Assessment of Horticultural Seedling Business Opportunities in Ghana

Study Report

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List of Abbreviations

Abbreviation	Full Meaning
AGRA	Alliance for a Green Revolution in Africa
CESSA	Centre for Seed Systems and Agribusiness
CSIR	Council for Scientific and Industrial Research
CRI	Crops Research Institute
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
FSRP	West Africa Food System Resilience Programme
GNBCC	Ghana Netherlands Business and Culture Council
GSS	Ghana Statistical Service
IFPRI	International Food Policy Research Institute
KII	Key Informant Interview
LVVN	Ministry of Agriculture, Fisheries, Food Security and Nature
MAG	Modernizing Agriculture in Ghana
MoFA	Ministry of Food and Agriculture (Ghana)
NEIP	National Entrepreneurship and Innovation Programme
NGO	Non-Governmental Organization
PFJ	Planting for Food and Jobs
PPP	Public–Private Partnership
PPRSD	Plant Protection and Regulatory Services Directorate
PWD	Person with Disability
RVO	Netherlands Enterprise Agency (Rijksdienst voor Ondernemend Nederland)
SARI	Savanna Agricultural Research Institute
WTP	Willingness to Pay

Executive Summary

Vegetable production in Ghana has become one of the most dynamic and rapidly expanding subsectors of agriculture, contributing significantly to nutrition, employment, and livelihoods across rural and peri-urban communities. However, productivity and profitability remain constrained by persistent inefficiencies in the seed-to-field system. The study identifies the seedling stage, the bridge between seed and production, as the most fragile link in this chain. Farmers across the country continue to depend largely on self-raised seedlings produced under suboptimal conditions, which often result in low germination, high mortality, and uneven field stands. Professional nursery systems, proven to increase field establishment and yields by 15–30 percent, remain underdeveloped in Ghana due to a lack of technical capacity, limited access to inputs, high start-up costs, and the absence of regulatory or financial support structures. Addressing these constraints is critical to realizing the goals of Ghana's Feed Ghana Program (FGP) and the Netherlands' agricultural cooperation agenda on food security and private-sector development. The study was designed to identify and characterize key vegetable production regions across Ghana based on production scale, crop diversity, infrastructure, and accessibility; to collect agronomic and market data on seedling sourcing, seed varieties, and transplanting practices; to analyze seedling market potential through assessment of current practices, demand segmentation, and willingness to pay; and to evaluate enabling-environment factors including access to water, power, roads, skilled labour, and policy frameworks that affect the feasibility of establishing commercially raised seedling enterprises. A mixed-methods approach was used, combining quantitative surveys, qualitative key informant interviews, and focus group discussions. Data were collected from seven regions and twenty-one districts, covering 126 farmers, 42 key informant interviews, and 42 focus group discussions. These were complemented by institutional consultations with MoFA, CSIR, seed firms, agro-dealers, financial institutions, and sector experts, and analyzed through descriptive and thematic techniques supported by regional SWOT analysis.

Findings from the study reveal a dynamic but fragmented seedling industry characterized by widespread informal production. Across all regions, over eighty percent of farmers raise their own seedlings using locally sourced soil and minimal shading, resulting in low survival and inconsistent growth. Only a small proportion purchase seedlings from professional or semi-professional nurseries. Farmers universally acknowledge the benefits of using quality seedlings, particularly improved germination, uniform growth, and better yields, but cite affordability, trust, and supply reliability as key barriers to adoption. The mean willingness to pay for professionally raised seedlings was estimated between GHS 0.80 to 1.00 per seedling, with higher willingness among commercial producers in the middle belt and southern regions. Regional variations are significant. In the Northern and Upper East Regions, production of tomato, pepper, onion, and okra, benefits from irrigation schemes

such as Tono and Vea. However, persistent water scarcity during the dry season and inadequate infrastructure continue to limit productivity and market access. Cooperatives in these zones expressed readiness to manage community-based nurseries, though external support in irrigation, equipment, and training would be necessary. In Bono East and Ashanti, where production is more commercialized and connected to urban markets, there is strong potential for public–private partnership (PPP) nursery models led by agro-dealers and seed companies. The Eastern and Volta Regions show strong cooperative organization and gender inclusiveness, with farmers indicating interest in group-managed nurseries to supply members. However, these areas face recurring challenges with flooding and limited technical expertise. The Greater Accra Region, which serves as Ghana's largest horticultural market, is characterized by better infrastructure, private-sector presence, and Dutch agribusiness partnerships but limited land availability due to urbanization pressures. This region offers the highest potential for high-tech demonstration nurseries integrating greenhouse and solar irrigation technologies.

The market assessment confirms that Ghana's seedling sector holds significant untapped potential for commercialization. Seedlings of high-demand vegetables such as tomato, pepper, onion, and cabbage are commonly traded at prices between GHS 0.50 and 1.00 per seedling. Demand is seasonal, peaking during the March–June and September–November planting periods. Most existing nurseries operate informally and lack access to finance or certification. However, there is growing interest among private actors and financial institutions. Banks and fintech firms interviewed indicated willingness to design seedling-specific credit products once business performance data become available. Seed companies, including East-West Seed, Rijk Zwaan, and Enza Zaden, also expressed readiness to engage in contract propagation, training, and co-investment in regional hubs. These trends signal the emergence of a viable market segment for structured nursery enterprises. Gender, youth, and inclusion dimensions emerged as central to the sector's growth potential. Women and youth form the majority of vegetable producers but remain underrepresented in nursery ownership and input supply chains. Yet both groups expressed strong willingness to participate in nursery ventures if training, credit, and market linkages were accessible. The study also identifies opportunities for engaging persons with disabilities (PWDs) in nursery operations, given the relatively low physical intensity of seedling work. Mainstreaming gender and youth participation in business planning, extension services, and PPP frameworks will enhance both social equity and enterprise sustainability.

At the policy and institutional level, the study highlights the absence of a nursery-specific regulatory framework as a key gap. While MoFA's Plant Protection and Regulatory Services Directorate (PPRSD) oversees seed certification, no licensing or quality standards currently exist for commercially raised seedling producers. Weak coordination among district-level agencies and inadequate extension logistics further constrain the sector. However, national initiatives such as PFJ 2.0 (the Feed Ghana Program), the Ghana Seed Sector Strategy and Investment Plan (2023–2030), and the Dutch–Ghana Seed Partnership provide an enabling platform for integrating nursery regulation, training, and investment promotion. The report concludes that Ghana's horticultural seedling industry presents a strong opportunity for agribusiness development, youth employment, and private investment. The sector's transition from informal to formal enterprise will depend on targeted investments in irrigation infrastructure, training, financing, and policy alignment. The study recommends developing a national nursery accreditation system, establishing regional demonstration hubs through PPPs, and designing blended finance and insurance products tailored for nursery investors. It further proposes capacity-building programs for extension agents, cooperatives, and women-led groups, alongside mechanisms for integrating digital finance and traceability systems.

In the short term (0–1 year), pilot nurseries should be established in three high-potential regions, Bono East, Volta, and Greater Accra, supported by training and business coaching. Within the medium term (1–3 years), PPP nurseries can be scaled up across all major production zones through blended finance schemes and certification frameworks. Over the long term (3–5 years), a National Seedling Business Framework should be institutionalized under MoFA to coordinate policy, investment, and quality standards. Through these strategic steps, Ghana can unlock a competitive and inclusive horticultural seedling industry that drives productivity, resilience, and shared prosperity.

1. Introduction

1.1 Background

Vegetable production has become a vital sub-sector of Ghana's agricultural economy, contributing to employment creation, household income, and food and nutrition security. Rapid urbanization and changing dietary preferences have driven the demand for vegetables such as tomato, pepper, onion, okra, garden egg, cabbage, and leafy greens (FAO, 2022; Wongnaa et al., 2024). FAOSTAT-derived data show that the total vegetable output in Ghana stood at approximately 788,693 tonnes in 2021, reflecting modest growth but also underlying production constraints. According to the Ministry of Food and Agriculture (MoFA), vegetables constitute a priority area under the Planting for Food and Jobs (PFJ) initiative, reflecting the government's goal of improving productivity, supporting youth agripreneurship, and enhancing import substitution (MoFA, 2021). Nevertheless, yield performance in Ghana's vegetable subsector remains below potential, despite favourable agroecological zones, due to limited access to quality inputs, irrigation, and extension services, as well as weak market linkages (IFPRI, 2018).

The seed sector that underpins vegetable production in Ghana comprises of both formal and informal systems. The formal system, comprising of certified seed companies, research institutions, and regulatory bodies, produces and markets improved and hybrid varieties, while the informal system involves farmer-saved and open-market seeds that dominate smallholder production (Ayamga, 2018). Multinational firms such as East-West Seed, Rijk Zwaan, Bakker Brothers, and Enza Zaden have established distribution networks and demonstration plots that help disseminate improved varieties and train farmers in modern production practices (Ghana Seed Sector Assessment, 2024). Despite these developments, a considerable proportion of vegetable farmers still rely on uncertified or recycled seed, leading to low germination, inconsistent varietal performance, and poor yields (IFPRI, 2018). The coexistence of these systems creates a fragmented value chain that limits access to reliable planting materials and reduces competitiveness.

A critical yet underdeveloped link in this chain is the seedling system, which bridges seed supply and field establishment. Most Ghanaian farmers raise their own seedlings under rudimentary conditions, often on bare soil, without sterilized media, and with inadequate irrigation or shading. Such informal nursery practices commonly result in poor germination, uneven growth, damping-off disease, nematode infestations, and high mortality during transplanting (Osei et al., 2021). Because of these inefficiencies, many farmers fail to realize the yield advantages of improved and hybrid seeds, which require optimal nursery management to attain their full potential. Studies have shown that using professionally produced seedlings enhances field establishment, uniformity, and yield by 15 - 30%

compared to self-raised seedlings (Riikonen & Luoranen, 2018). However, the absence of dedicated commercial nurseries, limited technical know-how, and inadequate quality-control systems constrain the development of this promising segment.

Recognizing these systemic gaps, the Government of the Netherlands, through the Dutch Ministry of Agriculture, Fisheries, Food Security and Nature (LVVN) and the Embassy of the Kingdom of the Netherlands in Accra, has prioritized Ghana's horticultural value-chain transformation as part of its broader agricultural cooperation agenda. Within this framework, several initiatives have been launched, including the Ghana Seed Partnership, the Agricultural Working Group, and a Technical Working Group on Seeds. The partnerships aim to strengthen bilateral cooperation, institutional capacity, stimulate private investment, and promote the adoption of high-quality seeds and seedlings through technology transfer, training, and market facilitation

1.2 Study Rationale and Alignment with Embassy Objectives

This assessment directly supports the Dutch–Ghana agricultural cooperation by generating evidence to strengthen the horticultural seedling industry, an emerging priority under the Netherlands' development cooperation agenda in West Africa. The Embassy of the Kingdom of the Netherlands in Accra identifies horticulture and the seed sector as key pillars of bilateral cooperation, focusing on sustainable production, private investment, and agribusiness linkages (Netherlands & You, 2022). The Ghana–Netherlands Seed Partnership (GNSP) and related PPPs coordinated by the RVO and the GNBCC exemplify this approach, fostering technology transfer and inclusive market growth across the horticultural value chain (SeedNL, 2024).

The rationale for this study stems from persistent inefficiencies in Ghana's seed-to-field system. Although the country has adopted policies such as the National Seed Policy (2013) and the Seed Sector Investment Plan (2023), implementation has focused mainly on seed production, leaving the intermediary seedling stage largely underdeveloped (MoFA, 2013; AGRA & CESSA, 2023). Professional nurseries remain scarce, and informal propagation practices limit the yield potential of improved and hybrid varieties (IFPRI, 2018). Also, the initiative aligns with broader food-security and private-sector development goals. Access to high-quality seedlings can raise yields, reduce production losses, and improve smallholder profitability, outcomes that resonate with the objectives of Ghana's Planting for Food and Jobs 2.0 and the Netherlands' Food Security and Agribusiness Agenda (FAO, 2022; MoFA, 2021). In addition, promoting commercial nurseries presents opportunities for youth and women entrepreneurship, skills transfer, and local job creation, central themes in both Dutch development policy and Ghana's agricultural modernization strategy.

1.3 Study Objectives

The overarching objective of this study, as stated in the Terms of Reference issued by the Dutch Ministry of Agriculture, Fisheries, Food Security and Nature, is to assess market conditions, map key vegetable production zones, and evaluate cropping systems, seed usage, and the demand for commercially raised seedling services in Ghana. The findings are expected to guide the selection of three high-potential locations and inform the development of a viable business model for a commercial vegetable seedling nursery enterprise in the country.

To achieve this goal, the assessment is designed to generate a comprehensive understanding of Ghana's horticultural seedling ecosystem through both secondary and primary data collection, stakeholder consultations, and field validation. Specifically, the study sought to:

1. Identify and characterize key vegetable production regions across Ghana based on production scale, crop diversity, infrastructure, and accessibility.
2. Collect agronomic and market data in each region, including dominant crops, seed varieties, sources of seed and seedlings, production seasons, and constraints in seedling access and transplanting practices.
3. Analyze seedling-market potential by examining current production practices, gaps, constraints, willingness to pay, demand segmentation, and the presence or closure of existing nurseries.
4. Assess enabling-environment factors such as access to water, power, roads, and skilled labour, proximity to markets, logistics systems, and regulatory frameworks that influence the feasibility of establishing commercially raised seedling enterprises.
5. Synthesize findings into actionable recommendations that can inform both private investment and policy dialogue aimed at developing sustainable seedling-business models in Ghana's horticultural sector.

1.4 Expected Outcomes and Deliverables

The assignment delivered the following outputs:

- Plan of Approach: outlining methodology, tools, timelines, and stakeholder engagement strategy.
- Draft Report: presenting findings from desk review, field surveys, FGDs, and KIIs, including regional analyses and SWOT assessments.
- Validation Workshop: a consultative meeting was held with the key stakeholders interacted with during the study to review and refine preliminary findings.

- Final Report: incorporating stakeholder feedback and containing detailed regional profiles, SWOT matrices, and proposed business models for seedling enterprises.
- Presentation Slides: summarizing key results for dissemination at Agrofood Ghana 2025.
- Monthly Updates: shared with the Embassy of the Kingdom of the Netherlands (EKN), RVO, Advance, and GNBCC during project implementation.

1.5 Scope and Limitations

This study focuses on the seedling production and distribution systems within Ghana's horticulture sector. Geographically, it covers seven regions and twenty-one districts, selected to reflect the diversity of agro-ecological conditions and production systems across the country. The study targeted a broad spectrum of stakeholder groups, including farmers, farmer cooperatives, agro-dealers, the Ministry of Food and Agriculture (MoFA), research institutions such as the Council for Scientific and Industrial Research (CSIR), private seed companies, sector experts, transport and logistics providers, and financial institutions. By engaging these actors, the study captured perspectives across the production, regulatory, research, and market dimensions of the seedling value chain.

2. Methodology

2.1 Research Design and Approach

The study adopted a mixed-methods design, integrating both qualitative and quantitative tools to generate a comprehensive understanding of seedling production and commercialization dynamics. This approach ensured that numerical data on production, costs, and market performance were complemented by rich qualitative insights from stakeholder experiences and perceptions. A participatory approach guided the design and implementation of the study. Key actors across the seedling value chain, including farmers, cooperatives, agro-dealers, seed firms, research institutions, and policymakers, were actively engaged in shaping the inquiry, validating findings, and co-developing recommendations. The study was also gender-responsive, with deliberate efforts made to capture the voices and perspectives of women and youth who are often underrepresented in horticultural seedling enterprises. Data collection tools and methods were designed to be inclusive, and disaggregated analysis was conducted to highlight gendered opportunities and constraints. Finally, the research applied a market-oriented lens to assess the commercial viability and scalability of seedling enterprises. This involved examining demand and supply dynamics, cost structures, investment requirements, and institutional arrangements that influence the sustainability of the seedling business.

2.2 Data Collection Methods

The study adopted a mixed-methods approach, combining both quantitative and qualitative techniques to generate comprehensive evidence on Ghana's horticultural seedling sector. This approach ensured triangulation across data sources, enabling the team to capture both statistical patterns and stakeholder perspectives from different nodes of the value chain.

2.2.1 Quantitative Data Collection

Quantitative data were obtained primarily through structured surveys administered to vegetable farmers, nursery operators, and agro-dealers across the seven selected regions. The survey instrument, developed in consultation with key sector experts. Enumerators used KoBoToolbox to collect responses digitally, allowing real-time monitoring and quality checks by the research team. Prior to deployment, enumerators participated in a one-day training on ethical standards, interview procedures, and the technical content of the survey.

2.2.2 Qualitative Data Collection

Qualitative information was obtained through a series of Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) with diverse stakeholder groups. In total, 42 KIIs and 42 FGDs were conducted, providing in-depth insights into policy, market dynamics, technical capacity, and investment opportunities. Interviews were audio-recorded, with participant consent, and complemented by detailed field notes.

2.3 Sampling and Regional Coverage

The study employed a multi-stage purposive sampling design to capture the diversity of Ghana's horticultural seedling landscape across agro-ecological zones, production scales, and stakeholder categories.

2.3.1 Regional and District Selection

Seven regions were selected purposively to ensure ecological and market diversity. For each of these regions, three districts were also purposively selected due to the dominance of vegetable production in consultation with key stakeholders (Table 1).

Table 1: Regions and Districts Selected

Region	Districts
Ashanti	Offinso North, Asante Akyim North, Ahafo Ano Southwest
Bono East	Techiman South, Nkoranza South and Techiman North
Eastern	Fanteakwa North, Atiwa East and Kwahu East
Greater Accra	Ga South, Kpone Katamanso and Ada East
Volta	Anloga, Akatsi North and Agortime Ziope
Northern	Tolon, Kumbugu and Savalugu
Upper East	Kassena Nankana, Bongo and Talensi

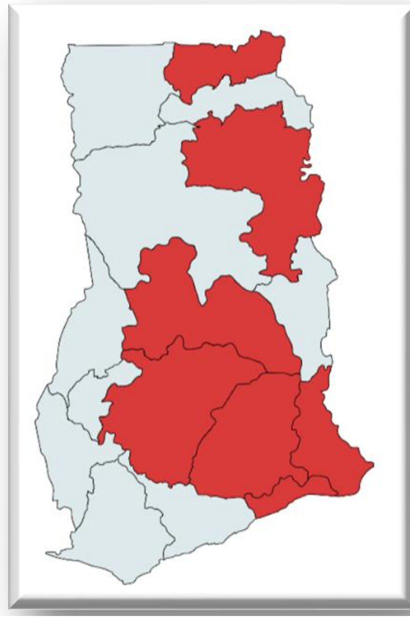


Figure 1: *Regions covered in the study*

2.4 Data Analysis

The data analysis for this assessment combined both quantitative and qualitative approaches to ensure comprehensive interpretation of findings across regions, stakeholder groups, and thematic areas. The mixed-methods design provided a basis for triangulating insights from surveys KIIs, FGDs, and field observations, thereby strengthening the validity and reliability of the conclusions drawn.

2.4.1 Quantitative Analysis

Quantitative data derived primarily from the structured farmer surveys administered across the seven regions (Bono East, Eastern, Ashanti, Greater Accra, Volta, Northern, and Upper East) were systematically cleaned, coded, and analyzed. The analysis focused on generating summary measures such as means, frequencies, and percentages to describe production practices, seed and seedling sourcing patterns, input use, costs, and farmer preferences. Cross-regional comparisons were conducted to identify spatial variations in seedling production systems, market access, and willingness to pay for commercially raised seedlings. This facilitated the identification of regional clusters with the highest potential for nursery establishment based on production intensity, market proximity, and enabling infrastructure.

2.4.2 Qualitative Analysis

Qualitative data from FGDs and KIIs were transcribed, reviewed, and analyzed using thematic and content analysis techniques. This process involved an iterative reading of transcripts to identify recurring themes, patterns, and relationships relevant to the study's objectives. Codes were developed both deductively, based on the ToR and study instruments, and inductively from emerging issues raised by participants. Thematic categories included seed sourcing and quality perception, seedling production challenges, business and financing constraints, gender and youth participation, and institutional support mechanisms.

2.4.3 SWOT Analysis

A Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis was conducted for each of the seven study regions to assess the market potential for commercially raised seedling businesses. The SWOT framework integrated both quantitative indicators such as production scale, market size, and infrastructure availability, and qualitative insights on stakeholder perceptions, policy environment, and institutional capacity.

- Strengths captured internal advantages such as favourable climatic conditions, farmer interest, existing seed distribution networks, and presence of development projects.
- Weaknesses highlighted internal constraints, including limited technical skills, inadequate nursery infrastructure, and high input costs.
- Opportunities represented external factors that could be leveraged, such as growing urban demand, private-sector investment interest, and policy support from MoFA and Dutch partners.
- Threats reflected external risks, including climatic variability, pest and disease outbreaks, and competition from imported seedlings or hybrid seeds.

2.5 Ethical Considerations

All participants were fully informed about the study's purpose, procedures, and voluntary nature before participating. Enumerators obtained written informed consent using standardized consent forms that explained participants' rights, including the freedom to withdraw at any time without consequence. Strict confidentiality was maintained throughout; no personal identifiers were recorded in the final data, and all digital survey files were stored securely on password-protected servers. Data use was limited to research purposes only.

3. Overview of Ghana's Vegetable and Seedling Sector

3.1 National Context

Ghana's vegetable sub-sector plays a critical role in national food security, nutrition, and rural incomes. Key vegetables cultivated include tomato, pepper, onion, cabbage, garden egg, and leafy greens, many of which now receive increasing consumer demand in urban markets. Nevertheless, production faces structural constraints: yield gaps persist because many farmers rely on low-quality planting materials, weak irrigation infrastructure, and limited value-chain support. As documented in the Ghana Seed Sector Assessment (2024), the national seed sector has historically emphasized cereals and legumes, with vegetable seed and propagation systems receiving less policy attention (Bonnand et al., 2024). The formal seed system in Ghana is governed by the National Seed Policy (2013) and associated regulatory instruments, which emphasize breeder, foundation, and certified seed production under government oversight; yet the majority of smallholder farmers still obtain seeds through informal channels such as farmer-saved seed, local markets, or seed exchange (MoFA, 2013). Despite these challenges, recent policy shifts such as inclusion of vegetable crop varieties under the Planting for Food and Jobs initiative signal growing recognition that seedling systems must be strengthened to close yield gaps and boost productivity.

3.2 Policy and Institutional Landscape

The policy and institutional architecture governing Ghana's seed and crop development is anchored in MoFA's Crop Services and regulatory divisions, with oversight from PPRSD (Plant Protection and Regulatory Services Directorate). The National Varietal Release and Registration Committee (NVRRC) is charged with approving new varietal releases under formal procedures (Ministry of Food and Agriculture, 2013). The Ghana Seed Sector Strategy & Investment Plan (2023–2030) further situates seed system priorities, including certification, accreditation, and regulatory harmonization, as critical pillars for sector transformation (AGRA & CESSA, 2023). Ghana is also engaged in regional initiatives for seed policy harmonization, particularly under ECOWAS frameworks, to align national regulations with broader regional standards for seed movement and certification (Kuhlmann & Zhou, 2016). However, a notable institutional gap remains: no regulatory instrument explicitly covers commercial vegetable seedling nurseries, leaving propagation stages underregulated and limiting accountability in quality assurance. Coordination between national directorates and district agricultural structures often remains weak, constraining policy translation into local practice.

3.3 Seedling Systems and Technologies

In Ghana, most vegetable seedlings are currently produced via low-input, informal nurseries by farmers themselves. These systems typically use soil beds, local soils, basic shading, and irregular watering, which exposes seedlings to pests, diseases, and environmental stress. More advanced propagation technologies such as seed trays, sterilized substrates, shaded nurseries (shade nets or greenhouses), drip irrigation, and hardening protocols are uncommon, limited mostly to research plots or demonstration sites. The Ghana Seed Sector Assessment (2024) notes that some seed companies are piloting contract nurseries to ensure varietal integrity, but such operations remain scarce and not widespread (Bonnand et al., 2024). Without structured scaling of propagation technologies across regions, the seedling systems remain a bottleneck in converting certified seed into healthy, uniform transplants.

3.4 Market and Value Chain Actors

The vegetable seedling value chain in Ghana comprises of multiple interlinked actors. At the upstream end are breeders and public research institutes such as CRI, CSIR-SARI, responsible for varietal development and early seed multiplication. Private seed companies multiply and distribute certified seed, often linking with demonstrative farms and traders. Nurseries, private, cooperative, or informal, propagate seedlings from seed, selling them to farmers. Agro-dealers often serve as distribution outlets, supplying inputs and in rare occasions, seedlings. Farmers themselves may either purchase seedlings or raise them. Downstream, aggregators, traders, and markets connect farmers to urban, regional, and export demand. Financial actors (rural banks, microfinance, fintech) provide credit, payments, or insurance services to value chain actors, though their role in seedling financing remains nonexistent currently. Government extension services, district MoFA offices, and regulatory agencies support training, oversight, and quality monitoring. NGOs, development partners, and donors often support pilots, demonstration nurseries, and market linkages. Yet despite this breadth of actors, the chain faces fragmentation, weak coordination, and misaligned incentives that impede scale and quality across regions.

4. Regional Findings and Analysis

4.1 Northern and Upper East Regions

The Northern and Upper East Regions remain Ghana's leading dry-season vegetable production belts, with strong traditions in tomato, onion, pepper, and okra farming. Most farmers still rely on open-field nurseries using local soil and manual watering, which increases vulnerability to drought and pest damage. A farmer in the Kassena-Nankana area noted that "*the irrigation pump is unable to draw sufficient water because many of us rely on the same machine. We also face challenges in accessing certain seeds, particularly onions, as well as dealing with pests and diseases*".

Inadequate irrigation infrastructure was consistently cited as the major barrier to expansion. One respondent emphasized, "*Yes, but inadequate water has been an obstacle to expanding our operations*". Despite these constraints, cooperatives in the region are increasingly motivated to diversify into nursery enterprises. A youth leader mentioned, "*Our youth in the cooperative are ready to participate because they are those doing the tree seedlings and have the passion for it*".

Seedling practices in this zone remain rudimentary, but awareness of improved methods is growing. One farmer explained, "*The germination rate is usually low because insects and birds eat up some of the seeds. But with nursing, the germination rate is much better*". These insights point to both the limitations of current methods and the high potential for training-driven improvement. Cooperative readiness, combined with the presence of CSIR–SARI and MoFA extension staff, provides an institutional base for piloting community-managed nurseries using solar-powered irrigation and low-cost tray systems.

4.2 Bono East and Ashanti Regions

Bono East and Ashanti Regions emerged as the commercial hubs of Ghana's vegetable production landscape. Techiman, Tuobodom, and Akomadan recorded the highest concentration of farmers using hybrid seeds and practicing year-round cultivation. Agro-dealers and seed companies are active in this zone, creating a more vibrant seedling economy. One agro-dealer remarked, "*We can easily add seedlings to what we sell; customers already come to us for seed and fertilizer, so it will move fast if we get training and trays*".

The regions benefit from irrigation systems and accessible road networks, although the high cost of electricity remains a challenge for water pumping. Market proximity and aggregation networks in Techiman and Kumasi further enhance profitability. However, smaller farmers still face knowledge gaps in modern propagation techniques. A farmer in Akomadan reflected, "*When you sow directly, some will not germinate… but with seedlings they are already there*".

With high market demand, active seed companies, and youth labour availability, these regions are well-positioned for PPP nursery development, where private agro-dealers, cooperatives, and research institutions can co-invest in commercially raised seedling hubs.

4.3 Eastern and Volta Regions

The Eastern and Volta Regions present a strong community-based model for vegetable production. Farmers cultivate cabbage, pepper, okra, and leafy greens under small-scale irrigation systems. Cooperatives and youth groups show a willingness to adopt improved nursery systems but require capacity building. A cooperative leader explained, "*We hold a strong interest in managing a group vegetable nursery, because there is availability of adequate land and labour to support such an initiative*". In the Volta Region, enthusiasm for joint nursery ownership was accompanied by recognition of key needs: "*External support in the form of quality seeds, nursery tools, and inputs would be necessary to make the business viable*". Extension officers in Hohoe and Kpando highlighted the importance of demonstration nurseries for training, citing strong interest among women and youth.

Seasonal flooding, saline soils, particularly in Keta, and limited access to input financing were identified as critical challenges. Despite these, the region's cooperative culture and gender inclusivity make it an ideal zone for piloting community-managed nurseries under MoFA - CSIR–Dutch technical collaboration.

4.4 Greater Accra Region

The Greater Accra Region hosts Ghana's most advanced vegetable value chain, with peri-urban farms in Dawhenya, Amasaman, and Nsawam producing for urban supermarkets, hotels, and processing firms. Market access and infrastructure are superior to other zones, but high land rental costs and labour competition with construction work constrain nursery expansion. Private entrepreneurs in Amasaman shared that "*we have customers ready to buy, but renting land for nurseries is too expensive, and labourers prefer construction work*". This situation underscores the need for government or PPP-supported demonstration sites on public land. Also, the region's concentration of Dutch agribusinesses and horticultural innovation partners makes it suitable for advanced, high-tech nurseries integrating greenhouse propagation, solar-powered irrigation, and automated seedling trays technology. Such nurseries could serve as national centers for technical training and certification.

4.5 Cross-Regional Comparative Insights

Across Ghana's agro-ecological zones, the study identified clear regional differentiation in production capacity, infrastructure, and market dynamics. The Northern and Upper East Regions are resource-rich but infrastructurally weak, best suited for cooperative or donorsupported nurseries. Bono East and Ashanti combine commercial scale with private-sector presence, making them ideal for PPP expansion. Eastern and Volta show social cohesion and willingness to engage collectively but require technical training and flood-resilient infrastructure. Greater Accra exhibits the highest market demand but faces land scarcity.

Enabling environmental factors, especially access to irrigation, energy, roads, and skilled labour, strongly shape regional competitiveness. Cross-cutting challenges include lack of seedling certification, limited finance, and weak coordination among regulatory bodies. Collectively, these insights demonstrate the need for region-specific interventions aligned with the objectives of this study.

5. Market Analysis and Business Potential

5.1 Current Seedling Market Landscape

The vegetable seedling market in Ghana remains largely informal but shows rapid signs of commercialization. Most farmers (approximately 80%) still produce their own seedlings, while a growing minority purchase from emerging private nurseries, mostly by colleague farmers, with tomato, pepper, and cabbage being the most demanded. Adoption barriers remain high. As one farmer explained, "*Most farmers in this area still prefer broadcasting seeds directly onto seedbeds rather than using seed trays. The practice of raising seedlings in trays is not very common*". Cost is also a deterrent; another participant stated, "*The main challenge is the high cost of seedlings. Additionally, farmers sometimes receive seed varieties that differ from what they actually requested for*".

Despite these challenges, farmers are increasingly aware of the advantages. A respondent emphasized, "*Farmers would feel assured if the seedlings offered are early maturing, high-yielding, and resistant to pests and diseases". Moreover, the business potential is acknowledged even by smallholders: "It is a viable business because it has the potential to bring money into our pockets*". Financial institutions recognize this opportunity but remain cautious. A bank officer noted, "*We support vegetable farmers, but not nursery producers yet; it's new for us, and we need more data before we can design products*". This underscores a key market gap, nursery operators lack tailored financing, yet banks show interest in developing products once performance data is available.

5.2 SWOT Summary by Region (Agro-ecological Zones)

The regional SWOT analysis integrates quantitative data from farmer surveys, field observations, and qualitative insights from KIIs and FGDs. It captured the relative strengths, weaknesses, opportunities, and threats shaping the competitiveness of seedling enterprises across Ghana's main agro-ecological zones. The analysis also identified the enabling factors and risks that influence investment decisions and adoption readiness within each region.

5.2.1 Northern and Upper East Regions (Guinea Savannah Zone)

Strengths

- Availability of large tracts of arable land suitable for vegetables such as onion, pepper, and tomato.
- High farmer interest and existing cooperative structures supporting group production.
- Presence of irrigation infrastructure such as the Tono and Vea schemes, though underutilized.
- Active research and extension presence through CSIR-SARI and MoFA regional offices.

Weaknesses

- Recurrent water shortages during the dry season and poor maintenance of irrigation systems.
- Limited access to credit and high input costs.
- Weak nursery infrastructure and lack of greenhouse or shade-net facilities.
- Poor feeder roads affecting transport and seedling survival.

Opportunities

- Potential to rehabilitate irrigation systems under PFJ 2.0 and FSRP.
- Growing market linkages with aggregators in Tamale and Bolgatanga.
- Strong interest among youth and cooperatives to co-manage nurseries if provided with technical training.
- Potential for Dutch–Ghana partnerships in low-cost solar irrigation systems.

Threats

- Erratic rainfall and increasing climate variability.
- High pest and disease pressure, especially damping-off and nematodes.
- Input price volatility and market uncertainty during harvest seasons.

5.2.2 Bono East and Ashanti Regions (Forest–Transition Zone)

Strengths

- High concentration of commercial vegetable farmers and agro-dealers, particularly in Techiman and Akomadan.
- Relatively reliable water access and proximity to trunk roads linking major markets.
- Presence of experienced nursery operators and cooperatives with access to land.
- Supportive MoFA extension units and research demonstration plots.

Weaknesses

- Dependence on manual nursery techniques and limited adoption of tray-based systems.
- Inconsistent power supply and high energy costs for irrigation pumps.
- Limited access to working capital for small nurseries.

Opportunities

- Viable location for PPP demonstration nurseries linking Dutch seed companies and local cooperatives.
- Growing private-sector investment interest (East-West Seed, Rijk Zwaan, and Enza Zaden).
- Availability of youth labour and strong local markets.

Threats

- Land-use competition with maize and tree-crop cultivation.
- Fluctuating vegetable prices and middlemen dominance in marketing.
- Potential pest outbreaks linked to year-round production.

5.2.3 Eastern and Volta Regions (Forest–Deciduous Zone)

Strengths

- Long-established vegetable-growing traditions and steady local demand.
- Access to irrigation from rivers and wells, especially in Kpando, Hohoe, and Asuogyaman.
- Strong cooperative presence and good agro-dealer networks.
- Willingness among women and youth to invest in group-managed nurseries.

Weaknesses

- Lack of standardized seedling production practices and poor disease management.

- Inadequate access to modern nursery inputs (trays, fertilizers, and shade nets).
- Weak linkages between MoFA and seed distributors for hybrid dissemination.

Opportunities

- Potential for year-round seedling production with small-scale irrigation.
- Strategic proximity to the Greater Accra market.
- Integration with tourism and agribusiness investment corridors.

Threats

- Occasional flooding during peak rains affecting nursery sites.
- Market saturation during harvest periods.
- Limited availability of technical personnel in remote districts.

5.2.4 Greater Accra Region (Coastal Savannah Zone)

Strengths

- Largest concentration of peri-urban commercial vegetable farmers.
- High market demand from urban households, hotels, and processing firms.
- Good road network, energy access, and logistics infrastructure.
- Presence of private nurseries and ongoing Dutch–Ghana PPP pilots.

Weaknesses

- High land rental costs and limited availability of affordable plots.
- Soil salinity and water contamination in certain coastal areas.
- Labour shortages during the dry season due to urban competition.

Opportunities

- Viable environment for modern greenhouse-based nurseries.
- Potential for technology transfer and branding of quality-certified seedlings.
- Strong private-sector presence, including Dutch seed companies and input dealers.

Threats

- Urban sprawl reducing agricultural land availability.
- High input costs and dependency on imported materials.
- Climate risks related to coastal flooding and saltwater intrusion.

5.3 Willingness to Pay and Adoption Readiness

Understanding farmers' willingness to pay (WTP) for commercially raised seedlings and their readiness to adopt nursery-grown transplants is central to determining the market viability of a horticultural seedling enterprise in Ghana. Both the field survey and qualitative interviews reveal that while farmers recognize the benefits of professionally raised seedlings, especially in improving crop quality, survival rate, and time efficiency, cost, trust, and accessibility remain major barriers to adoption.

5.3.1 Farmers' Perceptions of Seedling Benefits

Across all seven study regions, farmers expressed strong appreciation for the potential advantages of nursery-raised seedlings, particularly for crops such as tomato, pepper, onion, garden eggs, and cabbage. Many respondents associated high-quality seedlings with improved germination, uniformity, and reduced replanting costs. One farmer in Techiman explained, "*When you buy healthy seedlings, you are sure that all of them will grow. The ones we raise ourselves die a lot because of diseases and heat*." Similarly, a female farmer from the Volta Region noted that "*using seedlings saves us time… you don't waste seeds, and the plants grow faster and evenly*." The Survey data support these perceptions. Approximately 82% of respondents (n=126) agreed that using professionally raised seedlings would improve their productivity, while 71% indicated that it would save them time and labour during land preparation. Farmers also valued the reduced seed wastage, estimated at 20–25% savings compared to direct seeding or on-farm nursery practices.

5.3.2 Cost Thresholds and Price Sensitivity

Despite the positive perceptions, affordability remains the decisive factor shaping adoption readiness. Farmers' current expenditure on self-produced seedlings averages between GHS 0.45 and 0.60 per seedling (including seeds, labour, and materials), depending on the crop. When asked about their willingness to pay for professionally produced seedlings, 58% of respondents reported a willingness to pay a premium if quality is guaranteed. The mean acceptable price across crops was approximately GHS 0.80 to 1.00 per seedling, though this varied regionally.

Farmers in Greater Accra and Ashanti Regions were the most willing to pay higher prices, reflecting their proximity to markets and access to commercial buyers. One agro-dealer in the Akomadan area explained, "*Farmers here can pay more if the seedlings are ready on time and can survive. But in the northern areas, people don't have that capital at the beginning of the season*." In contrast, farmers in the Northern and Upper East Regions were less willing to pay beyond GHS 0.70 per seedling, citing liquidity constraints and risk aversion due to unpredictable rainfall and market volatility.

A vegetable farmers' cooperative member in the Volta Region summarized this trade-off: "*We will buy seedlings if the price is fair. The problem is not that we don't want them, it's that we have to buy fertilizer, pesticides, and pay labour at the same time. It's about timing and money* *flow*." This suggests that farmers' willingness to pay is conditional, depending on credit access, seasonal cash availability, and trust in the quality and consistency of supply.

5.3.3 Economic Comparison of Self-Produced and Commercially raised Seedlings

An economic comparison of self-produced and commercially raised seedlings highlights the potential efficiency gains achievable through professional nurseries (Table 2). Based on survey responses and cost estimations:

Table 2: Estimated Cost Comparisons

Cost Category	Self-Produced Seedlings (GHS per 1000 seedlings)	Commercially raised Seedlings (GHS per 1000 seedlings)
Seeds (hybrid/local)	200 - 250	- (included in nursery cost)
Labour and inputs (soil/land preparation, watering, shading, etc.)	150 - 200	-
Losses (non-germination, mortality)	20 - 30%	<10%
Total effective cost	450 - 500	800 – 1,000
Survival rate after transplant	65 - 75%	90 - 95%
Average yield gains	-	+20 - 30%

While commercially raised seedlings are more expensive upfront, their higher survival and yield rates offset the cost difference. The data suggests that farmers adopting nursery-grown seedlings could recover the cost premium within a single production cycle through improved yields and reduced replanting expenses. This aligns with findings from other seed-sector assessments, which show that professionally raised seedlings improve profitability by 15 to 30% when managed under good agronomic practices (AGRA & CESSA, 2023; FAO, 2022).

5.3.4 Adoption Readiness and Constraints

Despite the general enthusiasm expressed by farmers, adoption readiness is moderated by three interlinked factors: (i) access to capital, (ii) trust in quality assurance, and (iii) timeliness of supply. Many farmers expressed a lack of confidence in current seedling suppliers, citing inconsistent quality and limited extension support. As one farmer in the Upper East Region noted, "*We don't have a nursery we can rely on here… sometimes people bring seedlings that die after two days*."

Credit constraints also affect adoption. Only 28% of surveyed farmers reported access to formal financing or input credit, and even fewer had access to dedicated horticultural loans. Informal arrangements, like cooperative contributions or pre-financing by aggregators, were the most common mechanisms. These findings underscore the importance of linking nursery businesses with microfinance institutions or fintech solutions capable of offering short-term input credit tailored to seedling purchases.

Finally, timeliness is critical. Several respondents noted that delayed supply from nurseries undermines their planting schedules. "*If the seedlings come too late, we lose the season*," one onion farmer in Kumbungu explained. This indicates a market opportunity for nurseries capable of offering scheduled delivery services and predictable supply calendars.

5.4 Enabling Environment

Ghana's enabling environment for horticultural seedling enterprises remains weak and unevenly distributed across regions. Factors such as infrastructure, skilled labour, and regulatory support influence the feasibility of nursery businesses in distinct ways.

5.4.1 Infrastructure (Water, Power, Roads, and Market Access)

Access to irrigation water emerged as one of the most decisive factors influencing vegetable and seedling production. Respondents frequently highlighted water scarcity, especially in the northern regions. One municipal officer explained that "*water for irrigation is a challenge here… they wanted to dig boreholes in some places so that farmers could access water for their farm activities, but they never came back to implement that project*." Similarly, a respondent in Techiman noted that "*there are two irrigation facilities, Kaniego and Tanoso, that primarily support vegetable farming. Unfortunately, the Tanoso facility has been out of operation for some time due to a major hydrant breakdown*."

While some infrastructure exists, respondents emphasized that many facilities built under past projects such as GCAP, where cold storage facilities were built, are underutilized: "*People have paid for them, and they are storing other non-horticultural crops… a waste of built packhouses and cold rooms*". Such inefficiencies reduce the potential for reliable seedling production and distribution.

Road infrastructure is another constraint. Although main highways connecting major production centres are in good condition, respondents across multiple regions indicated that "*most of them are feeder roads*," which makes transporting delicate seedlings risky and expensive. Poor rural connectivity limits access to markets, especially during the rainy season.

On the positive side, new municipal initiatives are improving market infrastructure. For example, one respondent reported that "*the current policy is the establishment of a 24-hour economy market… a four-acre site where vegetable farmers in the municipality can send their produce for sale*". Such infrastructure, if realized, could provide a consistent outlet for nursery products and vegetable trade.

Electricity was not highlighted as a dominant barrier, though respondents implied that rural operations are often dependent on unreliable power. This presents an opportunity for solar-based irrigation systems, an approach consistent with MoFA and Dutch-supported sustainable agriculture strategies.

5.4.2 Labour and Technical Skills Availability

Labour availability for vegetable farming was described as adequate, but respondents underscored serious skill gaps in nursery management. One key informant observed that "*there are no clear government interventions for horticultural crops in raising seedlings… apart from the foundation [irrigation schemes], which is the water bodies that we have access to. And that one is only individual farmers who are raising [seedlings] because of the demand from their colleagues*." This shows a reliance on informal, experience-based knowledge rather than structured technical training.

Extension officers revealed that mobility and funding limitations impede their ability to provide field support. As one MoFA officer in the Eastern Region explained, "*the biggest gap I can talk about now is the challenge involved in our movement… the initiative [Modernizing Agriculture in Ghana (MAG) project] ended last year, so getting access to the farmers on a regular basis is a challenge*". Such institutional capacity gaps restrict the dissemination of nursery technologies and best practices.

Nevertheless, stakeholders such as CSIR/SARI and the University of Ghana's Department of Crop Science are potential hubs for technical training. A CSIR researcher explained that "*research in northern Ghana has focused on improving access to improved seed varieties and promoting the use of seedling trays for improved quality and yield… however, higher costs and technical knowledge required for tray systems remain barriers to widespread adoption*."

5.4.3 Policy and Regulatory Context for Nursery Establishment

The findings revealed an almost unanimous perception of a policy vacuum for vegetable seedling businesses. Respondents repeatedly stated that "*there is no such policy specifically on commercially raised vegetable seedling nurseries*." The only relevant framework frequently cited was the Feed Ghana Agenda, which aims to improve mechanization and access to water pumps and farm inputs but does not directly regulate or promote nursery enterprises.

A MoFA official in the Upper East Region emphasized governance and coordination challenges: "*At the national level, we are with the ministry… but when it comes to the regional level, we are a department under the Ministry of Local Government. That has really distorted our work… there is no specific horticultural desk to design programs within the region*." The decentralization of MoFA's functions has created inconsistencies between national policy intent and local implementation.

Stakeholders further noted that weak regulation allows NGOs and private actors to operate without oversight: "*Because we don't have clear regulations, they are doing what they want, and you can't question them*." This regulatory gap undermines quality assurance and investment confidence. However, initiatives such as the PFJ 2.0 and the Dutch-supported Seed Sector Development Ghana project create opportunities to integrate nursery accreditation, business registration, and incentive frameworks into national and bilateral policy agenda.

5.5 Investment Landscape and PPP Opportunities

The assessment revealed that Ghana's investment landscape for horticultural seedling businesses is gradually expanding, supported by a growing interest among private-sector actors, development partners, and government institutions. However, the market remains fragmented, with limited formal partnerships and weak financial linkages constraining scalability. The analysis identifies emerging PPP opportunities between Dutch and Ghanaian actors, and the potential role of financial, insurance, and fintech institutions in catalyzing investment within the seedling value chain.

5.5.1 Potential Partnerships with Dutch and Ghanaian Private Actors

The study revealed a strong interest in collaboration between Ghanaian institutions and Dutch seed and technology firms. Extension officers and agro-dealers expressed that partnerships with Dutch companies could strengthen the technical capacity and credibility of nursery enterprises. One agricultural officer explained that "*we serve as a link between the researchers and the farmers, so we definitely play a major role… any information that has to reach the farmers passes through us*". This underscores the importance of leveraging MoFA's extension network to support technology transfer and awareness creation for commercially raised seedlings.

Stakeholders repeatedly emphasized the need for infrastructural and financial backing to complement technical expertise. As one officer stated, "*we don't have the resources here… we need a full lab to extract vegetable seeds so that we can use them as a seed bank, where farmers can easily have access to these seeds*". Dutch and other multinational companies such as Rijk Zwaan, Enza Zaden, East-West Seed, and Bakker Brothers, which already operate demonstration plots in Ghana, could act as technology and quality-control partners in nursery ventures. Meanwhile, local agro-dealers and cooperatives could manage distribution and farmer engagement. The collaboration between CSIR-SARI, CRI, and public universities in Ghana would be pivotal in providing varietal testing, disease diagnostics, and certification services to underpin commercial nursery credibility.

5.5.2 Role of Financial Institutions, Insurance, and Fintech Solutions

Interactions with rural banks and fintech providers revealed that while there is existing support for vegetable farmers, there are no dedicated loan products for seedling producers. A credit officer at Naara Rural Bank in the Upper East Region stated, "*we support a lot of them, especially the vegetable value chain, like those in the production of onions, pepper, tomatoes… we support them with a loan facility to make a payback at the end of their harvest*". However, he clarified that "*with the seed producers, we've not worked with them… mostly the customers we are dealing with do their own seedings and transplant to their field*".

Another officer from Atiwa Rural Bank in the Eastern Region, when asked about supporting seedling production, confirmed that "*our package is not for a particular kind of farmer… once you are a customer, we will give you*" but explained that "*the only risk is about nonpayment of loans… some wanted to finish production before repaying, so it turned out to be a risk for the bank*". This highlights the financing gap for horticultural nurseries and the perceived risks that deter banks from designing flexible, short-cycle credit for seedling producers.

Despite these limitations, there is clear willingness among financial institutions to innovate. One bank representative, a credit officer in the Volta Region, stated, "*we will consider designing the product… so that we can actually sponsor only those who are into seedling production… we will be so much interested to develop financial products that will fit into that aspect of the value chain*". Others stressed the importance of market assurance, with a financial officer in the Volta Region noting, "*if the farmers are willing to trust these seedling growers and buy from them, we will be happy to advance the money*".

However, the same officers pointed out persistent market and insurance challenges. One explained that "*we don't have an insurance policy now, but what we do is we can give the fellow another chance… we don't have any insurance policy for farmers now*". A financial officer in Tamale emphasized that "*if we would have gotten a good market… we wouldn't be having problems because it's not easy to come by seed… if maybe they would have gotten us a good market… it will be very nice [for the farmers]*". These statements confirm that market volatility and lack of insurance coverage remain significant deterrents to horticultural financing.

5.5.3 Emerging PPP and Investment Models

The findings suggest three promising PPP and investment models suitable for Ghana's seedling sector:

1. **Technology Transfer PPPs:** International/Multinational seed and technology companies co-invest with Ghanaian agribusinesses to establish regional demonstration nurseries. These partnerships would integrate modern nursery infrastructure (trays, irrigation, solar-powered greenhouses) with business mentorship and technical training.
2. **Cooperative-Based Investment Platforms:** Farmer cooperatives, youth groups, and women's associations co-own nurseries supported by concessional loans or grants from MoFA, NEIP, or Dutch-funded PPPs. Cooperative governance structures ensure equitable access and aggregation of seedling demand.
3. **Fintech-Enabled Financing Partnerships:** Local fintech firms collaborate with input dealers and microfinance institutions to provide credit, mobile payments, and insurance products tailored for seedling purchases. This model could leverage digital tools to reduce transaction costs and improve repayment tracking.

6. Proposed Business Models for Seedling Enterprises

6.1 Typology of Nursery Models

The study identified three interrelated nursery business models with the greatest potential for Ghana's horticultural seedling sector being: individual commercial nurseries, cooperative or community-based nurseries, and PPP nurseries. Each model reflects varying degrees of capital intensity, management capacity, and institutional linkage, offering multiple entry points for smallholders, youth, and private investors.

6.1.1 Individual Commercial Nurseries

Individual commercial nurseries are small, privately managed enterprises owned by farmers or agro-dealers who produce seedlings for sale within their local communities. Interviews indicate that individual growers often start from existing farm operations and rely on personal savings to scale up their nursery activities. One seedling producer in Kassena Nankana explained, "*I look for the better-looking fruits, take out their seeds, and raise them into seedlings for sale*".

Such entrepreneurs are driven by immediate market opportunities, particularly for high-demand crops such as pepper, cabbage, and tomato. Another producer emphasized that "*for cabbage, the spacing on the bed is wide… because of the nature of the leaves, if it's closer…, it* *becomes thin*", reflecting the practical knowledge and crop-specific experience that shape individual nursery practices.

However, these small-scale operators face constraints related to access to irrigation and input costs. As one respondent noted, "*for now, there is no clear infrastructure support that supports the vegetable seedling industry… only individual farmers are raising [seedlings] because of the demand from their colleagues*". This highlights the need for financial and technical assistance to strengthen private nursery entrepreneurs as key actors in the seedling value chain.

6.1.2 Cooperative and Community-Based Nurseries

Cooperative nurseries, often managed by youth or farmer-based organizations, emerged as one of the most promising and inclusive models during the study. These initiatives leverage group labour, shared land, and collective marketing to reduce costs and risks. A cooperative member from Fara Ja Masim Kuliga explained, "*yes, even though some of us are not correct, they should not be our concern now because we those who are ready for such are even more… this will even help bring our community name back on track*".

The willingness to co-invest and manage nurseries collectively was also strong. Farmers expressed readiness to contribute financially: "*Yes, something we have been waiting for and the cooperative won't share? We will do that [contribute to set up a seedling nursery]*". They also recognized the broader social and economic benefits: "*I don't think it should be a risk but a benefit because we are going to learn a new way of business… it will help we, the young ones, most especially the single parents who lost their husbands*".

Several groups already possess land and basic structures that could serve as nursery sites. As one participant stated, *"[There is enough] land for nursing, and I believe there will be demos before we start with anything*". These responses suggest that cooperative or community-based nurseries can be effective entry points for engaging women and youth, particularly when supported with training and access to starter inputs.

6.1.3 Public–Private Partnership (PPP) Nurseries

The third typology, PPP nurseries, combines the resources and mandates of public institutions such as the Ministry of Food and Agriculture (MoFA) with the technical expertise and investment capacity of private companies. MoFA officials acknowledged the importance of this approach, noting that "*private partnership would have been a very good idea… most of the activities we do here are being sponsored by private institutions*".

The PPP model is particularly suited for large-scale nursery hubs that integrate research, demonstration, and training. A sector expert from a private horticultural firm, Maphlix Trust, described a functional version of this collaboration: "*we work with outgrowers… we provide* *for them their seedlings… and at the end of the day we gain and they also gain; business goes on*". Such arrangements ensure consistent seedling quality and reliable market linkages between nursery operators and farmers.

At the policy level, MoFA officials underscored their potential facilitative role: "*our role is to provide agronomic support and then education… advise them from nursery to transplanting to harvesting and also take them to the market and financial institutions*". These statements demonstrate institutional readiness to support integrated PPP frameworks that combine technical, financial, and market functions.

PPP models could follow several forms:

a. **MoFA - Private Seed Firm Partnerships**: Government provides land, infrastructure, or extension services, while the private partner supplies hybrid seeds, trays, and technical supervision.
b. **Research - Private Sector Collaborations**: Institutions such as CSIR-SARI and the University of Ghana contribute expertise in varietal evaluation and raising of disease-free seedlings, while investors handle the commercial operations.
c. **Donor-Facilitated Consortia**: Development partners such as the Netherlands Ministry of Agriculture and RVO co-finance equipment and training to accelerate adoption and scaling.

Interactions with financial institutions confirm that blended-finance mechanisms and risk-sharing arrangements could make PPP nurseries profitable. As one rural-bank representative indicated, "*we will consider designing the product so that we can actually sponsor only those who are into seedling production*". This demonstrates readiness among local financiers to support PPP ventures when clear governance and repayment structures are in place.

6.2 Business Model

The business model canvas outlines the operational and financial logic for establishing commercially viable and inclusive horticultural seedling nurseries in Ghana. It captures how nursery enterprises, whether individual, cooperative, or PPP based, can deliver value, organize their key activities and partnerships, and maintain financial sustainability in a competitive environment. The analysis synthesizes quantitative and qualitative evidence from the study to provide a practical blueprint for investors, policymakers, and development partners.

6.2.1 Value Proposition, Key Activities, and Partners

The core value proposition of a horticultural seedling business in Ghana lies in providing high-quality, disease-free, and ready-to-transplant seedlings that enhance crop establishment, save farmers' time, and increase yield consistency. Across all seven regions, farmers emphasized the advantage of quality seedlings over self-raised transplants. As one respondent, a farmer in the Bono East Region, noted, "*when you buy healthy seedlings, you are sure that all of them will grow; the ones we raise ourselves die a lot because of diseases and heat*".

This value proposition addresses three critical farmer pain points identified in the survey and fieldwork:

- Low survival rates from self-produced seedlings (average 70%) compared to 90 - 95% for nursery-grown transplants.
- High seed wastage and replanting costs.
- Time savings, especially for women and youth who juggle multiple livelihood activities.

Also, nurseries offer the potential for off-season and bulk production, meeting the growing urban demand for vegetables year-round, particularly in the major cities within the country.

6.2.2 Key Activities

The study identified, through interactions with major stakeholders, a set of essential operational activities that underpin the commercial viability of a nursery enterprise:

- **Seed sourcing and treatment**: Acquisition of certified hybrid or open-pollinated seeds from trusted distributors like Rijk Zwaan, Enza Zaden, East-West Seed.
- **Seedling propagation**: Germination in trays or sterilized soil under controlled conditions; watering, fertilization, pest control, and hardening-off before sale.
- **Quality control**: Regular inspection for pest and disease management, with guidance from MoFA and CSIR-SARI officers.
- **Market coordination**: Coordinating production cycles with farmers' planting seasons, as emphasized by a respondent in Kumbungu: "*If the seedlings come too late, we lose the season*".
- **Training and demonstration**: On-site learning for farmers and youth on nursery management and transplanting techniques.
- **Distribution and after-sales support**: Delivery of seedlings to farmers' fields and monitoring performance post-transplant.

These activities can be adapted depending on the business model. For example, cooperative nurseries may focus more on community-level production and aggregation, while PPP nurseries emphasize training and innovation.

6.2.3 Key Partners

The success of a commercial nursery hinges on building a robust ecosystem of partners that provide technology, finance, inputs, and policy support. Field interviews revealed strong interest from both public and private institutions in partnership roles:

- **Public institutions**
  - MoFA will provide extension support, business registration, and coordination with district-level officers. "*Our role is to provide agronomic support and then education… advise them from nursery to transplanting to harvesting*".
  - Universities, CSIR–SARI/CRI will conduct research, seedling quality standards, and varietal trials.
- **Private sector**
  - Seed companies will supply improved seeds, technology transfer, and technical mentorship.
  - Local agro-dealers and cooperatives will take up seedling distribution and farmer aggregation.
- **Financial institutions and fintech firms**
  - Rural Banks and others expressed readiness to design loan products for nursery producers: "*We will consider designing the product… so that we can actually sponsor only those who are into seedling production*".
  - Fintech platforms can facilitate mobile payments and digital tracking of credit repayment.
- **Development partners**
  - The Netherlands Embassy, RVO, and the Ghana Netherlands Business and Culture Council (GNBCC) will provide facilitation, investment promotion, and linkages with Dutch technology providers for greenhouse and irrigation systems.
  - International organizations such as AGRA, and the World Vegetable Center can support training, co-funding of demonstration nurseries, and policy dialogue to integrate nursery business models into national horticulture programs.

6.2.4 Operational and Financial Sustainability Considerations

Sustainability in Ghana's seedling industry depends on a balanced mix of technical efficiency, market access, and institutional partnerships. The study identified four core pillars that determine the long-term operational and financial viability of nursery enterprises.

First, input supply and technology management. Sustained profitability relies on consistent access to high-quality seeds, substrates, trays, and irrigation inputs. Partnerships with seed companies and agro-dealers are critical for ensuring timely supply and technical guidance. In regions such as Bono East and Volta, farmers underscored the importance of reliable inputs, noting that "*farmers need to be sensitized on the benefits of purchasing seedlings from professional producers*". This aligns with evidence from Wageningen University's Ghana Seed Sector Assessment (Bonnand et al., 2024), which emphasizes that stable input chains are central to nursery scalability. ***Second, labour and skill development***. Skilled technicians are essential for maintaining quality control and efficient operations. Field interviews revealed limited capacity among youth in nursery management, pest control, and recordkeeping. Hence, structured training, potentially through MoFA and Dutch technical partners, will be indispensable for maintaining seedling quality and reducing losses. ***Third, market linkages and risk management***. Sustained revenue requires predictable off-take agreements with cooperatives, aggregators, and vegetable processors. Contract propagation and collective marketing through farmer organizations can help stabilize demand and mitigate seasonal price fluctuations. In the Northern Region, one farmer observed that "*it is a viable business because it has the potential to bring money into our pockets*", reflecting strong entrepreneurial appetite among producers if access to markets is ensured. ***Finally, financial planning and institutional support***. The absence of tailored credit and insurance products remains a binding constraint. Banks expressed cautious interest, stating, "*we support vegetable farmers, but not nursery producers yet; it's new for us, and we need more data before we can design products*". This underscores the need for blended finance models, integrating guarantees and fintech-enabled microcredit. Similar risk-sharing frameworks have proven successful in Kenya and Uganda (Udohaya, 2025), suggesting that Ghana could adopt comparable approaches under PFJ 2.0 or RVO-backed investment schemes.

6.3 Scalability and Replication Strategy

Scaling horticultural seedling businesses in Ghana requires deliberate investment in technical training, farmer sensitization, and infrastructural support. Evidence from the fieldwork and stakeholder interviews demonstrates that nurseries can be successfully replicated in other regions if they are grounded in local partnerships, robust capacity-building systems, and practical demonstrations that make the benefits visible to farmers.

6.3.1 Conditions for Scaling to Other Regions

Nursery operators and seed company representatives emphasized that scaling depends on financial support, technical training, and partnerships with outgrowers. One respondent explained, "*Financial support to me is to help scale the expansion of the nursery seedlings*". Another added that structured partnerships are essential: "*When we have the partnership with our outgrowers…then we know as and when they [farmers] need to pick their seedlings [the seedlings are ready]… having that engagement with them will [help with] scale up because they will be ready at any time…. to pick the seedlings and this will go a long way to expanding the business*".

Scalability is also tied to community engagement. As one business owner stated, "*We also as a business entity go out for community sensitization… I first ask them what they like me to do through outreach programs… by that I'm scaling up because I'm not just trying to produce seedlings for them but trying to give them what they desire*". This suggests that responsiveness to farmer preferences and local agro-ecological conditions is key to replication success.

Moreover, environmental adaptability is critical. Nursery operators highlighted the need for infrastructure that supports production across seasons. One interviewee noted, "*Some of the vegetables don't grow well in that high humidity or very high temperature level, so when we have the greenhouse or the shade net, I think it will be a very best option for us*". Another added that "*in the minor season, to be able to produce seedlings all year round, I think irrigational system should be considered*". These findings confirm that replicating nursery businesses across regions requires flexible infrastructure, reliable irrigation, and localized demand assessments to align production with planting cycles.

6.3.2 Role of Demonstration Sites and Training Hubs

The transcripts clearly show that demonstration and training are among the strongest drivers of seedling adoption and replication. As one agricultural officer stated, "*The most effective way for most farmers is for them to actually see the end results of the seedlings that are going to be sold to them*".

Demonstrations serve as visible proof of proper growth and yield improvement and are essential for building trust among smallholder farmers who are hesitant to shift from raising their own seedling (traditional direct sowing). Another respondent explained, "*When we do that, definitely some of them will appreciate why it is necessary to get seedlings*".

Existing initiatives such as the Food System Resilience Project (FSRP) already provide a platform for training and demonstration. As one extension officer observed, "*We have one project called FSRP… they are into vegetable production, especially tomatoes… they are actually promoting vegetable production*". Leveraging such ongoing interventions can accelerate replication by embedding nursery training within established extension frameworks.

Furthermore, private-sector actors have existing capacity-building structures that can function as training hubs. A nursery company representative explained, "*We already have training institutes at other Centres… when you go to the Greater Accra region you will find one of our Centres there… potential vegetable farmers that are around those centre's could be trained… regular training could let them as trainers be on their toes and be on top of the job all the time*". This decentralized training model offers a ready mechanism for scaling through continuous skill transfer and mentorship.

7. Gender, Youth, and Inclusion Dimensions

7.1 Youth Engagement and Entrepreneurship Opportunities

Youth involvement in the horticultural seedling value chain offers significant potential for employment creation and innovation. In nearly all study regions, youth respondents expressed enthusiasm for nursery entrepreneurship, citing low entry barriers and quick turnover compared to field farming. A young cooperative member in the Northern Region shared: "*Our youth in the cooperative are ready to participate because they are those doing the tree seedlings and have the passion for it*."

This interest, however, is constrained by limited access to start-up capital and lack of business development training. Most youth-run operations are informal and dependent on project-based support. Youth participants emphasized the need for mentorship and small equipment support, such as trays, irrigation kits, and shade nets. In Bono East, youth groups noted that collective ownership models and revenue-sharing arrangements could make nursery ventures more attractive and sustainable. The potential to integrate digital technologies and fintech platforms, including mobile-based credit, payment systems, and online seedling ordering, was widely acknowledged. Aligning youth entrepreneurship initiatives with programs such as NEIP's Youth in Agribusiness and the Dutch-funded Orange Corners Innovation Fund could accelerate youth participation in commercially raised seedling production, particularly in peri-urban regions.

7.2 Inclusion of Vulnerable and Marginalized Groups

Beyond gender and youth, inclusivity for persons with disabilities (PWDs) and marginalized rural groups is central to equitable horticultural development. Field discussions revealed that few structured mechanisms currently exist to support these groups in nursery-related activities. Participants identified accessibility constraints in nursery design (raised beds, manual watering) and lack of targeted training. Nevertheless, stakeholders recognized that nursery work, due to its stationary nature and relatively low physical intensity, can be adapted to accommodate differently abled individuals. Extension officers in the Volta and Eastern Regions highlighted the potential for PWD inclusion in tasks such as seedling pricking, sorting, and packaging. Such adaptations align with the objectives of Ghana's National Social Protection Policy (2017), which calls for integrating persons with disabilities into productive rural enterprises.

Targeted inclusion strategies could include quotas for PWD participation in nursery training programs, accessible infrastructure (adjustable benches, shaded workspaces), and community sensitization on the economic potential of disability-inclusive horticulture.

8. Policy, Regulatory, and Capacity Considerations

The findings show that the policy framework for commercially raised vegetable seedling operations in Ghana is nascent and fragmented, with important implications for quality assurance and capacity building. The evidence points to three consistent themes: (i) regulatory gaps specifically affecting seedling production and oversight; (ii) weak or absent quality-assurance and licensing mechanisms along the seed-to-seedling pathway; and (iii) the pivotal but under-resourced roles of MoFA and research institutions in extension, demonstrations, and training.

8.1 Regulatory Gaps Affecting Commercially Raised Seedling Operations

Respondents across regions indicated the absence of a clear, sector-specific policy for commercial vegetable seedling nurseries. One key informant stated plainly that "*there is no such policy specifically about commercially raised vegetable seedling nurseries*" and that awareness of nursery-specific measures was limited to the broader Feed Ghana agenda. Asked whether new regulations were planned, a municipal respondent answered, "No". A different officer, pressed on whether any current policy influenced nursery development, reiterated, "*In fact, not as far as I know*."

Beyond the absence of nursery-specific rules, stakeholders also criticized enforcement in related domains, especially agro-chemical use. As one interviewee emphasized, "*for now… we only have regulations in books, but we do not have regulations on the ground*", calling for stronger regulation and training of agro-input dealers to protect farmers and consumers. Structural governance issues also surfaced: "*at the national level, we are with the ministry… but when it comes to the regional level, we are a department under the Ministry of Local Government. That has really distorted our work… we don't have clear regulations, they [NGOs and private institutions] are doing what they want, and you can't question them*."

8.2 Quality Assurance, Certification, and Licensing Mechanisms

Because no instrument directly targets nursery businesses, respondents were "*not aware of any facilities dedicated solely to vegetable seedling production,*" even where general infrastructure for crops exists. Several interviewees confirmed the policy vacuum for nursery oversight, again noting "*there is no such policy specifically about commercial vegetable seedling nurseries*". When probed on the legal basis that might guide nursery operators, one official conceded, "*Honestly, I won't be able to point out any specific ones.*"

The implications for quality assurance are twofold. First, without a licensing or accreditation mechanism tailored towards nurseries, operators and buyers lack a common standard for seedling quality. Second, weak enforcement in nearby areas (e.g., pesticides) undermines confidence along the chain. As one expert warned, farmers and some agro-input dealers "*know next to nothing about chemical formulations… [and] withdrawal period*," reinforcing the need for regulatory strengthening and mandatory training tied to licensing.

8.3 Role of Extension and Research Institutions (CSIR/SARI/CRI, MoFA)

MoFA officials articulated a clear facilitative mandate. As a district officer summarized, "*our role is to provide agronomic support and then education… [to] advise them… from nursery to transplanting to harvesting, and also… take them to the market, and then financial institutions*." Another MoFA respondent detailed a practical pathway for accelerating acceptance: "*MOFA will serve as a link between seedling producers and farmers by… helping to establish demonstration farms… farmers are then invited to field days… the results speak for themselves.*"

Extension delivery, however, is constrained by resources. Officers cited the end of the Modernizing Agriculture in Ghana (MAG) initiative and associated field allowances: "*getting access to the farmers on a regular basis is a challenge… because of the fuel*." Another officer re-echoed the same concern: "*if you get support in terms of finance and logistics, it will help*." Research and seed-company partners also underscored demonstrations and sensitization as essential for adoption; one private partner noted "*we exclusively promote hybrid seed varieties… Mostly demonstrations and referrals*," and confirmed readiness to support trials comparing traditional vs. seedling-based approaches.

8.4 Capacity Needs and Proposed Training Priorities

Three immediate capacity gaps emerged. ***First***, consistent farmer outreach requires transport, fuel, and allowances for field officers, as several extension staff stressed. ***Second***, practical, local demonstrations matter: "*The most effective way… is for them to actually see the end results of the seedlings… demonstrate and see how the end results are going to be*." This aligns with another officer's request that companies provide seed/seedlings for demos and small budgets for community information centers because "*seeing is believing*." ***Third***, regulatory literacy and safe-use training for agro-input dealers is urgent; as the interviewee argued, "*if there could be a regulation… mandating agri-officers [to] physically man these agrochemicals… or [provide] intensive training to these agrochemical owners*," it would improve public health and sector credibility.

Training priorities that emerged include: (i) nursery accreditation skills (propagation protocols, sanitation, traceability), (ii) MoFA-led demonstration management and season-aligned delivery planning, (iii) pesticide stewardship and post-harvest safety for dealers and farmers, and (iv) communication and market-linkage skills so officers can "*organize forums… [and] take them to the market, and then financial institutions.*"

9. Key Challenges and Lessons Learned

Field interviews, stakeholder meetings, and focus group discussions revealed that while Ghana's horticultural seedling sector holds immense potential, its development is constrained by several systemic challenges that cut across production, finance, and governance. The lessons derived from the study highlight both the practical realities facing farmers and investors, and the institutional gaps that must be addressed to build a viable, inclusive seedling industry.

9.1 Systemic Challenges Across the Seedling Value Chain

9.1.1 Weak Infrastructure and Limited Access to Water

Access to irrigation remains a central bottleneck for nursery and vegetable production. Respondents in multiple regions cited water scarcity and broken irrigation systems as the foremost limitation. A district agriculture officer explained that "*water for irrigation is a challenge here… they wanted to dig boreholes in some places so that farmers could access water for their farm activities, but they never came back to implement that project*". In Techiman, another respondent noted, "*there are two irrigation facilities, Kaniego and Tanoso… unfortunately, the Tanoso facility has been out of operation for some time due to a major hydrant breakdown*". These constraints undermine the consistency of nursery operations and limit expansion into the dry season, especially in northern Ghana.

9.1.2 Absence of Nursery-Specific Policy and Regulatory Frameworks

The study revealed a near-complete policy vacuum for commercially raised seedling operations. A MoFA official stated directly that "*there is no such policy specifically about commercial vegetable seedling nurseries*", while another emphasized that "*for now, we only have regulations in books, but we do not have regulations on the ground*". This regulatory gap allows informal and unstandardized nursery practices, resulting in inconsistent quality and limited confidence among farmers and financiers. The lack of nursery licensing or quality certification mechanisms also discourages private investment and hinders the formation of formal partnerships.

9.1.3 Financial Barriers and Limited Credit Products

Financing remains one of the most persistent challenges. Financial institutions interviewed, including rural banks, confirmed that they support vegetable farmers but lack dedicated credit products for nursery enterprises. A Naara Rural Bank officer stated, "*we support a lot of them… like those in the production of onions, pepper, tomatoes… but with the seed producers, we've not worked with them*". Other banks cited high default risks and absence of insurance as deterrents. One officer admitted, "*we don't have any insurance policy for farmers now*". These findings confirm that the horticulture sector remains underfinanced due to perceived risks, short production cycles, and lack of collateral.

9.1.4 Limited Technical and Entrepreneurial Skills

Across all regions, farmers and cooperatives expressed enthusiasm to engage in nursery enterprises but highlighted knowledge gaps in modern propagation and business management. One respondent emphasized that "*we don't have the resources here… we need a full lab to extract vegetable seeds so that we can use them as a seed bank, where farmers can easily have access to these seeds*". MoFA officers also cited mobility and logistical limitations following the end of the MAG project: "*getting access to the farmers on a regular basis is a challenge… because of the fuel".* Without targeted training and resources for extension officers, dissemination of nursery technologies and best practices remains slow.

9.1.5 Weak Coordination and Market Linkages

The findings revealed poor coordination between seed companies, research institutions, and district-level MoFA offices. One officer described the structural confusion: "*at the national level, we are with the ministry… but when it comes to the regional level, we are a department under the Ministry of Local Government… that has really distorted our work*". Limited communication channels and uncoordinated NGO activities contribute to duplication of efforts. Moreover, poor feeder roads and inadequate cold storage constrain distribution and raise post-nursery losses.

9.2 Lessons on Stakeholder Engagement and Regional Coordination

9.2.1 Local Ownership is Critical for Sustainability

The study shows that participatory engagement of farmer cooperatives, youth groups, and women's associations fosters ownership and accountability. Cooperative members voiced commitment to shared enterprises: "*Yes, even though some of us are not correct, they should not be our concern now because we those who are ready for such are even more… this will help bring our community name back on track*". Such collective motivation should be harnessed through cooperative-led nursery models that combine group governance with technical supervision from MoFA and private partners.

9.2.2 Demonstration and Sensitization Are Essential for Adoption

Extension officers consistently emphasized that farmers adopt innovations only after seeing tangible results. As one officer stated, "*the most effective way… is for them to actually see the end results of the seedlings… demonstrate and see how the end results are going to be*". This underscores the importance of establishing demonstration hubs in every major vegetable zone, linked to MoFA's extension system and Dutch-supported seed sector partnerships. Demonstrations build farmer confidence, promote hybrid seed adoption, and create early markets for nurseries.

9.2.3 Inclusive Partnerships Drive Learning and Scale

The collaboration between public institutions, private seed firms, and local financiers was repeatedly highlighted as essential for success. A private-sector respondent explained, "*we work with outgrowers… we provide for them their seedlings… and at the end of the day we gain and they also gain; business goes on*". Such partnerships distribute risk and expand knowledge sharing. MoFA's role as a "*facilitator and connector*" was particularly emphasized, with one officer describing it as "*our role is to provide agronomic support and education… and link farmers to markets and financial institutions*". These collaborations demonstrate how cross-sector partnerships can serve as incubators for commercial nursery enterprises.

9.2.4 Implications for Future PPP Initiatives

The findings present a clear roadmap for future Dutch–Ghana horticultural PPPs seeking to expand seedling systems:

- **Institutional Strengthening**: The absence of nursery-specific regulation calls for the integration of seedling certification and business registration within Ghana's seed policy framework. PPPs can support MoFA and PPRSD to pilot these standards.
- **Financial Innovation**: Banks' expressed willingness to "*design products for seedling producers*" should be leveraged through blended finance mechanisms, risk guarantees, and fintech partnerships.
- **Capacity Building and Demonstration**: Establish regional training hubs and demonstration nurseries jointly managed by MoFA, CSIR, and private seed companies. These can serve as centers for technical training, quality assurance, and entrepreneurship incubation.
- **Integrated Value Chain Coordination**: Strengthen linkages between seed suppliers, nursery operators, extension agents, and markets through structured PPP coordination platforms.
- **Gender and Youth Inclusion**: Prioritize support for cooperatives that engage women and young agripreneurs, who have shown enthusiasm but lack capital and training.

10. Conclusions and Recommendations

10.1 Summary of Key Findings

The assessment revealed that Ghana's horticultural seedling sector is characterized by strong market potential, increasing farmer interest, and growing engagement from public and private actors. Farmers across all seven study regions recognize the benefits of high-quality seedlings in improving germination rates, crop uniformity, and yield. There is clear awareness that professionally raised seedlings save labour and time, while also enhancing profitability.

Despite this potential, the sector remains constrained by several systemic challenges. Infrastructural deficiencies, particularly in irrigation and road networks, limit the establishment of year-round nurseries, especially in northern Ghana. Access to affordable finance for nursery entrepreneurs is another major barrier, as most financial institutions lack products tailored towards horticultural seedling operations. Additionally, the absence of a regulatory framework specific to vegetable seedling production has resulted in uncoordinated private-sector activity, limited quality control, and investor uncertainty.

Extension services and research institutions such as MoFA, CSIR-SARI, CRI, and public Universities like the University of Ghana play critical roles in farmer education and technical training but face resource constraints that reduce their outreach coverage and effectiveness. Nevertheless, strong stakeholder willingness, especially among cooperatives, youth, and women's groups, indicates readiness to participate in community-managed or private–public nursery enterprises. Banks, fintech firms, and development partners have also expressed growing interest in designing financial and risk-mitigation solutions for the seedling value chain. Overall, the findings show a sector that is institutionally ready but requires coordinated support to overcome financial, infrastructural, and regulatory constraints. With targeted investment and structured partnerships, the seedling industry can become a viable driver of horticultural transformation in Ghana.

10.2 Strategic Recommendations

10.2.1 Policy and Regulation

Harmonize standards and licensing for seedling producers

MoFA, through PPRSD, should develop and enforce a national framework for nursery accreditation, seedling certification, and quality assurance. This will ensure consistency in production, build investor confidence, and enhance traceability in the seed-to-seedling chain.

Strengthen MoFA's support to vegetable nurseries under Government Programs

The second phase of the Planting for Food and Jobs initiative and the Feed Ghana Program provides an opportunity to formally integrate nursery operations within its seed and input component. District MoFA offices should be resourced to supervise nurseries and support community-level propagation efforts.

10.2.2 Programmatic and Investment

Establish regional demonstration nurseries

Demonstration hubs should be set up in each major horticultural zone to serve as centres of learning and technology transfer. These sites, jointly managed by MoFA, research institutions, and private seed companies, will showcase best practices in propagation, irrigation, and business management.

Support cooperative-led and youth-focused seedling enterprises

Youth and women's cooperatives can co-own nurseries with technical and financial support from MoFA, NEIP, and Dutch-funded PPP initiatives. Targeted training, access to trays, irrigation kits, and business coaching will enhance inclusivity and sustainability.

Develop financing and insurance products for nursery investors

Banks and microfinance institutions should be encouraged, through risk-sharing facilities and blended finance mechanisms, to design credit lines tailored for short-cycle horticultural investments. Fintech and insurance providers can complement these with microinsurance or pay-as-you-grow schemes to safeguard farmers and investors.

10.2.3 Research and Extension

Promote adaptive research on hybrid–local variety performance

CSIR-SARI, CRI, and Dutch research partners should conduct trials comparing hybrid and local varieties to identify high-performing combinations suited to Ghana's agroecological zones. Findings should inform nursery production protocols and farmer advisory services.

Strengthen extension training on nursery management

MoFA's extension staff should receive specialized training on seedling propagation, tray management, pest and disease control, and marketing strategies. Refresher courses and training-of-trainers (ToT) programmes should be institutionalized annually to ensure sustained knowledge transfer.

10.3 Roadmap for Implementation

To maximize impact and ensure regionally balanced development, demonstration fields and seedling enterprises should be established in regions with strong vegetable production performance and proven market linkages. The Bono East and Ashanti Regions should serve as the primary hubs for large-scale commercial and PPP-led demonstration nurseries, given their established irrigation systems, concentration of agro-dealers, and year-round production capacity. The Volta and Eastern Regions are ideal for community-based and cooperative nurseries, leveraging strong group organization and youth participation, while

Greater Accra offers the best environment for high-tech, private-sector-driven nurseries linked to export and urban retail markets. In the Northern and Upper East Regions, demonstration plots should be integrated into existing irrigation schemes such as Tono, Vea, and Libga to promote climate-resilient vegetable production and strengthen cooperative-based nursery models. We recommend the following roadmaps for implementation.

10.3.1 Short-Term (0–1 year): Capacity Building and Pilot Phase

- Develop nursery accreditation guidelines and standard operating procedures.
- Establish three pilot nurseries in key production zones such as Upper East, Bono East, Volta, and Greater Accra).
- Conduct training for MoFA officers, cooperatives, and youth entrepreneurs on nursery establishment and business management.
- Engage rural banks and fintechs to co-design tailored financing schemes.

10.3.2 Medium-Term (1–3 years): Scale-Up and PPP Consolidation

- Expand demonstration nurseries to all major vegetable-growing regions.
- Formalize PPP agreements between MoFA, seed companies, and local agribusinesses for technology transfer and investment.
- Launch blended finance facilities combining credit, insurance, and guarantees for nursery investors.
- Integrate nursery certification and training components into the Seed Sector Investment Plan (2023–2030).

10.3.3 Long-Term (3–5 years): Institutionalization and National Framework

- Establish a National Seedling Business Framework under MoFA to guide policy coordination, funding, and quality standards.
- Institutionalize a public–private steering platform for continuous dialogue between government, research, private investors, and cooperatives.
- Monitor, evaluate, and document impacts of the seedling business on yield improvement, income generation, and youth employment.

Annexes

Annex 1: List of Stakeholders Consulted (KIIs and FGDs) and Farmer Survey Summary

Table A1: Survey, KIIs and FGDs by Region

#	Region	#Farmer Survey	# KIIs	# FGDs	Targeted Groups
1.	Ashanti	18	6	6	✓ 18 Vegetable farmers for survey ✓ 6 FGDs (1 with farmers; 2 with cooperatives; 2 with agro-input dealers; 1 with aggregators) ✓ 6 KIIs (1 Seedling Producer, 1 Transport & Logistics, 1 Extension Officer, 1 Sector Expert, 1 CSIR/SARI/CRI and 1 MoFA)
2.	Greater Accra	18	6	6	✓ 18 Vegetable farmers for survey ✓ 6 FGDs (1 with farmers; 1 with cooperatives; 2 with agro-input dealers; 2 with aggregators) ✓ 6 KIIs (Seedling Producers, 1 MoFA, 1 Extension Officer, 1 Seed Company, 1 Sector Experts and 1 Insurance/Fintech)
3.	Upper East	18	6	6	✓ 18 Vegetable farmers for survey ✓ 6 FGDs (2 with farmers; 2 with cooperatives; 1 with agro-input dealers; 1 with aggregators) ✓ 6 KIIs (1 CSIR/SARI/CRI, 1 Seedling Producer, 1 MoFA, 1 Extension Officer, 1 Transport & Logistics and 1 Insurance/Fintech)
4.	Volta	18	6	6	✓ 18 Vegetable farmers for survey ✓ 6 FGDs (1 with farmers; 2 with cooperatives; 2 with agro-input dealers; 1 with aggregators) ✓ 6 KIIs (1 Seed Company, 1 Transport & Logistics, 1 Sector Expert, 1 Extension Officer, 1 Insurance/Fintech and 1 CSIR/SARI/CRI)
5.	Bono East	18	6	6	✓ 18 Vegetable farmers for survey ✓ 6 FGDs (1 with farmers; 1 with cooperatives; 2 with agro-input dealers; 2 with aggregators) ✓ 6 KIIs (1 MoFA, 1 Seedling Producer, 1 Extension Agent, 1 Seed Company, 1 Sector Expert and 1 Insurance/Fintech)
6.	Eastern	18	6	6	✓ 18 Vegetable farmers for survey ✓ 6 FGDs (2 with farmers; 1 with cooperatives; 1 with agro-input dealers; 2 with aggregators) ✓ 6 KIIs (1 CSIR/SARI/CRI, 1 Seedling Producer, 1 MoFA, 1 Extension Officer, 1 Transport & Logistics and 1 Insurance/Fintech)
7.	Northern	18	6	6	✓ 18 Vegetable farmers for survey ✓ 6 FGDs (2 with farmers; 2 with cooperatives; 1 with agro-input dealers; 1 with aggregators) ✓ 6 KIIs (1 Seed Company, 1 Insurance/Fintech, 1 CSIR/SARI/CRI, 1 Extension Officer, 1 Sector Expert and 1 Seedling Producer)
	Total	**126**	**42**	**42**	

Note: *For each region, enumerators administered the survey questionnaire to 18 vegetable farmers, conducted 6 FGDs and 6 KIIs across three districts in their assigned region.*

Annex 2: SWOT Matrices

Table A2: SWOT summary Matrices

Strengths	**Weaknesses**
• Expanding domestic and export demand for vegetables, driven by urban consumption and institutional markets. • Strong network of farmer cooperatives and women/youth groups across all seven regions interested in nursery ownership. • Existing technical base through MoFA's extension officers and CSIR–SARI/CRI researchers supporting agronomic training. • Presence of private seed firms (East-West Seed) with willingness to partner in nursery development. • Increasing recognition of seedling quality as a productivity driver (82% of farmers value professional seedlings).	• Limited irrigation infrastructure; many boreholes and canals non-functional, constraining dry-season seedling production. • Absence of nursery-specific policy, licensing, or certification system - weak quality control. • Inadequate financing and lack of short-cycle credit or insurance products tailored to horticulture. • Poor logistics and feeder roads affecting transport of delicate seedlings. • Gaps in technical and entrepreneurial skills among small nursery operators.
Opportunities	**Threats**
• High willingness among farmers to pay GHS 0.80 - 1.00 per seedling. • Potential for Public–Private Partnerships (PPPs) linking MoFA, seed firms, and financial institutions. • Expansion of PFJ 2.0 and FSRP programs creates platforms for demonstration hubs and training. • Digital and fintech innovations can facilitate credit, savings, and traceability in nursery operations. • Growing youth interest in agri-preneurship and greenhouse farming.	• Climate variability - droughts and erratic rainfall increase production risk. • Land-use competition and rising urban encroachment in peri-urban vegetable zones. • High input costs (seeds, trays, fertilizers) and currency fluctuations affecting profitability. • Pests and diseases (damping-off, nematodes) threatening seedling quality. • Policy fragmentation and weak inter-agency coordination between MoFA, Local Government, and private actors.

Annex 3: Consent and Ethical Protocols

CONSENT FORM FOR ADULT PARTICIPANTS (KIIs / FGDs)

Title of Study: Assessment of Horticultural Seedling Business Opportunities in Ghana

Implementing Institution: West Africa Horticulture Innovation Hub

Consultant: Dr. Naalamle Amissah

Introduction

You are invited to participate in this study, which seeks to understand vegetable production practices, seed and seedling usage, challenges, and farmers' willingness to pay for professionally raised seedlings in Ghana. The findings will help guide the establishment of sustainable and commercially viable seedling nursery models that can improve productivity, reduce losses, and enhance farmer incomes.

Your Participation

- You will be asked to take part in a structured survey, Key Informant Interview (KII), or Focus Group Discussion (FGD).
- Participation will last approximately 30–60 minutes.
- While there may be no direct personal benefit to you, your responses will contribute to evidence that will inform better seedling services and support for farmers in Ghana.

Voluntary Participation

Your participation is entirely voluntary. You may choose not to answer any question or to stop the interview/discussion at any time without giving a reason. There will be no negative consequences if you decide not to participate.

Risks and Safeguards

The study poses minimal risks. Some questions may touch on challenges such as crop losses, costs, or access to resources. You may skip any question that makes you uncomfortable. All discussions will be conducted in a respectful and private manner to protect your dignity.

Confidentiality

All information you provide will remain confidential. Your name and personal identifiers will not appear in any transcripts, reports, or publications. Responses will be anonymised and presented in summary form only.

Consent Statement

I have read (or had read to me) in a language I understand the information above. I understand the purpose of the study and my rights as a participant. I freely consent to take part in this study.

Participant's Name: ________________________

Signature/Thumbprint: ____________________

Date: _______________

Interviewer's Name: _______________________

Signature: _______________________________

Date: _______________

Annex 4: Fieldwork Itinerary and Enumerator Details

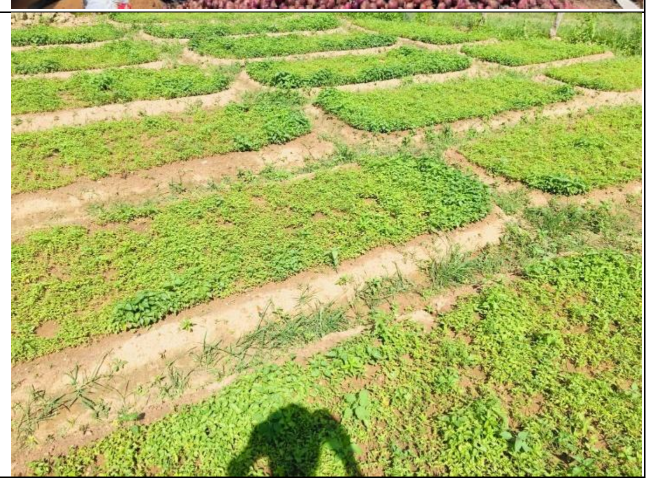
Table A4: Farmer Survey Sampling and Enumerator Details

REGIONS (7)	Number of Districts per Region	Number of Farmers (per district)	Number of enumerators	Name of enumerators	Tel. Numbers
Ashanti	3	6	1	Philip Kwarteng	0249166318
Bono East	3	6	1	Emmanuel Nanoa	0542746818
Eastern	3	6	1	Isaac Yao Akakpo	0543899282
Greater Accra	3	6	1	Jennifer Awu	0209045448
Volta	3	6	1	Daniel Amevor	0249387875
Northern	3	6	1	Alhassan Kanton	0542155636
Upper East	3	6	1	Isaac Kusohinam	0240332625
Total	**21**	**42**	**7**		

Annex 5: Photo Documentation



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Assessment of Horticultural Seedling Business Opportunities in Ghana
Stakeholder Validation Workshop
October 13, 2025


Annex 6: References

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