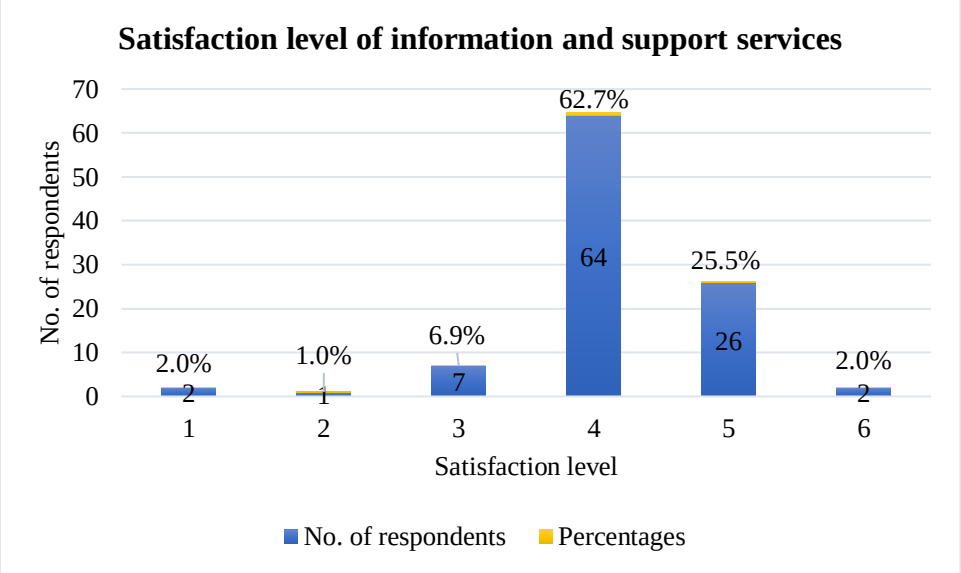

Figure 4: Satisfaction level of the support and information provided on effective use of the seeds

Source: Own editing based on own findings

The chart indicates that most of the participants (62.7%) rated their satisfaction at level 4, meaning they were slightly satisfied with the support and information on how to use the seeds effectively. Another 25.5% were satisfied, indicating a general positive sentiment towards the support and information provided. The sum of these two categories shows that a significant majority (88.2%) of the participants felt at least slightly satisfied or better. On the other hand, only 10% of participants expressed any form of dissatisfaction (levels 1 to 3), with very few (2%) reporting they were strongly dissatisfied. This response distribution suggests that the program was successful in providing support and information to the farmers, with most participants indicating positive reception. Only a small proportion of participants indicated a need for improvement in these areas.

4.3.4 Access to the distribution point

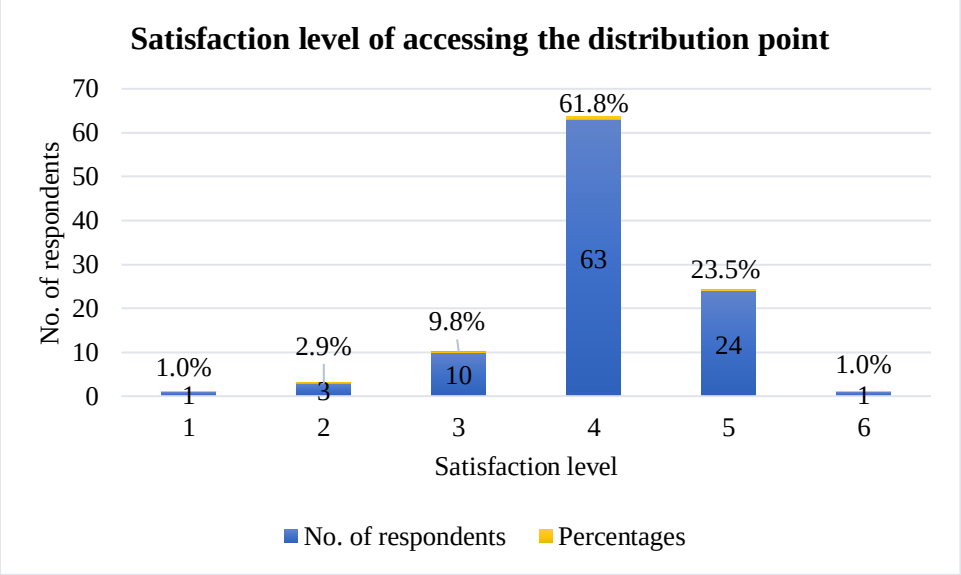

Figure 5: Satisfaction level of accessing the distribution point

Source: Own editing based on own findings

The majority of responses cluster at level 4, implying that most participants did not have significant issues with accessing the distribution point. However, they did not find it extremely easy either, suggesting room for improvement in making the distribution points more accessible. A smaller yet notable percentage of participants rated it at 5, indicating relative ease. The small number of participants at the extremes (1 and 6) suggests that while

there were no significant problems with access, very few found it exceptionally easy or difficult. The program could consider this feedback to further streamline the distribution process and enhance the accessibility of the distribution points.

4.3.5 Method of seed distribution

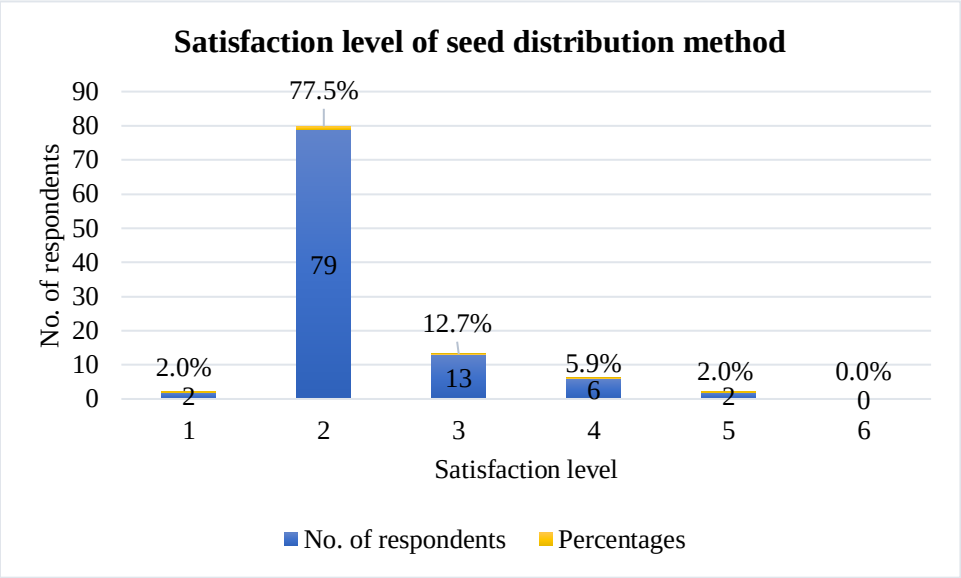

Figure 6: Satisfaction level of method of seed distribution

Source: Own editing based on own findings

The distribution of responses is heavily weighted towards dissatisfaction, with the vast majority indicating dissatisfaction (77.5% at level 2). There is also a noteworthy number of participants who felt slightly dissatisfied (12.7% at level 3). Conversely, satisfaction levels (levels 4 and 5) are quite low (combined 7.9%), and no one expressed complete satisfaction (level 6).

These results suggest that the seed distribution method may require significant improvement. Participants seem to have had a negative experience with the way seeds were distributed, as reflected in the high concentration of responses at the lower end of the satisfaction scale. Addressing concerns about the distribution method could be a critical step for the program to improve its effectiveness and farmer satisfaction.

4.3.6 Impact on crop yield

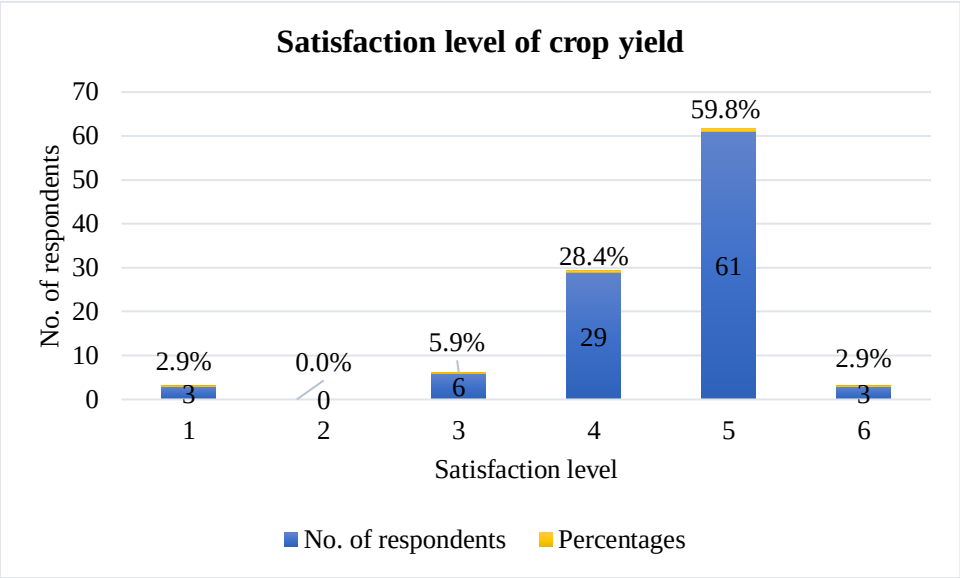

Figure 7: Satisfaction level of impact of the seeds on crop yield

Source: Own editing based on own findings

The majority of participants rated the impact as high (level 5), showing that most farmers observed a significant improvement in their crop yield due to the seeds. Another 28.4% rated the impact as moderate (level 4), suggesting that while not as substantial as the others, they still noted positive effects. The small number of responses at the extremes (level 1 and 6) indicates that very few participants found the seeds to have no impact or a very high impact. The absence of any rating for level 2 suggests that all participants felt that the seeds had some positive impact on crop yield, at least to some degree. These results overall suggest that the program was successful in terms of its primary goal, which is to improve crop yield through the distribution of quality seeds. The data reflects a positive trend in increased crop yield among most participants.

4.3.7 Overall satisfaction with the program

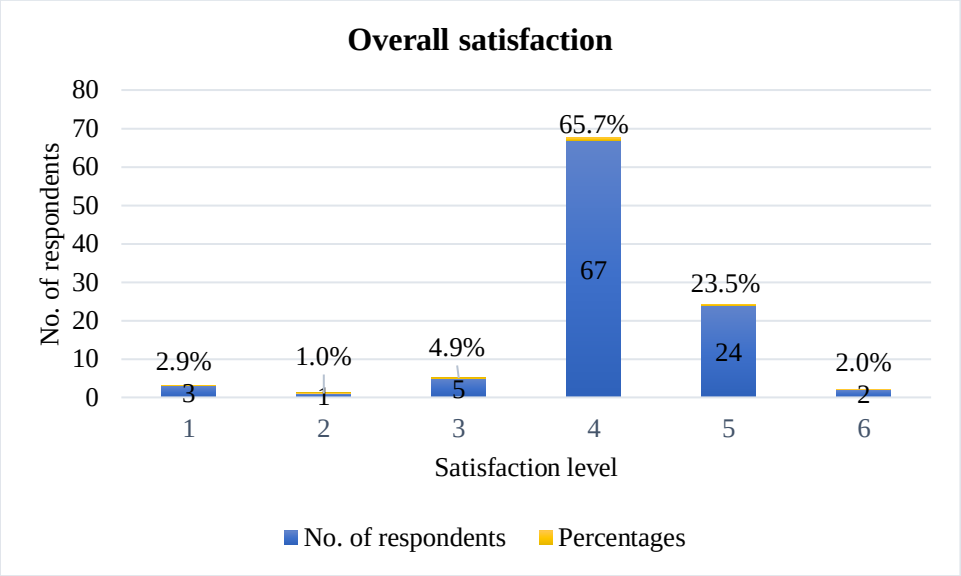

Figure 8: Overall satisfaction level of the program

Source: Own editing based on own findings

The most prominent observation is that the largest group of participants reported being slightly satisfied (rating 4), making up 65.7% of the responses. Additionally, 23.5% of participants were satisfied (rating 5), cumulatively indicating that a majority of the participants, 89.2%, felt some level of satisfaction with the program. On the other hand, a small proportion of participants were dissatisfied, with 2.9% very dissatisfied and 4.9% slightly dissatisfied. Only a minimal number of participants (2%) were very satisfied, suggesting that while most participants have a positive view of the program, there is a potential for improvement to shift satisfaction levels from 'slightly satisfied' to 'very satisfied. Overall, the program seems well-received, but the relatively low number of participants who are 'very satisfied' might highlight areas where the program could improve to enhance participant satisfaction further.

4.3.8 Assessing influences on farmer satisfaction

Table 3: Spearman's correlation

Variable		Seed Quality	Seed Quantity	Overall satisfaction	Seed distribution method	Impact on crop yield	Support services	Accessing the distribution point
Seed Quality	Spearman's rho	-						
	p- value	-						
Seed Quantity	Spearman's rho	0.16	-					
	p- value	0.109	-					
Overall satisfaction	Spearman's rho	0.496***	0.591***	-				
	p- value	<.001	<.001	-				
Seed distribution method	Spearman's rho	-0.117	0.352***	0.166	-			
	p- value	0.242	<.001	0.095	-			
Impact on crop yield	Spearman's rho	0.864***	0.172	0.526***	-0.082	-		
	p- value	<.001	0.084	<.001	0.415	-		
Support services	Spearman's rho	0.534***	0.261**	0.602***	0.044	0.570***	-	
	p- value	<.001	0.008	<.001	0.658	<.001	-	
Accessing the distribution point	Spearman's rho	0.513***	0.13	0.377***	-0.108	0.524***	0.421***	-
	p- value	<.001	0.191	<.001	0.281	<.001	<.001	-

* p < .05, ** p < .01, *** p < .001

Source: Own editing based on own findings.

Quality of the seeds received has a strong, positive correlation with the impact of the seeds on crop yield (rho = 0.864, p < .001), indicating that as the quality of the seeds increases, so does their impact on crop yield, and this is statistically significant.There is a moderately strong, positive correlation with overall satisfaction (rho = 0.496, p < .001), suggesting that higher quality seeds are associated with higher overall satisfaction. Quality of seeds also shows a

positive correlation with support services (rho = 0.534, p < .001) and accessing the distribution point (rho = 0.513, p < .001), both statistically significant.

Quantity of the seeds received show a moderate, positive correlation with overall satisfaction (rho = 0.591, p < .001), indicating that greater quantities of seeds are associated with higher overall satisfaction. A positive correlation is observed with the method of distributing the seeds (rho = 0.352, p < .001), implying that better satisfaction with the quantity is associated with the method of distribution. The relationship between quantity and the quality of seeds is positive but not statistically significant (rho = 0.160, p = 0.109).

Overall satisfaction with the program shows significant positive correlations with all other factors, most notably with the quantity of seeds received (rho = 0.591, p < .001) and support services (rho = 0.602, p < .001). This suggests these are important factors in overall satisfaction. The weakest significant correlation for overall satisfaction is with the method of distributing seeds (rho = 0.166, p = 0.095), which is on the edge of statistical significance.

Method of distributing the seeds to farmers has a significant positive correlation with the quantity of seeds received (rho = 0.352, p < .001) but a non-significant, slight negative correlation with the overall satisfaction (rho = -0.117, p = 0.242).

Impact of the seeds on crop yield is strongly correlated with the quality of the seeds received (rho = 0.864, p < .001), reinforcing the idea that better quality seeds significantly improve crop yield. It also has a moderate, positive correlation with overall satisfaction (rho = 0.526, p < .001) and support services (rho = 0.570, p < .001).

Support services has a moderate, positive correlation with the overall satisfaction (rho = 0.602, p < .001), indicating the importance of support services in determining satisfaction. It also has a statistically significant correlation with the quality of seeds (rho = 0.534, p < .001) and with accessing the distribution point (rho = 0.421, p < .001).

Accessing the distribution point shows a moderate, positive correlation with overall satisfaction (rho = 0.377, p < .001), implying that ease of access to the distribution point influences satisfaction. It also has significant positive correlations with the quality of seeds (rho = 0.513, p < .001) and the impact of seeds on yield (rho = 0.524, p < .001).

Therefore, it can be concluded that the impact of seeds on crop yield and the quality of seeds received are very strongly related, suggesting that quality is a primary driver of effectiveness. Overall satisfaction is significantly influenced by the quality and quantity of seeds, the impact on crop yield, and support services, with the strongest correlations being with quantity and support. The method of seed distribution appears to have less influence on overall satisfaction and other factors than the remaining variables. These results suggest associations between the variables but do not necessarily indicate that one variable causes the other to change.

4.4 Perceived impacts

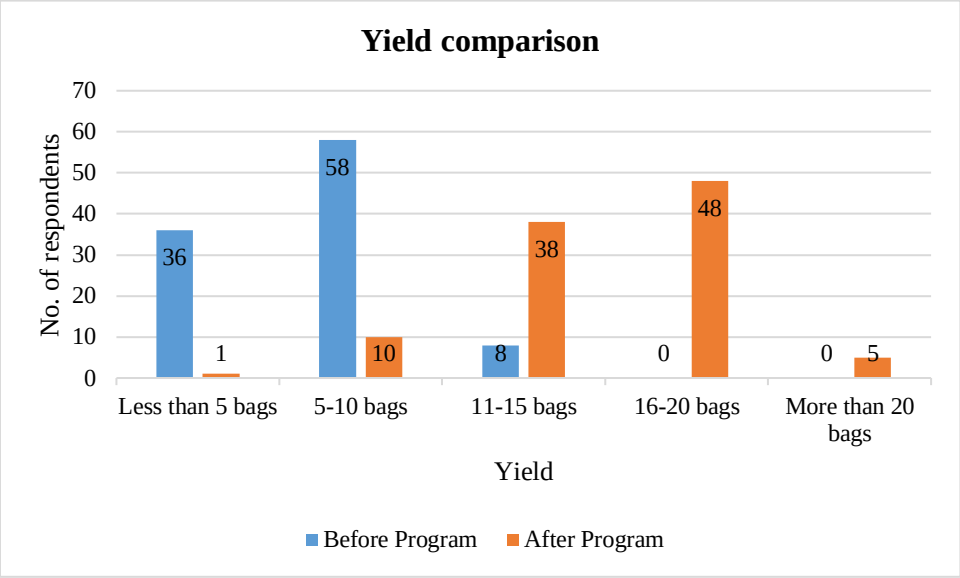

Figure 9: Average yield comparison per acre before and after program participation

Source: Own analysis based on own findings

An increase in the number of bars in the higher yield categories (e.g., "More than 20 bags") after participation indicates that the program might have positively impacted the yields. Similarly, a decrease in the bars representing lower yield categories after participation could further suggest that fewer farmers are yielding low amounts of maize per acre, aligning with an overall improvement in agricultural productivity. By comparing the two sets of bars, stakeholders can visually assess the effectiveness of the seed distribution program. If the "After" bars consistently show higher numbers than the "Before" bars across the higher yielding categories, it suggests that the program has likely led to increased maize production.

Table 4: Paired sample test

Measure 1	Measure 2	w	z	df	p
Maize yield per acre before program participation	Maize yield per acre after program participation	0.000	-8.463		<.001

Note: Wilcoxon signed-rank test

Source: Own editing based on own findings

The significant result ($p < .001$) strongly supports the hypothesis that the distribution of free certified maize seeds leads to a significant increase in maize yield per acre for the small-scale farmers in Kiambu County. The negative Z value and significant p-value together suggest that the program positively impacted the yields, indicating that the yields were generally higher after participation than before. This aligns with the goals of such agricultural intervention programs, demonstrating their effectiveness in improving agricultural output among the beneficiaries.

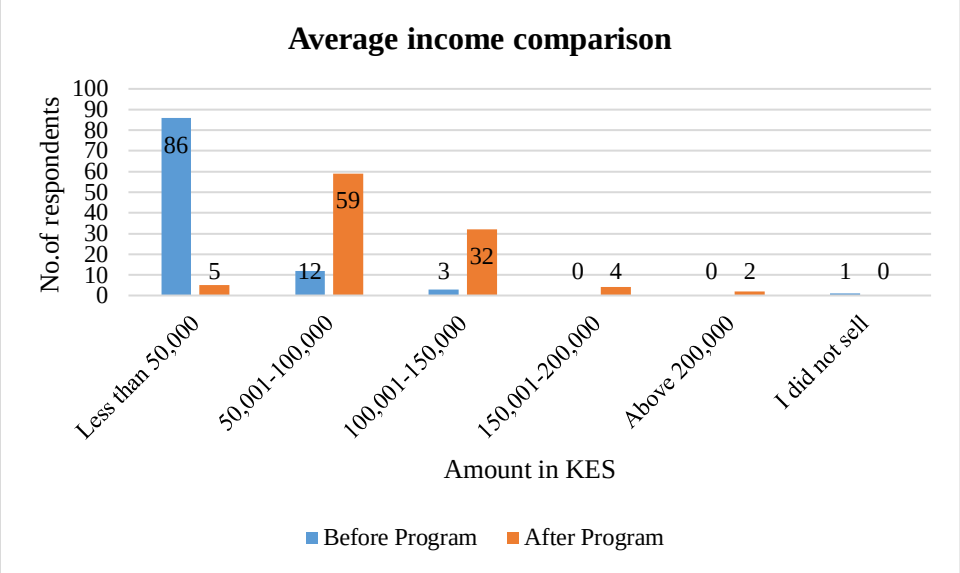

Figure 10: Average income per acre in KES comparison before and after program participation

Source: Own editing based on own findings

Most respondents before the program (blue bars) are in the "Less than KES 50,000" category, suggesting that most farmers were earning a lower income from maize farming. After

participating in the program (orange bars), there is a significant decrease in the number of respondents in the lowest income category and a substantial increase in higher income categories, particularly "KES 50,001-KES 100,000" and "KES 100,001-KES 150,000".

The presence of respondents in the "KES 150,001-KES 200,000" and "Above KES 200,000" categories after program participation, where there were none before, implies that the program had a positive impact on some farmers' incomes, moving them to higher income brackets. The "I did not sell my harvest" category has a single respondent before the program and none after, which might suggest that all participants sold their harvest post-program, possibly due to increased yields leading to a surplus.

Table 5: Wilcoxon signed rank test

Measure 1	**Measure 2**	**w**	**z**	**df**	**p**
Average income per acre before program participation	Average income per acre after program participation	94.000	-8.064		<.001

Source: Own editing based on own findings

W (Test Statistic) of 94.000 represents the sum of positive ranks for the differences where post-program income exceeds pre-program income. The Z (Standardized Test Statistic) of -8.064 is a large negative value, indicating a significant decrease in the rank sum score expected under the null hypothesis (that there is no difference).

The p-value of < .001 indicates that the probability of observing such an extreme value of W under the null hypothesis (that there is no change in income) is extremely low.

The significant result from the Wilcoxon Signed-Rank Test ($p < .001$) strongly suggests that there is a statistically significant increase in average income per acre after participating in the program compared to before. The negative Z value suggests a robust shift in income levels in the direction predicted by the program's goals.

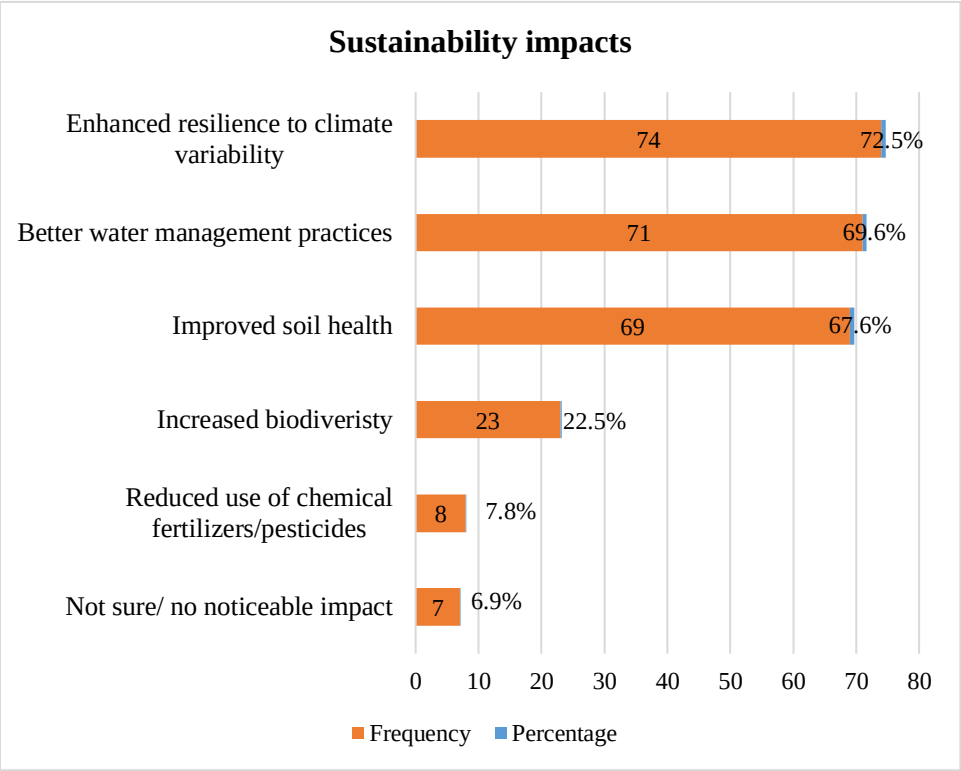

Figure 11: Impacts on agricultural sustainability

Source: Own editing based on own findings

A majority of respondents perceived a positive impact on their enhanced resilience to climate variability (72.5%) and better water management practices (69.6%), suggesting that the program may be effective in these areas. Improved soil health was also commonly reported (67.6%), which is critical for long-term agricultural sustainability. Fewer respondents noted increased biodiversity (22.5%) and reduced use of chemical fertilizers/pesticides (7.8%), which may indicate areas for further development or focus within the program. A small percentage (6.9%) of respondents are not sure or have not noticed any impact, which might indicate either a lack of change or a lack of awareness of the changes.

4.5 Challenges in using certified seeds

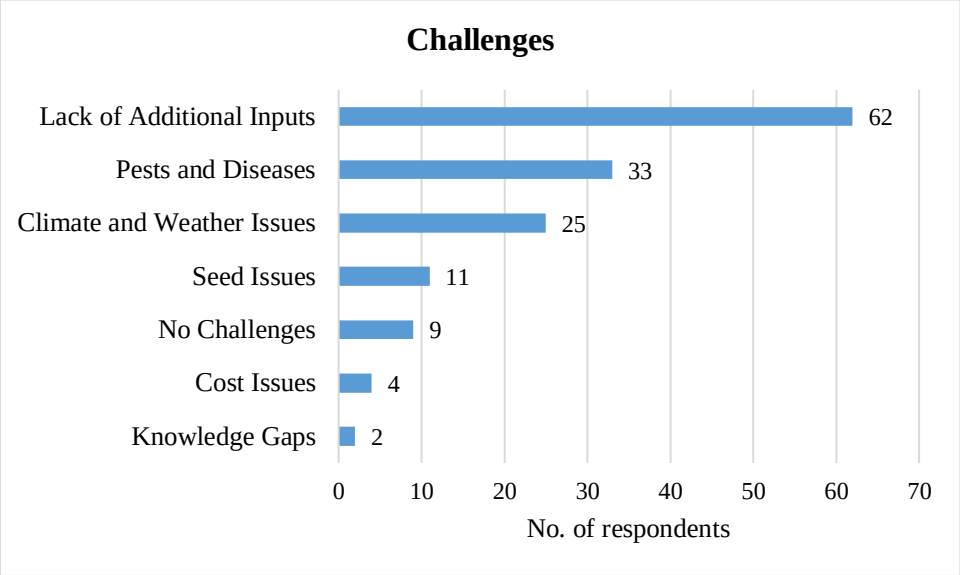

Figure 12: Challenges faced while using certified seeds

Source: Own editing based on own findings

The lack of additional inputs (62 mentions) was the most frequently mentioned challenge, indicating that a significant number of farmers struggle with not having enough additional resources, primarily fertilizers, to maximize the potential of the certified seeds. Without these inputs, the benefits of using high-quality seeds may not be fully realized, which can lead to sub-optimal crop yields.

The second most common issue relates to pests and diseases (33 mentions) affecting crops. This category consolidates all mentions related to pest infestations (including specific pests like the fall army worm) and diseases. These challenges can significantly hinder crop health and yield, especially when farmers are already dealing with other constraints such as lack of fertilizers.

Farmers reported various issues related to climate and weather (25 mentions), such as unpredictable weather patterns and climate change. These challenges include unexpected changes in weather that can affect growing conditions, leading to poor seed germination, increased susceptibility to diseases, and reduced crop yields. This reflects the vulnerability of agriculture to climatic factors, which are becoming increasingly unpredictable.

Seed Issues (11 mentions): This group covers issues directly related to the seeds, including poor germination and crop failure, and counterfeit seeds. Poor germination might indicate

problems with seed quality or unsuitable growing conditions, while counterfeit seeds pose a risk of unreliable performance and potential financial losses for the farmers.

A smaller group of respondents (nine mentions) indicated that they faced no challenges using certified seeds. This suggests that for some farmers, the program might be working well, or they may have conditions and resources that mitigate the common issues faced by others. The high cost of fertilizers (four mentions) was specifically noted as a challenge. Even when farmers have access to high-quality seeds, the additional cost of necessary inputs like fertilizers can be prohibitive, which limits their ability to use these inputs effectively.

Knowledge Gaps (two mentions): A few farmers pointed out difficulties in understanding the best practices for using certified seeds. This implies a need for more education and support in terms of agricultural extension services to help farmers optimize their use of such seeds.

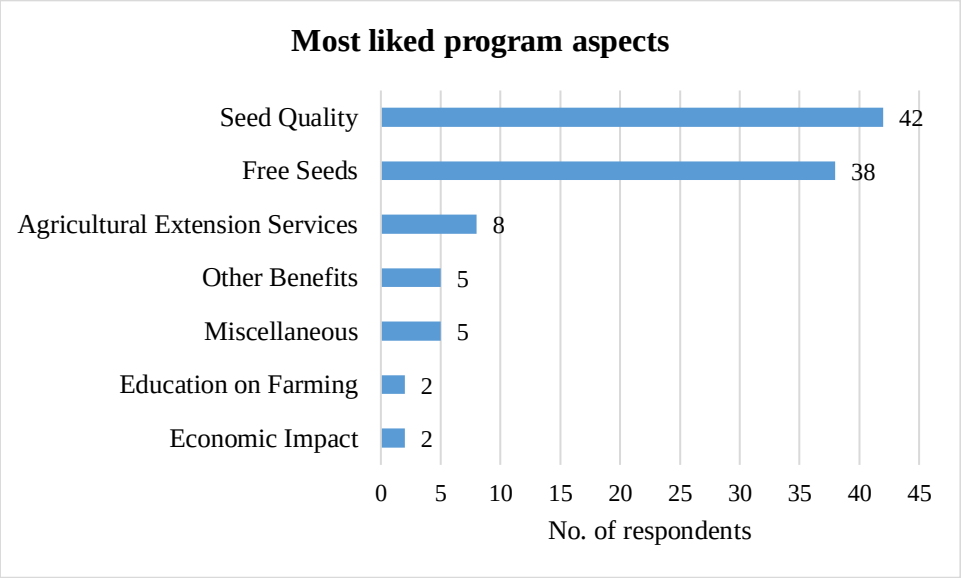

Figure 13: Most liked aspects of the seed distribution program

Source: Own editing based on own findings

Seed Quality (42 mentions) is the most appreciated aspect of the program. Participants highlight the high quality and yield potential of the seeds, which are likely to contribute to improved crop production outcomes. Free Seeds (38 mentions) was close behind in appreciation is the provision of seeds free of charge. This aspect greatly reduces the financial burden on farmers and makes it easier for them to engage in farming activities.

Agricultural Extension Services (eight mentions) includes mentions of the guidance, support, and information provided by agricultural experts, which are valued for enhancing the farming practices of the participants. Other Benefits (five mentions) include varied benefits such as fighting hunger, helping farmers in general, and proper identification of farmers, indicating broader social and community impacts of the program.

Education on Farming (two mentions): Some participants value the new information and techniques in farming that the program introduces, though this aspect is less frequently mentioned.

Economic Impact (two mentions): A few responses highlighted the economic benefits brought about by the program, such as improved income and economic well-being, indicating that the financial impacts, while significant, were not the primary focus for most respondents.

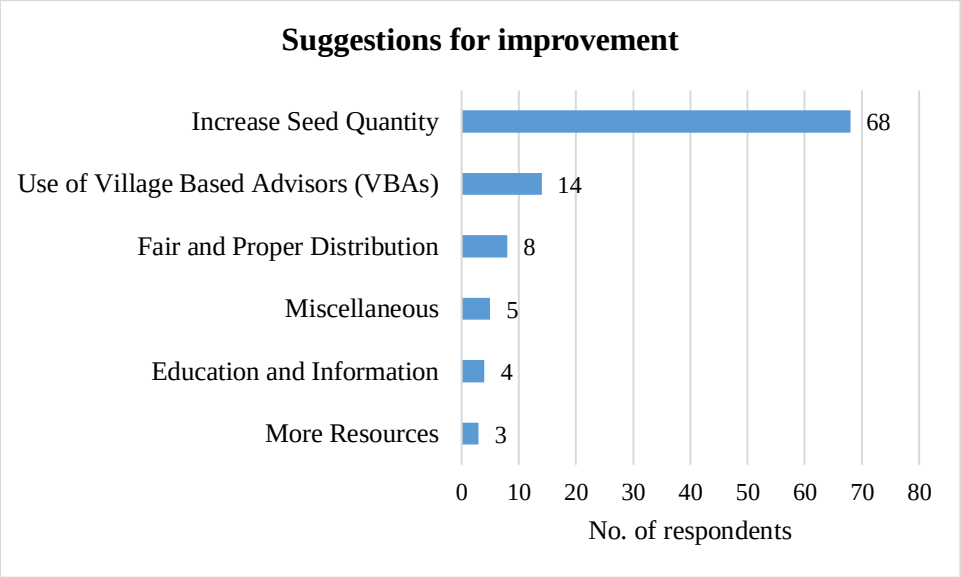

Figure 14: Suggestions for improvement of the seed distribution program

Source: Own editing based on own findings

Increase Seed Quantity (68 mentions): This is the most common suggestion, with many participants indicating a need for more seeds to be distributed. This could be due to a perceived shortage relative to demand, suggesting that an increase might help satisfy the needs of more farmers. This can also be attributed to the fact that farmers only receive a 2kg packet of the certified seeds against the recommended seed rate of 10kg/acre which means that they should be receiving five- 2kg packets

Use of Village-Based Advisors (VBAs) had (14 mentions). There is a notable preference for involving VBAs in the seed distribution process. Participants seem to value the local knowledge and trustworthiness of VBAs, believing that their involvement would enhance the fairness and effectiveness of the distribution.

Fair and Proper Distribution had eight mentions. Suggestions in this category focus on improving the distribution mechanisms to ensure that seeds are accessible to all farmers and that the actual beneficiaries are farmers and not intermediaries. Education and Information (four mentions): A few participants suggested that more educational efforts and better

information dissemination would improve the program, possibly by ensuring farmers are better prepared to utilize the seeds effectively.

More Resources (three mentions): These suggestions highlight the need for additional resources beyond seeds, such as agricultural extension services and subsidized fertilizers, to support the overall farming ecosystem.

Despite the challenges all the surveyed farmers responded that they would continue participating in the program

5. CONCLUSIONS AND SUGGESTIONS

The aim of this research is to evaluate the satisfaction and perceived impacts of the free certified maize seeds distribution program among small-scale farmers in Juja Farm, Kiambu County in Kenya. The results from the analysis revealed that there was an almost balanced gender distribution with male respondents at 52% while female at 48%. Therefore, the findings of this study can be applied to both genders. 41.2% of the participants were in the age category of 35-44 years thus revealing a mature and potentially experienced segment of the farming community.

89.2% of the respondents owned a land size of 1-5 acres which is essentially the most common type of farm size for the majority of small scale farmers in Juja Farm. Very few farmers own more than 5 acres because the current boom of real estate and infrastructure development has made many farmers sell part of their land in order to make some quick money. This is a threat to the food security of the region and efforts must be put in place to counter these rapid effects of urbanization.

It was also found that the most common method that farmers learned about the seed distribution program was through community meetings and neighbors/friends which signify a high prevalence of social capital which is critical for rural development projects to be effective and impactful. This inter-connectedness of the Juja farm community can be built upon and utilized in the implementation of future programs or projects.

The study has quantitatively demonstrated that the majority of small-scale farmers in Juja Farm are satisfied with the certified seed distribution program, which has led to significant improvements in both crop yield and farmers' incomes. This direct link between seed distribution programs and increased agricultural productivity provides robust support for similar initiatives in comparable regions.

It also supports the theoretical framework that suggests access to high-quality agricultural inputs, like certified seeds, directly contributes to enhanced agricultural productivity and economic benefits for small-scale farmers. It reinforces theories related to technology adoption and diffusion within rural development models, highlighting the importance of tailored approaches that consider local farmer needs and regional challenges.

From the analytical results it was evident that farmers recorded an increase in both their yield and income after participating in the program .From the correlation analysis, it is quite clear that farmer’s overall satisfaction is significantly influenced by factors such as seed quality,

impact on crop yield and moderately influenced by seed distribution methods. The findings highlight the critical role of agricultural extension services in enhancing the impact of seed distribution programs. By showing that farmer satisfaction and productivity are influenced by the support they receive, the study argues for the strengthening of extension services as a key component of agricultural development programs.

In terms of impacts on agricultural sustainability 72.5% of the respondents said the program has enabled their crops to be more resilient to climate changes and this is because the seeds distributed are primarily suited to withstand drought hence decreasing harvest losses that can be caused by drought.Among the challenges that farmers faced while using the certified seeds was the lack of additional inputs especially fertilizers due to the high costs and sometimes poor fertilizer quality, thereby limiting the maximum output that they could get from their farms. It was noted that most farmers liked the program mainly because they were receiving quality seeds for free every season.

However, it is important that farmers do not become over-reliant on the program since a considerable number complained about the seed quantity as they expected the county government to provide them with required seed rate of 10kg/acre instead of 2kg. Agricultural programs and interventions should assist farmers but not make them to be heavily dependent as it would make the cost of running such programs quite high and unsustainable. Therefore from this study we can confirm the following hypotheses to be true:

- H1: Farmers who have participated in the maize seed distribution program have a higher crop yield compared to previous years without the program.
- H2: Satisfaction levels among farmers with the maize seed distribution program are significantly influenced by factors such as seed quality and impact on crop yield,
- H3: Farmers who have participated in the maize seed distribution program have a higher income compared to previous years without the program

5.1 Implications for policy and Practice

- **Quality Control and Seed Certification**: Policies should emphasize stringent quality control measures for seed certification to ensure that only high-quality seeds are distributed. This will help in maintaining farmer trust in the program and ensuring the biological efficacy of the seeds, which directly affects crop yields.
- **Integration with Local Agricultural Policies**: It's essential for seed distribution programs to be integrated into broader agricultural policies. This includes linking them with existing initiatives on sustainable agriculture, climate resilience, and rural

development to create synergistic effects that benefit small-scale farmers more comprehensively.

- **Subsidies and Financial Support**: Given the economic constraints faced by small-scale farmers, policies should consider subsidies or financial incentives for farmers to access certified seeds. This would help in alleviating the initial cost barrier and encourage wider adoption of improved seed varieties.
- **Transparency and Accountability in Distribution**: Establishing transparent mechanisms for seed distribution can mitigate issues related to fairness and corruption, which were noted as concerns in this study. Policies should aim to create clear, accountable processes for how seeds are distributed to ensure equity and effectiveness.

5.2 Practical Applications

- **Enhanced Distribution Networks**: Practitioners should focus on developing robust and efficient distribution networks that can handle logistical challenges and ensure that seeds reach the intended recipients timely and in good condition. This might include the use of technology for tracking and managing distributions.
- **Farmer Education and Training**: Agricultural extension services need to incorporate targeted education programs that help farmers understand the benefits of certified seeds and best practices for their use. This should include training in modern agricultural techniques, pest management, and climate adaptation strategies.
- **Feedback Mechanisms**: Implementing strong feedback mechanisms where farmers can report back on their experiences and challenges will help in continuously refining the program. Such feedback can guide the adaptation of seed varieties to better suit local conditions and farmer needs.

Continuous monitoring and evaluation should be integral to the seed distribution programs to assess their impact and effectiveness regularly. This can help make necessary adjustments to improve outcomes and ensure the program's sustainability.

6. SUMMARY

This thesis has systematically evaluated the satisfaction levels and perceived impacts of a free certified maize seed distribution program among small-scale farmers in Juja Farm, Kiambu County, Kenya. The primary objectives of this study were: To assess the level of satisfaction among small-scale farmers with the free certified maize seeds distribution program in Juja Farm. To determine the perceived impacts (increased income, increased yield, agricultural sustainability) of the maize seeds' distribution program on agricultural productivity among small-scale farmers in Juja Farm. To identify factors influencing the satisfaction and perceived impacts of the maize seed program. To provide recommendations for improving future seed distribution programs based on the findings.

The sampling technique used was snowball sampling, The data was collected through structured questionnaires administered to 102 small-scale farmers who participated in the seed distribution program. Qualitative data were obtained from focus group discussions and individual interviews, providing deeper insights into the farmers' experiences and perceptions. Data analysis involved statistical testing to establish correlations and interpret the significance of findings concerning farmers' satisfaction and perceived impacts.

Key findings from the study are that most farmers expressed high satisfaction with the quality of seeds, which was closely linked to improved crop yields and increased income The distribution of certified seeds led to notable improvements in maize yield and overall agricultural productivity. Despite the successes, challenges such as insufficient seed quantities, distribution inefficiencies, and a lack of accompanying agricultural inputs (e.g., fertilizers) were prevalent. There was a need for enhanced agricultural extension services to better support farmers in maximizing the benefits from high-quality seeds.

The study concluded that the certified seed distribution program in Juja Farm significantly enhances agricultural productivity and contributes to increased incomes among small-scale farmers. However, for the program to realize its full potential, there is a need to address logistical challenges in distribution, ensure adequate supply of seeds, and improve farmer education on best agricultural practices.

This thesis contributes valuable insights into the effectiveness of seed distribution programs in improving the livelihoods of small-scale farmers. The recommendations provided aim to guide policymakers, program designers, and agricultural stakeholders in optimizing the design and implementation of similar programs to better serve the agricultural community and enhance food security in Kenya and other similar regions.

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ANNEX 1

1.1 QUESTIONNAIRE

Evaluating the Satisfaction and Perceived Impacts of the Free Certified Maize Seeds Distribution Program among Small-Scale Farmers in Juja Farm, Kiambu County, Kenya.

As a way to enhance agricultural productivity and sustainability among small-scale farmers in Juja Farm, Kiambu County, I am conducting an evaluation to understand the satisfaction levels and perceived impacts of the Free Certified Maize Seeds Distribution Program. Your insights and experiences are invaluable and will play a crucial role in assessing the effectiveness of the program, identifying areas for improvement, and shaping future agricultural interventions.

This questionnaire is designed for small-scale farmers who have participated in the program. It should take approximately 10-15 minutes to complete. Rest assured, your responses will be kept confidential and will only be used for the academic purposes of this evaluation.

Section 1: Demographics

Gender

- Male
- Female
- Prefer not to say

Age

- 18-24
- 25-34
- 35-44
- 45-54
- 54+

Farm size

- Less than 1 acre
- 1-5 acres
- More than 5 acres

Years of farming experience

- Less than 5 years

- 5-10 years
- 11-20 years
- More than 20 years

Have you previously used certified seeds before participating in the program?

- Yes
- No

Section 2: Program participation

When did you start participating in the program?----------

How did you know about the free certified maize seeds distribution program? (multiple responses allowed)

- Local government office
- Community meetings
- Neighbors/friends
- Radio/TV
- Social media
- Print media (newspapers)

For how many seasons have you received the free certified maize seeds?

- This is my first time
- 2 seasons
- 3 or more seasons

Section 3: Satisfaction with the program

How satisfied are you with the following aspects of the seed distribution program? (Rate 1-6, where 1 is strongly dissatisfied, 2 is dissatisfied, 3 is slightly dissatisfied, 4 is slightly satisfied, 5 is satisfied and 6 is strongly satisfied)

Quality of the seeds

1 2 3 4 5 6

Quantity of the seeds

1 2 3 4 5 6

Support and information provided on how to use the seeds effectively

1 2 3 4 5 6

Accessing the distribution point

1 2 3 4 5 6

Method of distributing the seeds to farmers

1 2 3 4 5 6

Impact of the seeds on crop yield

1 2 3 4 5 6

Overall satisfaction with the program

1 2 3 4 5 6

Section 4: Perceived Impacts of the seed distribution program.

Before participating in the program, what was your average maize yield per acre?

- Less than 5 bags
- 5-10 bags
- 11-15 bags
- 16-20 bags
- More than 20 bags

After participating in the program, what has been your average maize yield per acre?

- Less than 5 bags
- 5-10 bags
- 11-15 bags
- 16-20 bags
- More than 20 bags

Before participating in the program, what was your average annual income from maize farming?

- Less than KES 50,000
- KES 50,001-KES 100,00
- KES 100,001-KES 150,000
- KES 150,001-KES 200,000
- Above KES 200,000
- I did not sell my harvest

After participating in the program, what has been your average annual income from maize farming?

- Less than KES 50,000
- KES 50,001-KES 100,00
- KES 100,001-KES 150,000
- KES 150,001-KES 200,000
- Above KES 200,000
- I did not sell my harvest

In your opinion, has the program contributed to your economic well-being?

- Significantly
- Neutral
- Not at all

How has the program impacted agricultural sustainability on your farm? (choose all that apply)

- Improved soil health (reduced soil erosion, better moisture retention)
- Increased biodiversity (more crop varieties, beneficial insects)
- Better water management practices
- Reduced use of chemical fertilizers/pesticides
- Enhanced resilience to climate variability
- Not sure/ no noticeable impact
- Other----------

Have there been any challenges in using certified seeds? (multiple responses allowed)

- Difficulty in understanding best practices for seed usage
- Poor germination or crop failure
- Lack of additional inputs (fertilizers)
- No challenges
- Other----------

Section 5: Suggestions for improvement

What do you like most about the program?----------

What suggestions do you have for improving the seed distribution program?----------

Would you participate in this program again in the future?

- Yes
- No
- If No, explain why?----------

ANNEX 2

Images representing theoretical frameworks

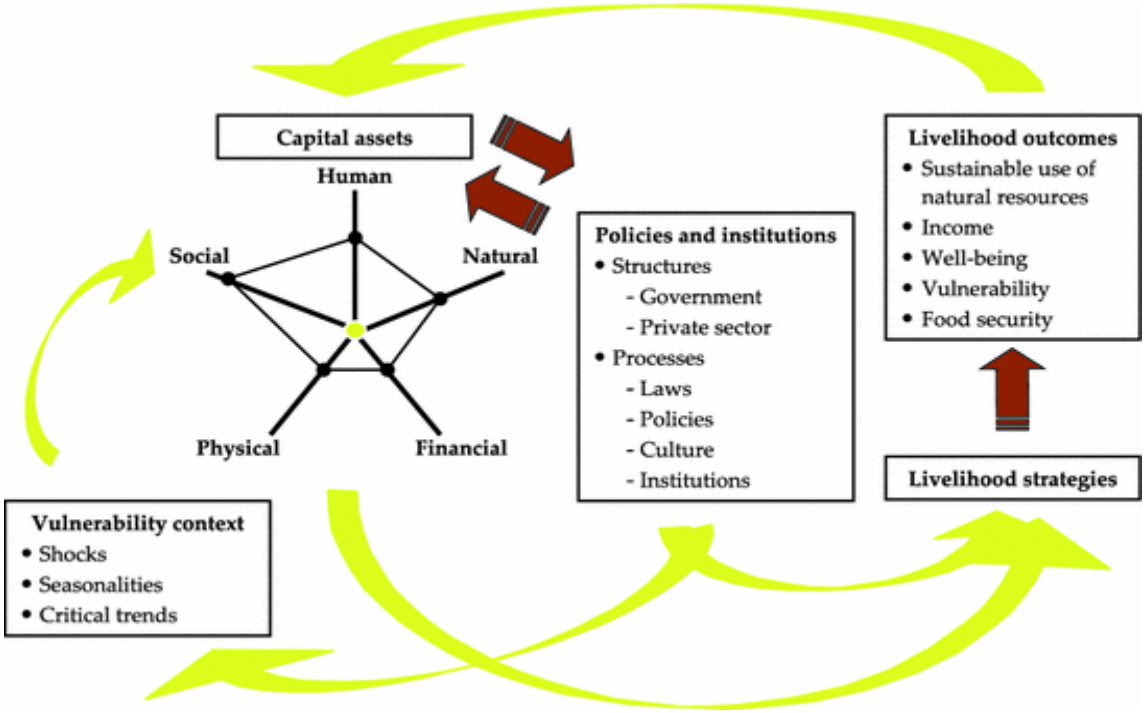

Image 2: The Sustainable Livelihood Approach Framework
Source: SLA

Image 3: Community Capitals Framework

Source: CFF

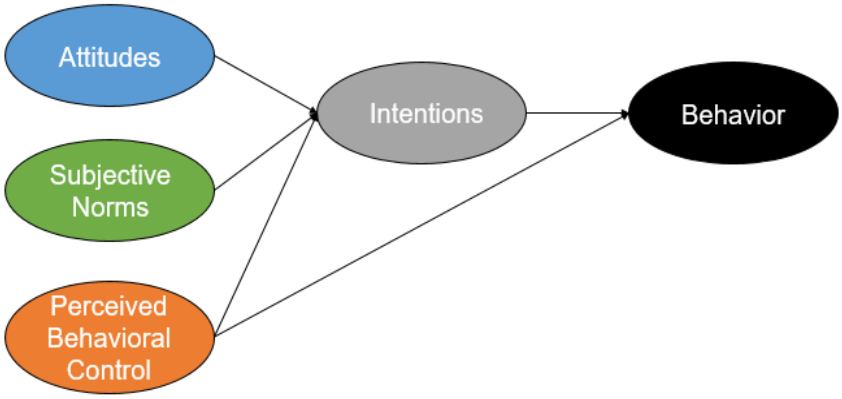

Image 4: Theory of Planned Behavior
Source: TPB

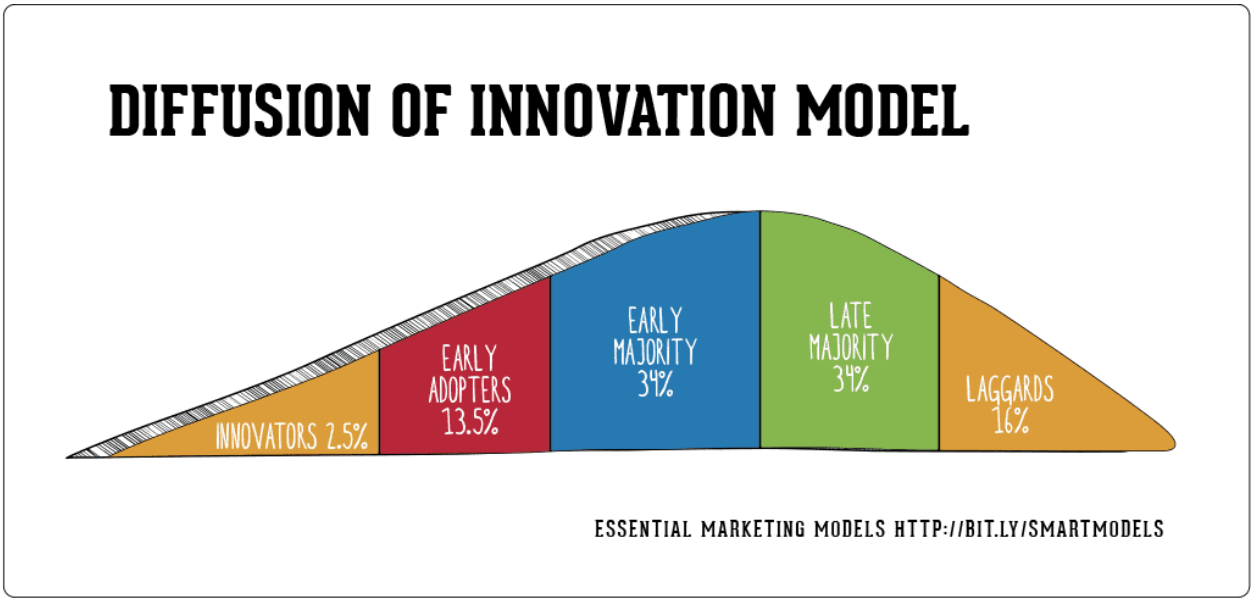

Image 5: Diffusion of Innovation Model
Source: DOI

APPENDIX 1

ABSTRACT OF THESIS

Thesis title: Evaluation of the Satisfaction and Perceived impacts of the Free Certified Maize Seeds Distribution Program among Small-Scale Farmers in Juja Farm, Kenya.
Author name: Ng'ang'a Samwel Ngigi
Course: MSc. Rural Development and Engineering
Institute: Institute of Sustainable Development and Economics
Primary thesis advisor: Áldorfainé Czabadai Lilla Mária

This study investigates the satisfaction and perceived impacts of a free certified maize seed distribution program among small-scale farmers in Juju Farm, Kiambu County, Kenya. The program, implemented by the county government, aims to enhance food security and support the livelihoods of local farmers by providing high-quality, drought-resistant maize seeds. The research utilized a snow ball sampling technique to acquire the participants and questionnaires in Google Forms were used for data collection. 102 participating farmers were surveyed. Key variables assessed included satisfaction with seed quality and quantity, the impact on agricultural productivity and income, and the overall effectiveness of the program.

The findings indicate that the majority of farmers experienced significant improvements in crop yield and income following their participation in the program. The high-quality seeds provided were well-received, with most farmers reporting satisfaction with both the seeds and the accompanying agricultural extension services. However, challenges such as inadequate seed quantities and inefficiencies in the distribution process were noted, which affected the overall satisfaction levels.

The study suggests that while the seed distribution program has been largely successful in achieving its goals, there is a need for improvements in distribution logistics and increased provision of agricultural inputs like fertilizers. The involvement of Village-Based Advisors (VBAs) was also recommended to enhance the fairness and effectiveness of the distribution process. Overall, the program has made significant contributions to agricultural productivity and economic stability among small-scale farmers in Juja Farm, supporting broader sustainable development goals in the region.

This research provides a foundational understanding of the impact of seed distribution programs and offers evidence-based recommendations for enhancing the scalability and sustainability of such initiatives in Kenya and similar contexts.

Key words: Seed distribution programs, Farmer satisfaction, Certified seeds, Agricultural productivity.

DECLARATION

on authenticity and public assess of master's thesis

Student's name:	Ng'ang'a Samwel Ngigi
Student's Neptun ID:	I70NFA
Title of the document:	Master's Thesis
Year of publication:	2024
Department:	Rural Development and Sustainable Economy

I declare that the submitted final essay/thesis/master's thesis/portfolio[1] is my own, original individual creation. Any parts taken from an another author's work are clearly marked, and listed in the table of contents.

If the statements above are not true, I acknowledge that the Final examination board excludes me from participation in the final exam, and I am only allowed to take final exam if I submit another final essay/thesis/master's thesis/portfolio.

Viewing and printing my submitted work in a PDF format is permitted. However, the modification of my submitted work shall not be permitted.

I acknowledge that the rules on Intellectual Property Management of Hungarian University of Agriculture and Life Sciences shall apply to my work as an intellectulal property.

I acknowledge that the electric version of my work is uploaded to the repository sytem of the Hungarian University of Agriculture and Life Sciences.

Place and date: Gödöllő, 2024 year April month 28 day

Student's signature

DECLARATION

Ng'ang'a Samwel Ngigi (name) (student Neptun code: I70NFA)
as a consultant, I declare that I have reviewed the final thesis and that I have informed the student of the requirements, legal and ethical rules for the correct handling of literary sources.

I recommend / do not recommend[1] the final thesis / dissertation / portfolio to be defended in the final examination.

The thesis contains a state or official secret: yes no*[2]

Date: 2024.04.26.

Aleksandra Czabradi Lilla
insider consultant

[1] The appropriate one should be underlined.
[2] The appropriate one should be underlined.