



Improving Market Access for Smallholder Farmers: Implementation Lessons from a Value-Chain Case Study in Zambia

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Abstract. Improving market access remains a persistent challenge for smallholder farmers in low- and middle-income countries, where coordination failures, weak aggregation systems, and limited buyer linkages constrain commercialization and income growth. This paper examines a value-chain intervention implemented in Zambia that sought to improve smallholder market access through farmer aggregation, structured market linkages, and coordination with private off-takers. Using a case study design, the study draws on programme monitoring data, stakeholder interviews, and implementation records to document how the intervention was operationalized, the challenges encountered, and the early outcomes achieved. The findings highlight the importance of aggregation mechanisms, trust building between farmers and buyers, and institutional coordination in translating market-access initiatives into practical gains for smallholders. While the analysis does not claim causal impacts, it provides evidence-based implementation lessons that are relevant for policymakers and practitioners designing similar agricultural commercialization interventions. The study contributes practical insights on improving market access for smallholder farmers through value-chain implementation lessons from Zambia.

Keywords: commodity aggregation, collective marketing, bean value chain, commercialization, digital platforms, Northern Province (Zambia)

JEL Classification: O13, Q12, Q13

1. Introduction

Agriculture remains a primary source of food, employment, and income for a large share of the population in developing countries. Most of the world's poor continue to reside in rural areas and depend on agriculture and related activities for their livelihoods. Recent global estimates indicate that around 70–80 percent of people living in extreme poverty reside in rural areas, where agrifood systems constitute the primary source of employment and income (Food and Agriculture Organization of the United Nations [FAO], 2023). Although small farms cultivate a relatively small share of the world's agricultural land (around 10–15 percent), they remain central to rural livelihoods, employing over two billion people globally and contributing a substantial share of food production in Asia and sub-Saharan Africa, where smallholder and family farms dominate agricultural systems (Lowder et al., 2016; FAO, 2021, 2023). Rural livelihoods and food security outcomes remain closely linked to agricultural performance and household vulnerability patterns in Zambia (Zambia Statistics Agency [ZSA], Ministry of Health [MOH], and Inner-City Fund [ICF], 2019). Rising population growth and food demand further increase the importance of strengthening agricultural productivity and market systems in developing economies (United Nations [UN], 2015b). As a result, smallholder agriculture continues to play a central role in food security, poverty reduction, and broader socio-economic development (Mellor, 2017; Pingali et al., 2019). Agriculture has long been recognized as a critical driver of rural development and structural transformation in low-income economies (World Bank, 2007). An estimated 1.5–2 billion people worldwide continue to depend on smallholder and family farming for their livelihoods, making agriculture a critical pathway out of poverty when productivity improvements translate into reliable market participation and income growth (FAO, 2021; World Bank, 2022).

Substantial evidence shows that agricultural growth remains one of the most effective and equitable pathways for reducing poverty and food insecurity in developing economies. These relationships are also consistent with broader development evidence emphasizing the importance of sustained and inclusive growth strategies in reducing poverty and supporting structural transformation in developing economies (Deblock and Haji, 2008). Recent empirical work indicates that increases in agricultural output and productivity can reduce poverty more effectively than growth in non-agricultural sectors (Gupta and Sharma, 2023). Beyond income effects, agricultural performance is strongly linked to improved food availability and nutrition, which are central to food security (Pawlak and Kołodziejczak, 2020). Sustainable agricultural growth is also increasingly recognized as central to achieving long-term food and nutrition security outcomes in developing countries (Fan and Brzeska, 2016). These relationships are reflected in international frameworks such as Sustainable Development Goal 2, which emphasizes ending

hunger, achieving food security, and promoting sustainable agriculture as central development priorities (UN, 2015a).

Despite its importance, the performance of smallholder agriculture in many African countries remains constrained by structural and institutional challenges, particularly limited access to markets. Smallholders frequently face high transaction costs, weak bargaining power, inadequate aggregation mechanisms, poor infrastructure, and limited access to reliable buyers, which restrict their ability to commercialize production and capture value (Barrett, 2008; Magakwe and Olorunfemi, 2024). Recent evidence also shows that market participation positively influences smallholders' incomes and diet quality, but that persistent barriers to formal market integration continue to limit potential welfare gains (Ma et al., 2024). Productivity gains alone are often insufficient to improve welfare outcomes when market access remains weak, as surplus production may be sold under distress conditions or lost through post-harvest inefficiencies. Consequently, improving market access – including through aggregation support, infrastructure development, and coordinated buyer linkages – has emerged as a key policy and development priority within agricultural commercialization strategies.

Zambia provides a relevant context for examining these challenges. Agriculture remains a central pillar of economic growth and poverty reduction in Zambia, employing around 55–60 percent of the total workforce and supporting approximately 1.5 million smallholder farming households, which together account for most of the domestic food production (Ministry of Agriculture [MoA] and Ministry of Fisheries and Livestock [MFL], 2016; World Bank, 2025; ZSA, 2022). The sector is identified as a priority area for achieving Zambia's Vision 2030 goal of attaining middle-income status (Ministry of Finance and National Planning [MFNP], 2022). However, despite its strategic importance, agricultural productivity and farm incomes remain low, particularly in rural areas where poverty rates exceed 50 percent (ZSA, 2015). Limited market access, reliance on rain-fed production, exposure to climate risks, and weak access to inputs, finance, and advisory services continue to constrain smallholder commercialization (Mulenga et al., 2020).

Market access constraints are especially pronounced for crops that receive limited policy support. While government programmes such as the Farmer Input Support Programme have focused primarily on maize production and marketing, smallholder farmers cultivating alternative crops often lack access to formal and predictable markets (IAPRI, 2015; MoA, 2022a). As a result, farmers frequently rely on informal traders and middlemen, selling produce at low prices and incurring substantial post-harvest losses. These conditions weaken incentives to invest in productivity-enhancing technologies and contribute to persistent rural poverty and food insecurity.

In response, value-chain development and market linkage interventions have gained prominence as mechanisms for improving smallholder market participation. Such interventions typically emphasize aggregation, quality upgrading, buyer

coordination, and institutional support to reduce transaction costs and improve price realization. However, while impact evaluations have assessed whether these interventions improve incomes or productivity, comparatively less attention has been paid to how they are implemented in practice and which operational mechanisms are most critical to their success.

This paper addresses this gap by examining a market-access intervention implemented in Zambia that sought to link smallholder farmers to structured markets through commodity aggregation and coordinated engagement with private buyers. Adopting a case study approach, the analysis focuses on the implementation process, the challenges encountered, and the early outcomes observed during the intervention's rollout. Rather than estimating causal impacts, the study draws on programme monitoring data, stakeholder interviews, and implementation records to generate evidence-based implementation lessons.

By documenting how a value-chain intervention was operationalized in a low-income country context, this paper contributes to the agricultural economics literature in three ways. First, it provides empirical implementation evidence that complements impact-focused studies on smallholder commercialization. Second, it highlights the role of aggregation, coordination, and institutional arrangements in shaping market access outcomes. Third, it offers transferable lessons for policymakers and practitioners designing market-access interventions aimed at promoting inclusive agricultural development in sub-Saharan Africa.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature on smallholder farmers, market access, value-chain development, and digital agricultural support systems. Section 3 outlines the research methodology, including the case study design, data collection procedures, and analytical approach. Section 4 presents and discusses the findings of the study, focusing on implementation lessons, institutional challenges, digital interventions, and market integration outcomes for smallholder farmers in Zambia. Section 5 discusses the implications of the findings in relation to policy and practice, while Section 6 concludes the paper by summarizing the key findings and providing recommendations for improving market access among smallholder farmers.

2. Literature Review

This section reviews the literature on market access constraints faced by smallholder farmers, with particular attention to aggregation models as mechanisms for improving participation in agricultural markets. It synthesises evidence on the determinants of market access, the role of collective action and aggregation in addressing smallholder disadvantages, and the benefits and limitations of commodity aggregation. The review provides the conceptual grounding for the

case study by situating the intervention within established agricultural economics and development literature.

2.1. Market Access Challenges among Smallholder Farmers

Marketing in agriculture involves identifying buyers, understanding their requirements, and organizing production and exchange in ways that meet market standards. Smallholder agriculture remains one of the most important economic activities globally and constitutes the primary source of income and employment for a large share of the rural poor (Poole, 2017). Smallholders contribute substantially to food security, income distribution, and economic growth, yet they continue to face significant barriers to effective market participation. These barriers include weak physical access to markets, limited availability of market information, high transaction costs, and unreliable linkages with buyers (Chiuri et al., 2013; Magesa et al., 2014).

In many developing-country contexts, smallholder farmers remain dependent on informal markets due to the absence of structured marketing arrangements. Although higher levels of market participation can significantly improve farm incomes, participation rates remain low, particularly among farmers located in remote areas with poor transport infrastructure and weak market institutions (Baloyi, 2010; Ferris et al., 2014). Small production surpluses further expose farmers to high per-unit transaction costs and increased market risks, reducing incentives to engage in formal markets. Marketing decisions are therefore heavily influenced by proximity to markets, access to price information, and the availability of reliable trading partners (Magesa et al., 2014).

Beyond physical and informational barriers, household characteristics and farm-level factors also shape market participation outcomes. Education levels, household size, farming experience, access to off-farm income, and agroecological risks influence both production decisions and the capacity to engage in markets (Omiti et al., 2009; Aku et al., 2018). Limited access to secure and predictable markets thus remains a major constraint facing smallholder farmers in many developing economies.

2.2. Market Access and Smallholder Aggregation Models

Aggregation models have emerged as an important institutional response to smallholder market constraints. Globally, most farms are small or marginal, with approximately 84 percent of farms operating on less than two hectares (FAO, 2014; Gomez et al., 2020). Aggregation models enable producers to collectively access inputs, credit, information, and output markets, thereby reducing transaction costs and overcoming scale-related disadvantages (Abraham et al., 2022). Recent evidence further highlights the importance of institutional coordination, agri-

business engagement, and structured market integration mechanisms in enabling smallholders' participation in modern agricultural systems (Chen et al., 2025). Collective action arrangements also strengthen smallholders' ability to engage with agribusiness systems and improve coordination within agricultural value chains (Johnson and Berdegué, 2004). Through collective action, smallholders can improve bargaining power, meet quality and volume requirements, and enhance their integration into formal value chains.

Aggregation can take different institutional forms, ranging from bottom-up producer organizations and cooperatives to top-down arrangements such as contract farming and out-grower schemes. While contract farming can facilitate market access, buyers often select farmers with higher asset endowments or lower perceived risk, potentially excluding poorer households (Barrett et al., 2012; Bellemare and Bloem, 2018; Barrett and Carter, 2020). In contrast, farmer-led aggregation models are typically embedded within local communities and aim to promote inclusive participation, although they often depend on external support from governments, non-governmental organizations, or development partners.

Historically, cooperatives have played a major role in agricultural development, particularly in Europe, where they account for a substantial share of agricultural input supply and output marketing (Bijman and Iliopoulos, 2014). Agricultural cooperatives also function as institutional coordination mechanisms that facilitate collective bargaining, market access, and risk-sharing among smallholder producers (Tortia et al., 2013). More recently, renewed interest in aggregation models has been driven by population growth, urbanization, income growth, and changing consumer preferences towards higher-quality and more differentiated food products (Pingali, 2007; Ortega and Tschirley, 2017; Pingali et al., 2019). Contemporary aggregation models differ from traditional cooperatives by placing greater emphasis on market orientation, quality standards, and responsiveness to buyer demand, addressing limitations that hindered earlier cooperative structures (Abraham et al., 2022).

2.3. Benefits and Limitations of Commodity Aggregation

Commodity aggregation has been widely identified as an effective channel for linking smallholder farmers to profitable markets. Aggregators act as intermediaries between dispersed producers supplying small quantities and buyers demanding large, consistent volumes of produce. By bulking commodities at designated collection points, farmers achieve economies of scale that attract bulk buyers and reduce search and logistics costs for both parties (Birachi, 2012; MoA, 2022b). Aggregation also facilitates access to market information, improves quality control, and strengthens relationships with traders, processors, and input suppliers (Chiuri et al., 2013; Ton et al., 2018).

Empirical studies demonstrate that participation in collective marketing arrangements can improve prices received, farm incomes, and food security outcomes (Fischer and Qaim, 2012; Arouna, 2018). Aggregation benefits extend beyond farmers to include buyers, government agencies, and financial institutions by improving harvest forecasting, reducing transaction costs, and supporting compliance with contractual obligations (Abraham et al., 2022). Strengthened farmer organizations also enhance the diffusion of innovations and adoption of post-harvest technologies, reducing losses and improving product quality (Aku et al., 2018). Legumes such as beans play an important role in food security, nutrition, and sustainable agricultural systems due to their protein content and contribution to soil fertility (FAO, 2015; FAO, 2016).

However, aggregation is not without challenges. Recent stakeholder-based evidence suggests that the success of aggregation models depends heavily on trust, governance quality, coordination mechanisms, and the alignment of incentives among farmers, aggregators, and buyers (Marisetty and Nema, 2025). Studies report that lack of trust, weak governance structures, delayed payments, stringent quality requirements, and limited information often discourage farmer participation in collective marketing (Ssajakambwe et al., 2019). Fear of rejection due to grading standards and the additional labour required for post-harvest handling can further reduce participation. Sustained success of aggregation models therefore depends on transparent governance, regular communication, reliable payment systems, and proximity of aggregation centres to farmers (Ton et al., 2010; Nangobi and Mugonola, 2018).

2.4. Conceptual Grounding: Aggregation, Coordination, and Market Access

From a theoretical perspective, aggregation can be understood as a coordination mechanism that reduces transaction costs and mitigates market failures associated with scale, information asymmetry, and risk. By pooling output and organizing collective marketing, smallholders gain access to market information, technologies, and higher-value markets that would otherwise be inaccessible (Ssajakambwe et al., 2019). Aggregation centres provide predictable market outlets and enable buyers to source quality-assured commodities efficiently, thereby improving value-chain coordination (MoA, 2022b).

In Zambia, beans have increasingly emerged as a commercially viable crop in response to growing consumer demand, improved varieties, and institutional support mechanisms such as seed buy-back schemes (Birachi, 2012). Despite this potential, smallholder bean producers continue to face marketing constraints arising from fragmented production and limited group marketing arrangements. The absence of effective aggregation mechanisms constrains their ability to negotiate favourable prices and capture value from expanding markets.

2.5. Digital Platforms and Aggregation Models

Recent advances in digital technologies have introduced new opportunities to strengthen aggregation and market access for smallholder farmers. Digital and mobile platforms can reduce information asymmetries, improve price discovery, and facilitate linkages between farmers, aggregators, and buyers, thus lowering transaction costs and enhancing smallholder participation in formal markets (Birachi, 2012; Aker and Mbiti, 2019). Emerging evidence also suggests that e-commerce and digital trading platforms can strengthen agricultural market integration and improve sustainability outcomes for smallholder producers (Morepje et al., 2024). Recent studies from sub-Saharan Africa further highlight both the opportunities and implementation challenges associated with agricultural digitalization, including connectivity limitations, affordability constraints, and uneven digital literacy among smallholder farmers (Nxumalo and Chauke, 2025). Digital tools also support access to climate-smart advisory services, e-extension information, input and output market prices, and mobile financial services such as savings, credit, and crop insurance, which further reduce barriers to market integration (Choruma et al., 2024). When combined with physical aggregation infrastructure, digital platforms have the potential to improve coordination along agricultural value chains and enhance the effectiveness of aggregation models by aligning farmer supply with buyer demand in real time (Kudama et al., 2021; Ma et al., 2024).

The literature suggests that aggregation models – particularly when supported by effective governance structures and digital innovations – offer a promising pathway for improving smallholder market access. However, outcomes depend critically on how these models are implemented in specific contexts. This underscores the need for empirical case studies that document implementation processes, challenges, and lessons, thereby complementing impact-focused research on smallholder commercialization.

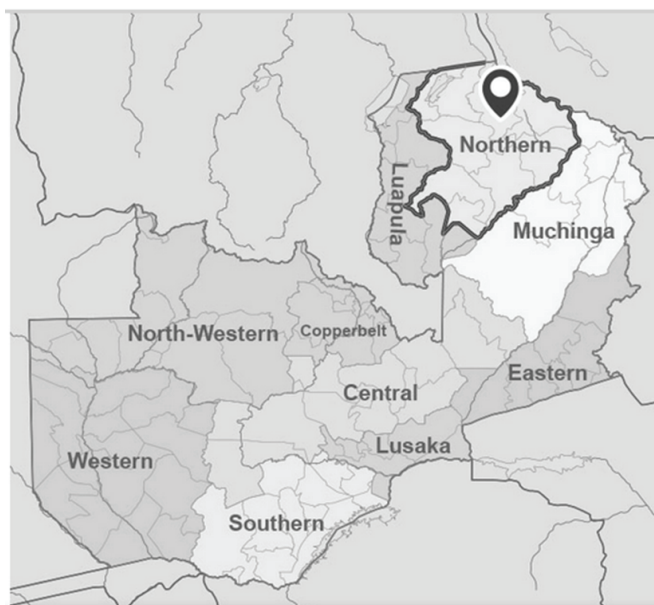
3. Methodology

3.1. Study Design and Approach

This study adopts an implementation-oriented case study design to examine how a market-access intervention was operationalized in Zambia and to derive transferable implementation lessons. Case study approaches are particularly appropriate when the objective is to understand processes, institutional arrangements, and operational mechanisms in real-world settings, especially where interventions involve multiple actors, context-specific adaptations, and evolving implementation conditions (Yin,

2018; George and Bennett, 2005). In development and policy research, case studies are widely used to generate practice-relevant insights into how and why interventions succeed or encounter constraints, rather than to estimate average treatment effects (Gerring, 2007).

Consistent with the paper's "case study and implementation lessons" angle, the analysis prioritizes how the intervention functioned in practice, the constraints that emerged during rollout, and the mechanisms through which aggregation and market coordination influenced smallholder market access. This approach aligns with implementation science and realist evaluation perspectives, which emphasize understanding context–mechanism–outcome relationships in complex development interventions (Andrews et al., 2017). Rather than assessing causal impacts in a counterfactual sense, the study seeks to identify plausible pathways through which aggregation, capacity building, and digital tools interacted to shape observed outcomes.



Source: <https://zambia.opendataforafrica.org/>

Figure 1. *The Northern Province of Zambia*

The case study focuses on the Social Change Initiative (SCI) implemented in Chindo Agricultural Camp, Senga Hill District, Northern Province, Zambia (Figure 1). The intervention targeted smallholder bean farmers and sought to address fragmented production, weak bargaining power, and limited buyer linkages through the promotion of commodity aggregation, strengthened input–output market coordination, and facilitated engagement with structured buyers.

Aggregation-based market access interventions of this kind are widely recognized as critical institutional mechanisms for reducing transaction costs and improving smallholder commercialization in low-income settings (Barrett et al., 2012; Abraham et al., 2022; Villar et al., 2023; Ma et al., 2024).

The intervention also aimed to integrate a digital marketing and service delivery platform to improve price discovery, information flows, and payment transparency. However, consistent with findings from digital agriculture studies, implementation adapted over time in response to connectivity, financing, and institutional constraints (Aker and Mbiti, 2019; Choruma et al., 2024). These adaptive dynamics are treated not as deviations but as analytically relevant features of real-world implementation, offering insights into the conditions under which digital and physical aggregation mechanisms can be effectively combined.

3.2. Intervention Description and Implementation Components

The SCI was structured around two interlinked implementation components centred on commodity aggregation and market linkage facilitation. The first component focused on strengthening farmer organizations and local aggregation capacity to enable farmers to bulk beans at a designated collection point (bulking/aggregation centre). This mechanism was intended to improve economies of scale, support quality control through sorting and grading, reduce search and transport costs, and increase bargaining power in negotiations with bulk buyers (MoA, 2022b). The aggregation point served as the operational interface between dispersed farmers and off-takers, enabling larger volumes of quality-assured produce to be traded in a single location.

The second component focused on market linkage facilitation and service coordination. The intervention facilitated engagement between farmer groups, aggregators, and formal buyers or off-takers, alongside complementary support such as post-harvest handling training, dissemination of market information, and coordination with extension officers and implementing partners. A digital platform, initially envisioned as the Maano Virtual Farmers Market, was intended to support farmer registration, information sharing, and market service delivery. However, due to resource constraints, the project utilized the Sustainable Intensification of Smallholder Farming Systems in Zambia platform as an alternative mechanism for selected functions, including input distribution, payment processing, and dissemination of marketing information.

These components were implemented sequentially and iteratively, with adaptation based on monitoring feedback and stakeholder consultations. Such adaptive implementation is typical in real-world value-chain interventions, particularly in contexts with logistical constraints and evolving partner roles.

3.3. Theory of Change and Analytical Framework

The study is anchored in a theory of change that links aggregation and market coordination to improved smallholder welfare through two primary pathways, consistent with the agricultural commercialization and collective action literature.

Market Participation Pathway

Aggregation is expected to reduce transaction costs associated with search, negotiation, and transport, while improving access to reliable buyers and price information. Lower transaction costs and improved coordination increase the likelihood of market participation, enhance price realization, and reduce distress sales among smallholder farmers (Key et al., 2000; Barrett, 2008).

Production and Investment Pathway

More predictable and reliable market access strengthens incentives for smallholders to invest in productivity-enhancing inputs, improved seed, and better post-harvest management practices. Over time, these investments can raise yields, expand marketed surplus, and increase household incomes, reinforcing the commercialization process (Poulton et al., 2010; Fischer and Qaim, 2012; Abraham et al., 2022).

Analytically, the study adopts an implementation lens grounded in transaction-cost economics and collective action theory, conceptualizing aggregation as an institutional arrangement designed to address scale disadvantages, information asymmetries, and coordination failures between dispersed smallholders and downstream buyers (Barrett et al., 2012). Consistent with the case study approach, the paper does not estimate causal effects; instead, it draws on process evidence and triangulated outcome indicators to assess whether the intervention plausibly progressed along its intended pathways (Yin, 2018).

3.4. Data Sources

To enhance rigour and transparency, the study drew on multiple data sources that were triangulated to validate key implementation claims. Routine programme monitoring records were used to document implemented activities, training sessions conducted, farmer participation, aggregation volumes, buyer engagement, and operational timelines. These records provided structured evidence regarding what activities were delivered and when they occurred.

The study also utilized implementation documentation, including project reports, operational notes, meeting minutes, and partner communications, to capture implementation decisions, strategic adjustments, and operational constraints

encountered during programme delivery. These documents were particularly useful in tracing changes in implementation strategy, such as the substitution of digital platforms, as well as challenges relating to funding limitations, monitoring capacity, and connectivity constraints.

In addition, semi-structured stakeholder interviews and field feedback were used to capture perspectives from key actors involved in implementation, including extension officers, farmer organization leaders, aggregators or bulking centre managers, and buyer or partner representatives. The interviews focused on operational bottlenecks, trust and governance issues, quality management practices, payment arrangements, coordination processes, and perceived intervention outcomes.

To contextualize the intervention environment, the study further relied on national policy documents, sector reports, and statistical sources relating to agricultural policy priorities, rural poverty patterns, and bean market conditions in Zambia (ZSA, 2015; MFNP, 2022; MoA, 2022a).

3.5. Sampling and Participants

Sampling followed a purposive strategy typical of implementation case studies, selecting respondents and documents based on their direct involvement in programme delivery and market transactions. The primary units of analysis were: (i) farmer organizations/cooperatives participating in aggregation; (ii) project implementers and extension personnel supporting training and coordination; and (iii) market actors (aggregators/off-takers) linked to the bulking model. Purposive sampling was complemented by the snowball identification of additional informants where key operational decisions required clarification (e.g. buyer requirements and pricing or collection arrangements).

The intervention was implemented in Senga Hill District and involved two farmer cooperatives comprising 204 beneficiary farmers, who participated in training, aggregation, and collective marketing activities. *Table 1* summarizes the beneficiary cooperatives and farmer participation in the study area. While the study prioritizes depth over representativeness, triangulation across actor groups reduces single-source bias and strengthens the credibility of the implementation narrative.

Table 1. *Beneficiary cooperatives and farmers in Senga Hill District*

Number	Cooperative	Beneficiaries	Women	Youths
1.	Chitusa	120	63	13
2.	Satoka	84	42	8
	Total	204	105	21

Source: cooperative membership registers, 2023

3.6. Measurement and Outcome Indicators

Given the paper's implementation-oriented case study focus, outcome assessment relies primarily on descriptive indicators rather than econometric estimation. The indicators were selected to reflect progress along the intervention theory of change and to provide evidence on programme implementation, aggregation performance, market coordination, and early outcome signals associated with the aggregation model.

Table 2. *Descriptive statistics*

Indicator	Value
Programme coverage	
Beneficiary cooperatives	2
Total beneficiary farmers	204
Female farmers	105 (51.5%)
Youth farmers	21 (10.3%)
Aggregation and marketed volume	
Beans aggregated and marketed, 2022–2023	28.30 mt
Beans marketed in previous season	17.56 mt
Increase in marketed volume	61.2%
Productivity and production response	
Bean yield, 2020–2021	0.56 mt/ha
Bean yield, 2021–2022	0.56 mt/ha
Bean yield, 2022–2023	0.77 mt/ha
Yield increase	37.5%
Area planted, 2021–2022	60,250 ha
Area planted, 2022–2023	82,847 ha
Price realization	
Aggregated bean buying price	K15.50/kg
Prevailing informal market price	Approximately K13.00/kg

Source: authors' compilation based on programme monitoring records and MoA (2023)

The intervention involved two farmer cooperatives located in Senga Hill District, Northern Province, Zambia, comprising a total of 204 beneficiary farmers. Female farmers accounted for 105 participants (51.5%), while youths accounted for 21 participants (10.3%), indicating moderate inclusion of women but relatively lower youth participation. Commodity aggregation activities resulted in a total of 28.30 metric tonnes of beans being collectively marketed during the 2022–2023 season, compared to 17.56 metric tonnes in the previous season, representing an increase of approximately 61.2%. Bean productivity in Northern Province increased from

0.56 metric tonnes per hectare (mt/ha) in both the 2020–2021 and 2021–2022 seasons to 0.77 mt/ha in 2022–2023, corresponding to a productivity increase of approximately 37.5%. In addition, the total area planted under beans increased from 60,250 hectares in 2021–2022 to 82,847 hectares in 2022–2023, reflecting stronger production response and market participation following improved aggregation, market coordination, and input support interventions. The key descriptive indicators used to assess implementation performance, aggregation outcomes, price realization, productivity change, and farmer participation are summarized in *Table 2*.

The indicators used in the analysis reflected three broad dimensions of the intervention: implementation outputs, market linkage performance, and early outcome signals. Implementation output indicators included the number of trainings delivered, participation levels among farmers and extension personnel, the establishment and functionality of bulking, or aggregation centres, the adoption of sorting, grading, and post-harvest handling practices, as well as the use of digital platforms for payments, information dissemination, and farmer coordination. Market linkage indicators focused on the extent and nature of engagement between farmers, aggregators, and buyers. These indicators included the number and type of buyer engagements established during implementation, the existence of agreed collection points, and evidence of negotiated arrangements relating to quality standards, pricing mechanisms, and payment modalities.

Where data were available, the study also assessed early outcome signals associated with the aggregation model. These included volumes aggregated and marketed through the bulking system, changes in price realization relative to informal farm-gate sales, reported reductions in distress sales and post-harvest losses, changes in production behaviour and farmer confidence to expand cultivation, and observed changes in bean productivity and marketed surplus. Where quantitative measures were incomplete, the study treats them as indicative outcome signals rather than definitive impact estimates and corroborates them through interview evidence, programme monitoring records, and implementation documentation.

3.7. Data Analysis

Data were analysed using a structured qualitative approach complemented by simple quantitative summarization where appropriate. The analysis began with process tracing and implementation mapping, whereby implementation activities and operational decisions were reconstructed into a chronological sequence to identify critical steps, bottlenecks, and adaptive changes that emerged during programme delivery. This included documenting adjustments such as changes in buying point locations, substitution of digital platforms, and responses to monitoring and logistical challenges.

The study further employed thematic analysis of interview notes and implementation documents. The data were coded around pre-defined themes derived from the intervention theory of change, including transaction costs, aggregation governance, trust and compliance, quality management, buyer requirements, payment reliability, logistics and transport, and digital platform functionality. Comparisons across stakeholder groups were undertaken to identify areas of convergence and divergence in perceptions and experiences relating to programme implementation.

To strengthen credibility and validity, the study applied a triangulation strategy in which implementation claims were treated as robust only when supported by at least two independent sources such as programme monitoring records and stakeholder interviews or meeting minutes and buyer correspondence. Where inconsistencies emerged, these were addressed through further review of source documents and comparison of accounts across different stakeholder groups. This analytic strategy enhances credibility while remaining aligned with the case study's objective: generating actionable implementation lessons rather than causal attribution.

3.8. Ethical Considerations

The study follows standard ethical practices for research involving human participants. Participation in interviews was voluntary, respondents were informed of the study purpose, and responses were treated confidentially and reported in aggregate without identifying individuals. Where programme documentation was used, the analysis focused on operational content relevant to implementation learning.

3.9. Limitations

Several limitations should be acknowledged. First, as a case study, findings may not be statistically generalizable; however, they are analytically transferable to similar contexts where smallholders face coordination and market access constraints. Second, routine monitoring data may be incomplete or uneven across activities, limiting the precision of quantitative outcome measures. Third, without a counterfactual or experimental design, the study does not claim causal impacts on income or productivity. The results should therefore be interpreted as evidence of implementation mechanisms and early outcome signals, which can inform the design and operational strengthening of future market-access interventions.

4. Discussion of the Results

This section discusses the results emerging from the implementation of the Social Change Initiative (SCI), focusing on how the intervention components translated into observable changes in market access, production behaviour, and coordination among smallholder farmers. Consistent with the case study design, the discussion emphasizes implementation processes and early outcome signals rather than causal impact estimation.

4.1. Implementation Outputs and Operational Performance

The SCI implemented a sequence of interlinked interventions aimed at strengthening market access through capacity building, aggregation, and buyer coordination. A key institutional output was the training of agricultural marketing and extension personnel. Twenty-four Ministry of Agriculture (MoA) marketing officers from twelve districts in Northern Province participated in a trainer-of-trainers programme on market systems approaches, aggregator profiling, and commodity aggregation tools. Full participation across districts suggests strong institutional uptake and provided a foundation for cascading market-oriented training to field officers and farmers.

This capacity-building effort was reinforced through market-oriented agriculture training delivered to field officers under the Smallholder Horticulture Empowerment and Promotion framework. The training explicitly reframed production decisions around market demand, encouraging a shift from “grow and sell” to “grow to sell”. Such reframing is important in contexts where production decisions are traditionally decoupled from market signals and aligns with literature emphasizing the role of information and skills in improving market participation (Poole, 2017; Andrews et al., 2017).

At the farmer level, 204 smallholder producers from Chindo and Satoka cooperatives received training in commodity aggregation, post-harvest handling, quality grading, and basic contract management. These trainings were complemented by coordination with private sector actors and extension services, enabling farmers to align production, quality standards, and delivery schedules with buyer requirements. Together, these outputs strengthened the institutional and human capital prerequisites for effective aggregation.

4.2. Strengthening Input and Output Market Linkages

The intervention facilitated access to certified bean seed and agrochemicals through coordination between farmer cooperatives, the Zambia Agricultural Research Institute, private input suppliers, and implementing partners. Distribution via a

digital e-voucher system reduced transaction frictions and the ensured timely delivery of inputs. Farmers received an early-maturing bean variety with higher yield potential, which likely contributed to observed increases in production volumes.

On the output side, structured engagement with a formal off-taker, Good Nature Agro, resulted in a pre-announced buying arrangement with clear quality requirements, delivery timelines, and pricing. The agreed price of K15.50/kg exceeded prevailing informal market prices (approximately K13.00/kg), suggesting improved price realization through aggregation and reduced dependence on opportunistic middlemen. Payments were processed digitally within ten days of delivery, addressing a common constraint in smallholder marketing arrangements related to delayed or uncertain payments. These outcomes are consistent with empirical evidence showing that reliable buyer linkages, transparent pricing, and reduced transaction costs can improve market participation and farmer incomes (Fischer and Qaim, 2012; Ton et al., 2018).

4.3. Aggregation Outcomes and Market Participation

Commodity aggregation was operationalized through a centrally located bulking centre, reducing transport distances and coordination costs for both farmers and buyers. A total of 28.30 metric tonnes of beans were aggregated and sold collectively, representing a substantial increase compared to the 17.56 metric tonnes marketed in the previous season. While attribution should be treated with caution, this increase coincided with improved access to certified seed, clearer market signals, and strengthened aggregation arrangements. The proximity of the bulking centre reduced transport costs and lowered barriers to participation, particularly for smaller producers. Literature consistently identifies distance and transport costs as major determinants of market participation (Omiti et al., 2009; Simon et al., 2015). By localizing aggregation, the intervention reduced these frictions and enhanced the feasibility of collective marketing.

4.4. Changes in Production Behaviour and Productivity Signals

Evidence from programme monitoring records and farmer feedback indicates notable changes in production behaviour following the intervention. Farmers reported greater confidence in expanding bean production due to the availability of a predictable market and clearer price information. Bean productivity increased from an estimated 0.56 mt/ha to 0.77 mt/ha, alongside a substantial expansion in the area planted with beans. While these outcomes cannot be causally attributed to the intervention, their timing is consistent with empirical findings that access to certified seed and assured markets can incentivize on-farm investment and improve productivity (Chilundika, 2011).

The data in *Table 3* show that the increase in total bean output was driven by both higher yields and an expansion in cultivated area. Total marketable surplus rose from 17.56 metric tonnes in 2022 to 28.30 metric tonnes in 2023, suggesting an enhanced willingness among farmers to channel production through collective marketing arrangements rather than informal farm-gate sales. This pattern is consistent with reduced transaction costs and improved coordination between producers and buyers, facilitated by the aggregation model.

Table 3. *Mixed bean production and productivity in Northern Province*

Crop/Season	Hectares planted (ha)	Production (mt)	Yield (mt/ha)
2020–2021	59,127.00	33,027.00	0.56
2021–2022	60,250.00	33,921.00	0.56
2022–2023	82,847.00	54,674.00	0.77

Source: MoA (2023)

The observed shift away from mono-cropping towards bean cultivation also generated co-benefits related to household nutrition, soil fertility, and income diversification. Bean cultivation can also complement conservation agriculture systems by contributing to soil improvement and sustainable land management practices (Thierfelder et al., 2012). Legume integration contributes to nitrogen fixation and improved soil health while also enhancing dietary quality through higher protein intake. Legumes have long been recognized for their nutritional importance and contribution to diversified diets in developing-country farming systems (Barrett, 1990). Under increasingly water-constrained conditions in sub-Saharan Africa, legumes are also recognized as resilient crops with important adaptation potential for smallholder systems (Chivenge et al., 2015). Grain legumes additionally contribute important micronutrients and dietary diversity within rural food systems (Tharanathan and Mahadevamma, 2003). These outcomes align with the broader literature on the agronomic and nutritional advantages of legumes in smallholder farming systems (Bationo et al., 2011; Ojiewo et al., 2015).

4.5. The Role of Information and Digital Tools

Digital tools played a complementary role in strengthening coordination, communication, and information flows within the aggregation model. The registration of farmers on an electronic platform improved the dissemination of information relating to prices, buyer requirements, delivery schedules, and payment processes. Bulk SMS messaging was used to communicate market updates and facilitate coordination between farmers, aggregators, and buyers, thereby reducing information asymmetries and supporting timely decision-making.

The intervention also highlighted the potential role of more integrated application-based digital systems capable of supporting push notifications and real-time communication with farmers. Although the implementation of a fully operational mobile application was constrained by financial, infrastructural, and connectivity limitations, the experience demonstrated the importance of digital platforms in improving transparency, market coordination, and access to timely production and marketing information. Future aggregation interventions could benefit from dedicated mobile applications incorporating push notifications, digital payment tracking, buyer alerts, and real-time market information services to strengthen farmer participation and responsiveness within agricultural value chains. These findings are consistent with studies showing that mobile phone use and digital information systems can enhance collective marketing, reduce transaction costs, and improve smallholder market participation (Mango et al., 2017; Abdul-Rahaman and Abdulai, 2020; Nxumalo and Chauke, 2025).

4.6. Implementation Challenges and Coordination Lessons

Despite these positive outcomes, several implementation challenges emerged, including connectivity constraints, limited monitoring resources due to distance, and initial disagreements over buying point locations. These challenges underscore the importance of adaptive implementation, stakeholder negotiation, and flexible governance arrangements in aggregation models. Trust, timely payments, and transparent grading standards emerged as critical factors influencing farmer participation, echoing findings from Ssajakambwe et al. (2019) and Ton et al. (2010).

4.7. Synthesis of Key Results and Theoretical Implications

The results indicate that coordinated aggregation, supported by capacity building, digital information tools, and structured engagement with buyers, can strengthen smallholder access to formal markets and generate positive early outcome signals. The findings underscore that aggregation operates not merely as a logistical solution but as an institutional arrangement that reduces transaction costs, improves information flows, and enhances coordination among value-chain actors.

From a theoretical perspective, the aggregation model functioned as a coordination mechanism that lowered per-unit transaction costs associated with small production volumes, spatial dispersion, and limited market information. By reducing search, negotiation, and enforcement costs, aggregation increased the expected returns to market participation and improved the reliability of market signals faced by farmers. The observed changes in production behaviour, quality management, and collective marketing are therefore consistent with economic

theories of transaction costs and collective action, which emphasize the role of institutions in shaping market participation where formal market mechanisms are weak or incomplete.

Taken together, the results suggest that market access constraints in smallholder agriculture are fundamentally institutional in nature. Well-designed aggregation arrangements can partially substitute for missing or weak market institutions by aligning incentives across producers and buyers, thereby encouraging production expansion, quality upgrading, and sustained engagement with formal markets. While the findings should be interpreted cautiously given the case study design, they provide implementation-level evidence that complements impact-focused research and contributes to a more nuanced understanding of how aggregation models function in practice.

5. Conclusions

This study examined the implementation of a market-access intervention designed to improve smallholder participation in structured markets through commodity aggregation and coordinated buyer linkages in Zambia. Using an implementation-oriented case study approach, the analysis focused on how aggregation, capacity building, and digital tools were operationalized in practice and what early outcomes and lessons emerged. The findings reaffirm the central role of market access in shaping smallholder production decisions, income opportunities, and the effectiveness of agricultural commercialization strategies.

The results indicate that limited access to input and output markets remains a binding constraint for smallholder farmers in remote rural areas. Fragmented production, high transaction costs, weak market information, and unreliable buyer linkages continue to suppress productive potential and discourage investment in productivity-enhancing technologies. The case study demonstrates that coordinated aggregation arrangements, when combined with targeted capacity building and structured buyer engagement, can reduce these constraints by lowering transaction costs, improving price realization, and strengthening market participation.

A key conclusion is that aggregation functions not only as a logistical mechanism but also as an institutional arrangement that facilitates coordination, trust, and predictability among value-chain actors. The presence of local bulking infrastructure, clear quality standards, transparent pricing, and reliable payment mechanisms reduced uncertainty for both farmers and buyers, encouraging collective marketing and production expansion in response to market signals. While causal impacts are not estimated, observed increases in aggregated volumes, productivity indicators, and prices relative to informal markets provide credible early signals of effectiveness.

The findings further highlight the importance of complementary investments in human capital and information systems. Training of farmers and extension personnel improved the understanding of market-oriented production, quality requirements, and post-harvest management, while digital tools enhanced information flows, coordination, and payment transparency. Together, these elements supported more effective collective marketing arrangements.

From a policy perspective, the study underscores that market-access interventions are most effective when they address coordination failures along the value chain rather than focusing solely on input provision. Policies that support aggregation infrastructure, strengthen farmer organizations, and facilitate partnerships with private off-takers can enhance the inclusiveness and sustainability of agricultural commercialization. Digital innovations offer scalable opportunities to improve market access, particularly in geographically remote areas.

The study contributes implementation-level evidence to the literature on smallholder market access and aggregation models. By documenting how aggregation and market coordination were operationalized in a low-income country context, the paper complements impact-focused studies and provides practical insights for policymakers and practitioners. Future research could combine implementation analysis with rigorous impact evaluation to assess long-term welfare effects and scalability across crops and regions.

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