



Kenya

Establishment of a Basic Plan for Smart Farms in Konza Smart City

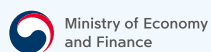
**2023/24 EIPP
Consultation
Report**



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Establishment of a Basic Plan for Smart Farms in Konza Smart City

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Project Title	Establishment of a Basic Plan for Smart Farms in Konza Smart City
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In Brief

What is the issue, and why is it important?

- **Enhancing Agricultural Productivity**
Agriculture is a key sector in Kenya's economy. Introducing smart farms can boost productivity and efficiency by leveraging advanced technologies such as ICT-enabled climate management, automated irrigation, and eco-friendly material supply systems.
- **Achieving Kenya Vision 2030**
Smart agriculture is integral to Vision 2030, aiming to transition Kenya into a middle-income country by improving high-value agricultural outputs and reducing income inequality through innovation.
- **Climate Change Adaptation**
With vast ASAL (arid and semi-arid areas), smart agriculture technologies are crucial to overcoming climate-induced challenges and ensuring food security.
- **Economic Growth and Job Creation**
The establishment of smart farm complexes and related infrastructure creates opportunities for startups, employment, and enhanced export capabilities, strengthening the overall economy.
- **Strengthening Value Chains and Branding:**
Smart agriculture enables the development of efficient agricultural value chains, from production to distribution, while also boosting Kenya's global brand in horticulture, coffee, tea, and food products.
- **Fostering International Collaboration**
Programs like EIPP (Economic Innovation Partnership Program) showcase the benefits of international cooperation, helping Kenya adopt successful Korean models for economic and technological advancement.

- Foundation for Digital Innovation and Sustainable Development
Konza Technopolis serves as a hub for integrating digital innovation industries with sustainable agricultural practices, ensuring long-term growth.

What did we learn?

- The study underscores the transformative potential of smart agriculture in Konza Technopolis. By addressing climate challenges, enhancing productivity, and building a sustainable value chain, the region can serve as a model for modern agriculture in Africa. The findings emphasize the need for continued investment, collaboration, and capacity-building to fully realize this vision.

Foundation for Digital Innovation and Sustainable Development Konza Technopolis serves as a hub for integrating digital innovation industries with sustainable agricultural practices, ensuring long-term growth.

- Smart Agriculture as a Solution to Climate and Economic Challenges
- Key Factors for Technology Adoption
- Key Crops and Associated Technologies
- Economic Potential
- Integrated Value Chain Development

Key recommendations

- SWOT Analysis
Utilize ICT and IoT technologies for smart agriculture, focus on climate resilience, and expand exports using Konza's logistics network. Address skill gaps with education programs and improve infrastructure in Konza for sustainable agricultural practices. Mitigate climate risks with predictive models and provide government subsidies for initial technology costs. Strengthen technical maintenance capabilities and expand market access through diversified distribution channels.
- Konza Smart Farm Business Development Concept
The Konza Smart Farm concept aims to collect, store, and process agricultural products from the integrated corn research and production complex and nearby areas. This initiative seeks to increase sales, build a brand, and create regional value by efficiently managing the supply chain and enhancing local agricultural economies.

1) *Konza Smart Farm R&D and Innovation Strategy (Agricultural Equipment, Systems)*

The innovation strategy focuses on R&D related to smart farming technologies, including the development of data collection and management systems. The strategy aims to maximize crop productivity through IoT and AI technologies, improving the efficiency of agricultural processes and the automation of farm operations. This includes technological solutions that address various aspects of smart farm systems, from irrigation to climate control.

2) *Smart Farm Production Complex Operation Strategy*

The strategy for operating smart farm production complexes includes establishing contract farming agreements and optimizing facilities like greenhouses, production bases, and irrigation systems. A key goal is to develop a year-round production system while providing education and training programs for local farmers. This approach aims to enhance production efficiency and ensure sustainable practices.

3) *Education, Training, and Model Dissemination*

Education and training programs are a central part of spreading smart farm technology. These programs aim to empower local farmers and agricultural startups by providing education, consulting, and business models for smart farming. Through these initiatives, the program seeks to strengthen farmers' capacities and expand the smart farm model regionally.

4) *Agricultural Product Collection, Processing, and Distribution Linkage Strategy*

A logistics system will be established to handle pre-cooling, sorting, processing, packaging, and freezing through cold chain systems. This strategy aims to minimize post-harvest losses, improve the quality of agricultural products, and integrate the product distribution networks efficiently. The linkage will maintain product integrity and expand market access.

5) *Konza Technopolis Infrastructure Integration and Linkage Strategy*

The strategy focuses on connecting Konza Smart Farms with the broader regional infrastructure, such as industry, transportation, and communication systems. By linking smart farms to the local economy, the initiative enhances regional innovation and supports the growth of a local smart agriculture ecosystem.

Background and Purpose of the Study

1. Background of the Study

Korea has been actively supporting Kenya's agricultural and economic development through various initiatives, particularly the Knowledge Sharing Program (KSP) and the Economic Innovation Partnership Program (EIPP). These programs are designed to enhance agricultural productivity and help Kenya achieve economic self-sufficiency by introducing smart farming practices. Through policy advice and feasibility studies, Korea aims to assist Kenya in modernizing its agricultural sector.

The Kenyan government's Vision 2030 focuses on transforming the country into a middle-income nation. One of the key projects under this vision is Konza Technopolis, which is set to serve as a hub for economic growth, digital innovation, and smart agriculture. This initiative is expected to foster future-oriented industries and contribute to solving issues like income inequality by generating high-value revenues from sectors like smart agriculture.

In line with this vision, smart farm complexes are being developed in Konza Technopolis. These complexes aim to increase agricultural productivity and contribute to Kenya's transition to a middle-income economy. The goal is to not only improve agricultural output but also boost exports, create jobs, and reduce economic disparities.

Korea and Kenya continue to deepen their collaboration through the EIPP, focusing on expanding smart farming, renewable energy, and agricultural incubation projects. These initiatives are laying the groundwork for sustainable development in Kenya, fostering innovation in agriculture and enhancing the country's overall economic growth.

As part of the strategy for Kenya's industrialization, priority is being given to the development of agricultural and processed industries, such as horticultural crops, food, tea, and coffee. Strengthening the agricultural value chain is essential to this effort, with the integration of ICT for managing climate-appropriate farming techniques, automatic irrigation systems, eco-friendly agricultural materials, and efficient storage and distribution processes. This will not only improve productivity but also create new job opportunities and increase exports, aligning with the broader goals of Vision 2030.

2. Purpose of the Study

2.1. Establishment of a Basic Plan for Building a Smart Agricultural System

The Konza Technopolis aims to establish a smart agricultural system designed to address the challenges posed by climate change and ensure value-added agriculture. By introducing advanced smart farm technologies, Konza seeks to enhance agricultural productivity and value addition, particularly in Arid and Semi-Arid Lands (ASAL) areas. These regions are highly vulnerable to climate-related stresses, such as droughts and erratic rainfall patterns, which threaten food production and stability.

To combat these challenges, the smart agriculture system will leverage innovative solutions like IoT (Internet of Things), AI-driven crop management, and precision irrigation systems to optimize resource use, increase crop yields, and reduce waste. Additionally, the introduction of climate-resilient crops and farming practices will support sustainable growth, enabling farmers to adapt to changing weather conditions. By building such a system, Konza Technopolis will not only address food security but also create economic opportunities through sustainable agricultural practices in regions that are often neglected in traditional agricultural development.

2.2. Proposal for Building and Operating a Smart Farm Demonstration Complex

To foster the growth of smart agriculture in Kenya and increase its appeal to both local and international businesses, Konza Technopolis proposes the creation of a smart farm demonstration complex. This initiative aims to provide a platform for showcasing the potential of smart farming technologies and solutions, demonstrating their effectiveness in real-world applications. The complex will serve as a testing ground for various smart farm systems tailored to the Kenyan climate, particularly in ASAL areas, where the impact of climate change is most pronounced.

The demonstration complex will not only serve as a model of sustainable and climate-smart farming practices but also promote the development of agriculture-related startups in Kenya. By providing the necessary infrastructure and knowledge transfer, the complex will help activate and accelerate the local startup ecosystem, creating opportunities for innovation in agricultural

technology. Furthermore, it will act as a gateway for foreign companies seeking to enter the Kenyan market by offering them a solid foundation to pilot their technologies and establish partnerships within the region.

This initiative will contribute to a stronger agricultural technology ecosystem in Kenya, increasing the competitiveness of local farms and businesses. Through collaborations and knowledge-sharing, Konza Technopolis will position itself as a hub for smart farming innovations, benefiting both Kenyan farmers and international companies looking to explore the growing market for climate-resilient farming solutions.

Key Results

1. Current Status Analysis and Improvement Measures

1.1. STEEP Analysis

Social Analysis: The Konza region demonstrates a strong agricultural dependency, with over 75% of farmers engaged in small-scale farming. This reliance highlights the critical role of agriculture in local livelihoods. Furthermore, the population exhibits high technology awareness and acceptance, particularly regarding smart farm solutions, which drives youth entrepreneurship. The region's annual population growth rate of 2.5% correlates with an anticipated 35% rise in food demand by 2030, underscoring the urgency for sustainable agricultural practices.

Economic Analysis: The Konza region boasts significant agricultural production and export potential, with over 2 million tons of crops and livestock products available for international markets. The development of a startup ecosystem, aimed at attracting more than 50 high-tech startups and agricultural investors, enhances cost efficiency and innovation. A sustainable agricultural model is central to smart farming initiatives, balancing economic benefits with environmental protection.

Environmental Analysis: The region faces climate change challenges that directly affect crops and pastures, emphasizing the need for resilient agricultural strategies. The area's fine-grained soils exhibit low drainage capacity, necessitating soil improvement measures. These environmental constraints call for advanced solutions to maintain productivity.

Technical Analysis: Climate-smart agriculture plays a pivotal role in addressing these challenges, incorporating water management systems as early warning tools and promoting organic farming for sustainability. The region's ICT infrastructure supports the implementation of smart farm technologies, including data-driven insights and automated systems. Research into drought-resistant crops, nursery/grafting systems, and cash crop markets further enhances the region's agricultural capabilities.

Political Analysis: Kenya is prioritizing smart agriculture to enhance productivity, sustainability, and resilience in its agricultural sector. The Science, Technology, and Innovation Act promotes innovations like automated irrigation and biological pest control to modernize farming while reducing environmental impact. Smart farming techniques, supported by the Agriculture and Food Security Strategy, aim to increase yields and ensure food security through improved supply chains and post-harvest management. Additionally, climate adaptation is a key focus, with policies like the Climate Change Act and Climate Smart Agriculture Strategy encouraging greenhouse farming and water-saving irrigation to combat droughts and erratic rainfall. Finally, smart agriculture policies facilitate the export of high-value processed goods, leveraging frameworks like the Export Promotion Act to boost Kenya’s competitiveness in global markets. These efforts collectively align with Kenya’s vision for sustainable agricultural development.

1.2. Technology Demand Analysis

As a result of an in-depth survey targeting literature analysis, technical experts, and field leading farmers, the following six technologies were commonly identified as technologies needed in the field. Smart agriculture integrates advanced technologies to enhance productivity and sustainability. Key components include real-time weather management using IoT sensors, automated farm equipment, and smart irrigation systems like drip irrigation and rainwater collection. It promotes soil and pest management through organic methods, smart seeds for resilient crops, and renewable energy-powered storage and packaging solutions. Education and tailored training programs ensure widespread adoption and effective implementation. These technologies aim to reduce resource wastage, improve market access, and create climate-resilient, sustainable farming systems.

<Table 2-1> Results of Smart Agriculture Technology Demand Analysis

Core technology		Key elements
Smart Farm Weather Management	Real-time weather data alert system	<ul style="list-style-type: none"> Early warning system for disasters such as typhoons, rain, drought, and pests - Climate event prediction tools and response plans - Farm monitoring based on drones , IoT sensors
	Smart Farm Equipment	<ul style="list-style-type: none"> - Automated and durable mechanical and sensor-based agricultural tools - Smart agricultural equipment (solar pumps, automated machines, sensors) (Base tool) - Integrated management system for smart agricultural equipment
	Crop cycle weather and crop consulting services	<ul style="list-style-type: none"> - Introduction of drought-resistant seeds - Crop diversification and rotation - Agriculture, forestry and mixed crop cultivation - Integrated crop-livestock management
Smart irrigation	Automatic irrigation system	<ul style="list-style-type: none"> - Drip irrigation system - Rainwater collection and storage system - Soil moisture sensor - Automated irrigation system
	Drainage Installation and Soil Improvement	<ul style="list-style-type: none"> - Organic soil conditioner - Container cultivation system

<Table 2-1> (Continued)

Core technology		Key elements
Smart Seeds	Smart Nursery	- Automatic grafting machine - Controlled environment nursery (seedling production and grafting production site)
	Smart Pasture	Greenhouse Pasture Production System - Greenhouse forage production system
	Water and environment resistant seed distribution	- Distribution of resistant varieties - Seed coating technology
Smart soil, pest management	Small-scale organic fertilizer production system	composting unit - Organic fertilizer production system
	Eco-friendly pesticide production system, integrated pest management (IPM) system	Eco-friendly pesticide production system - Integrated pest management tools
Smart Infrastructure/ Market Linkage	Refrigeration and packaging linked to renewable energy	Renewable energy sources (solar, wind) - Energy efficient refrigeration units - Advanced packaging technology
	High value-added food materialization	- Functional material extraction technology - Dry processing equipment – Food processing tools
	post-harvest losses and ensure safety	- Storage, sorting, packaging and refrigeration technology - Improve logistics and transportation systems - Technical approaches to reduce post-harvest losses - Mycotoxin management technology for preventing aflatoxin
Education, training and dissemination	Education and Outreach Programs	- Agricultural technology education and training programs - Information provision and extension programs - Locally tailored agricultural technology training

Source: Author (2024).

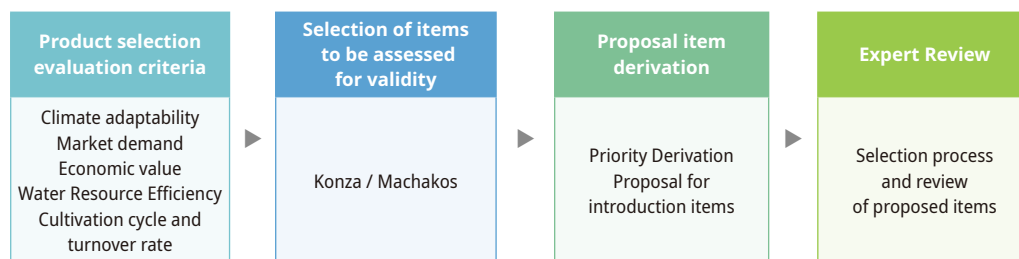
1.3. Selection of Key Crops Specialized for Smart Farms

Methodology for Selecting Key Crops

- In crop selection, evaluation criteria are selected, items subject to feasibility assessment are selected, and proposed items are derived, and then the final items are selected through review with a final expert group.
 - 1) Calculation of crop selection evaluation indicators: Design of evaluation items and setting of weights for each indicator
 - 2) Selection of items to be assessed for validity: Recommendation of items that can be quantitatively assessed + differentiated items (varieties)
 - 3) Derivation of proposed items: Derivation of priority of candidate items
 - 4) Expert review: Advice on the selection process and suitability of candidate items.

The key crop selection indicators are composed based on previous research on climate adaptability, market demand, water resource efficiency, etc., and evaluation indicators are selected for crop selection, items subject to feasibility assessment are selected, and proposed items are proposed.

[Figure 2-1] Method for Selecting Key Crops



Source: Author (2024).

Such as avocados, pineapples, mangoes, and passion fruits, but the long-term nature of field crops and production stability are low. However, the longer the period, the higher the profitability. Onions, tomatoes, strawberries, and watermelons Bananas have high potential for expansion in the future as long as there is stable production technology and quality improvement potential for domestic and export sales.

Optimal crop varieties in Kenya include drought-resistant Hass and adaptable Fuerte avocados, Kabode and Vita sweet potatoes rich in vitamin A, and Apple Mango and Tommy Atkins mangoes favored for export. Tomatoes like Rio Grande thrive in dry fields, while Anna F1 suits greenhouse farming. Chandler strawberries are high-yielding, with Rabunda excelling in disease resistance. These crops balance adaptability, productivity, and market demand.

<Table 2-2> Optimal Varieties and Characteristics by Crop

Crops	Optimal variety	Features and Reasons
Avocado	Hass	drought resistance and is in high demand in the export market.
	Fuerte	A commercially important variety, highly disease resistant and adaptable to a variety of climates.
	Puebla	Suitable for hot regions and well suited to the dry climate of Machakos and Konja.
Sweet potato	Kabode	It is highly adaptable to dry areas and is high in vitamin A.
	Vitaa	Contains vitamin A, high productivity even in dry environments, and uses less water.
	Jewel	It grows quickly and thrives even in poor soil.
Mango	Apple Mango	A commercially important variety in Kenya, suitable for dry climate and with high yields.
	Kent	Popular for export, it is disease resistant and grows well in high temperatures.
	Tommy Atkins	drought tolerance and high yield, so it is in high demand in the European market.

<Table 2-2> (Continued)

Crops	Optimal variety	Features and Reasons
Tomato	Determinate Variety: Rio Grande, Cal J, Super Rio	Suitable for dry climates, high yield and strong disease resistance in open field cultivation.
	Indeterminate Variety: Anna F1, Nyota F1	Suitable for greenhouse cultivation, highly disease resistant and capable of long-term harvest.
Strawberry	Chandler	High yield and quality, can be grown even in dry climates.
	Rabunda	It has strong disease resistance and adapts well to various soils.

Source: Author (2024).

1.4. Priority of Core Technologies by Crop

Tomato

In Implementing advanced cultivation and post-harvest technologies can significantly enhance tomato production efficiency and product quality.

- Facility Cultivation: Utilizing controlled environments, such as greenhouses, allows for year-round production and improved yields by mitigating external climate variables.
- Fertigation Systems: Combining irrigation and fertilization through fertigation optimizes nutrient delivery, enhancing plant growth and reducing resource wastage.
- Solar-Powered Irrigation: Implementing solar-powered irrigation systems offers sustainable water management solutions, particularly beneficial in regions with limited electricity access.
- Post-Harvest Sorting Technology: Employing automated sorting systems ensures uniformity in product quality, meeting market standards and increasing consumer satisfaction.
- Value-Added Processing: Developing processed tomato products, such as sauces and pastes, adds economic value and reduces post-harvest losses.
- Shade Net Houses: Utilizing shade nets protects crops from excessive sunlight and pests, creating a conducive microclimate for optimal growth.

Avocado

Efficient avocado harvesting employs crate technology to minimize damage during transport and storage, preserving fruit quality. Processing avocados into oil adds value and promotes sustainability, meeting the rising demand for health-conscious products. Grafting techniques enhance regional adaptability, productivity, and fruit quality by combining desirable traits from different avocado varieties. These advancements collectively improve efficiency and profitability in the avocado industry.

Strawberry

Implementing drip irrigation systems is crucial for conserving water and ensuring efficient usage in strawberry cultivation. This method delivers water directly to the plant's root zone, minimizing waste and reducing the risk of foliar diseases.

- Developing pest-resistant strawberry varieties, alongside effective pest and pesticide management strategies, is essential for enhancing productivity and fruit quality. Utilizing biological control agents, such as predatory mites and parasitic wasps, can effectively target common pests like aphids, reducing reliance on chemical pesticides. Drip irrigation systems for water conservation and efficient water use were evaluated to play an important role in strawberry cultivation. Development of pest-resistant varieties and pest and pesticide management also received high scores and were analyzed as important factors in improving the productivity and quality of strawberries.

Sweet potato

Sweet potato cultivation and post-harvest management are critical for ensuring crop quality and maximizing economic returns. Implementing effective harvesting techniques, post-harvest handling, and value-added processing can significantly enhance the shelf life and marketability of sweet potatoes.

- **Harvesting and Post-Harvest Management:** Sweet potatoes are typically ready for harvest between three to eight months after planting, with most varieties reaching maturity around five months. Timely harvesting is crucial, as both premature and delayed harvesting can lead to reduced yields and compromised quality. Post-harvest, curing the roots at approximately 30–32°C with 80–95% relative humidity for 4–10 days helps heal minor injuries and toughen the skin, thereby extending shelf life. Proper storage conditions involve maintaining temperatures between 12–16°C and relative humidity of 80–95%, along with adequate ventilation to prevent carbon dioxide accumulation, which can accelerate spoilage.
- **Value-Added Processing Transforming:** sweet potatoes into value-added products can diversify income streams and reduce post-harvest losses. Processing sweet potatoes into flour, starch, or syrups serves as intermediates for various food products and industrial applications. For instance, industrial sweet potatoes with high starch content can be converted into sugar syrups, which are viable for producing biofuels and value-added chemicals. Additionally, by-products from starch extraction, such as sweet potato starch residue, can be further utilized to extract high-value molecules like proteins and pectins, contributing to a zero-waste approach in sweet potato processing.
- **Pest and Disease Management** Ensuring the cultivation of virus-free sweet potato varieties is essential for maintaining crop health and productivity. Virus-free sweet potatoes exhibit improved growth and yield compared to infected plants. Implementing virus-free production technologies, such as meristem tip culture, can aid in developing healthy planting materials. Regular monitoring and adopting integrated pest management strategies further help in mitigating the impact of pests and diseases on sweet potato crops.

Water Melon

Integrated Pest Management (IPM) in watermelon cultivation combines biological and chemical methods to control pests, effectively addressing pest issues while minimizing environmental impact. This approach includes crop rotation, use of resistant varieties, and judicious pesticide application to manage diseases like Fusarium wilt and pests such as aphids and whiteflies.

- Developing early-maturing and drought-resistant watermelon varieties is crucial for regions with dry climates, such as Konza. Research has identified drought-tolerant germplasm, facilitating the breeding of varieties that maintain yield and quality under water stress conditions.
- Processing watermelons into products like juice adds economic value and opens opportunities in diverse markets. Watermelon is rich in nutrients, including vitamins C and A, making it suitable for various value-added products such as beverages and confections.
- Implementing these technologies—IPM, drought-resistant varieties, and value-added processing—can enhance watermelon production's sustainability and profitability.

Mango

Improved mango varieties (Keitt, Tommy Atkins, Kent) are pest-resistant and long-storable mango varieties that improve agricultural productivity with high productivity, profitability, and pest-resistance.

- Climate-smart agricultural practices (mulching, legume intercropping): Mulching helps retain soil moisture and reduce weeds, while legume intercropping improves soil fertility by fixing nitrogen while maintaining acidity, contributing to environmental protection.
- Post-harvest processing technology (zero energy brick cooling, waxing technology) Zero energy brick cooling uses almost no energy to keep produce fresh, and waxing technology extends the shelf life of mangoes: reducing post-harvest losses and maintaining the quality of produce, thereby increasing farm profitability.

Banana

Post-harvest management (laminated crates) is an important technology for reducing losses, receiving the highest rating in terms of fieldability, profitability, and scalability.

- Soil and water resource management (Zai Pit) and improved banana varieties are also key technologies highly evaluated in terms of field performance and productivity.
- Mechanization (tractor hole auger) is a specialized technology suitable for large-scale farms, while technologies such as Sucker Embryo Multiplication are more suitable for improving seedling multiplication in small and medium-sized farms.

1.5. Dry area Smart Farm Best Practice Key Success Factors

Smart farms in arid regions include water and nutrient management, stable supply of agricultural materials, decision-making systems, and locally adaptive technologies.

SunCulture’s solar-powered irrigation systems enhance water efficiency by up to 80% and boost crop yields by up to 300%, utilizing sustainable energy sources. Similarly, CropX offers AI-driven farm management solutions that reduce water usage by up to 50% and increase yields by up to 15% through real-time data analytics. Apollo Agriculture provides farmers with access to quality farming inputs and financial services, improving productivity and financial stability. Ujuzikilimo delivers data-driven agricultural solutions, including real-time soil and climate monitoring, to enhance operational efficiency and crop yields. These innovations collectively promote sustainable farming practices, optimize resource utilization, and support farmers in increasing productivity and income.

<Table 2-3> Success Factors of Best Practices in Smart Agriculture in Arid Regions

Field	Best Practices	Key Success Factors
Amniotic fluid management	SunCulture's solar irrigation system	Reduced energy costs (switching from diesel pumps to solar energy), maximizing water usage efficiency (up to 80% savings), increasing crop yields by up to 300%, using sustainable green energy, and continuing agricultural education and support.
	CropX Crop Stress Management Solutions	Real-time data collection and AI-based analytics, water usage reduction (up to 20%), cost reduction (at least 15%) through fertilizer and input optimization , promoting sustainable agricultural practices
Stable supply of agricultural materials	Apollo Agricultural Supplies Supply System	Strengthening accessibility to agricultural materials and financial services, convenient application and management of materials through introduction of mobile platform, credit assessment through machine learning and AI, increased agricultural productivity (reaching over 350,000 farmers)
Decision making system	Ujuzikilimo's data-driven agricultural solutions	Real-time soil and climate data monitoring, early detection of pests and diseases using IoT and drone technology, improved operational efficiency, and increased crop yields
	Early warning system focused on small-scale rice farmers in Laos	Strengthening climate resilience through early warning systems, stabilizing agricultural productivity and income through provision of real-time weather information
	Climate Smart Farm (CSA) Expansion (Guadeloupe)	Strengthening agricultural worker education, converting public incentives, increasing profitability of eco-friendly agriculture, and investing in continued research and development
	Mixed crop-livestock systems (developing countries)	Promoting soil conservation and agricultural diversity, optimizing livestock quarantine and resource management, improving climate adaptability, and increasing productivity and agricultural income.
	Transition to garden farming in Tapovan village	Introduction of drip irrigation system reduces water stress, increases water use efficiency by 70-80%, and increases yield by 50%
Locally adaptive	Tupewadi Village Shade Net House	shade net houses
	Farm Precise App in India	Providing real-time climate data and analysis to support agricultural decision-making, water conservation and irrigation optimization, pest and disease warnings, and market information
	PEPE Farm in Spain	water-saving drip irrigation systems and water harvesting systems, promoting biodiversity, and saving energy and reducing CO ₂ emissions with smart agricultural management systems.

Source: Author (2024).

1.6. SWOT Strategy

SO (Strengths-Opportunities) Strategy

- Expanding smart agriculture using cutting-edge technology: Building a sustainable agricultural system that can increase productivity and respond to climate change through water management systems, automated irrigation, and data-based crop management based on the ICT infrastructure and IoT technologies of Konza Technopolis.
- Expanding agricultural product distribution and exports by leveraging Konza's geographic advantages: Distributing agricultural products produced by nearby farms to export markets by leveraging Konza Technopolis' logistics network and proximity to Nairobi. Reducing logistics costs and maximizing market accessibility.

ST (Strengths-Threats) Strategy

- Konza Region Focused Technology Development for Climate Change Response: In order to prepare for climate change and natural disasters, Konza Region will focus on developing technological infrastructure such as climate prediction models and early warning systems. Encourage young farmers and leading farmers to adopt these technologies first, thereby increasing their resilience to the uncertainties of climate change.
- Government subsidies and support programs to ease the burden of initial costs: The government provides subsidies and financial support to reduce the initial cost of technology introduction in the Konza region. Incubation farms are initially established and operational experience and expansion are provided.

WO (Weaknesses-Opportunities) Strategy

- program centered on Konza Technopolis: Developing an intensive training and technology transfer program to address the lack of skills and education in the Konza region.
- infrastructure through introduction of smart farm technologies in Konza Technopolis area: Improving roads, communications, irrigation, administration, storage and transportation infrastructure in Konza area.
- the Konza Technopolis: Develop and introduce tailored agricultural technologies to adapt to climate change by expanding the participation of young farmers in technologies such as smart irrigation and water management systems, introduction of resistant crops, and automated environmental control.

WT (Weaknesses-Threats) Strategy

- Technical maintenance and infrastructure expansion: Train specialized personnel in Konza Technopolis and nearby farms, strengthen maintenance infrastructure to ensure continuous operation of smart farm technology. Cooperate with local maintenance companies to ensure prompt support and maintenance.

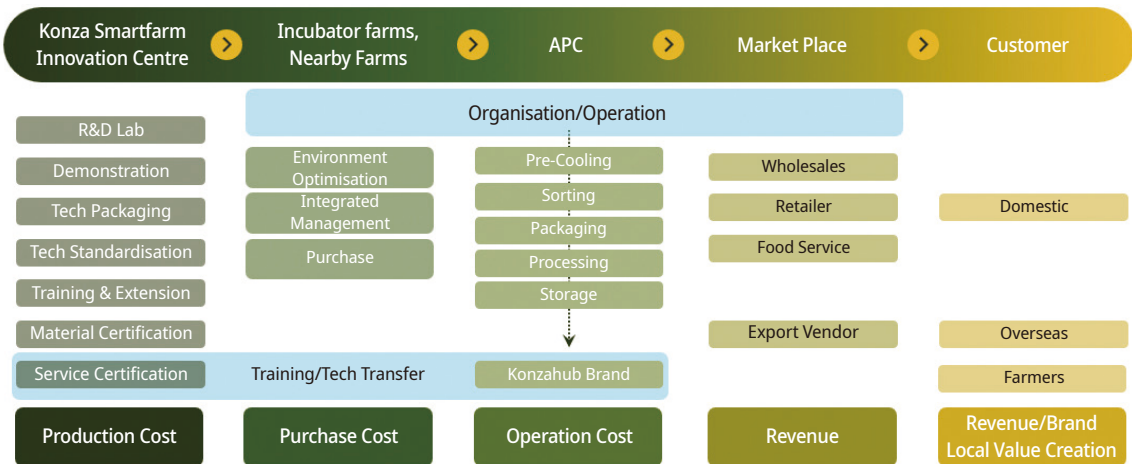
- Solving market access issues: Improve access to agricultural markets and diversify distribution channels through Konza Technopolis' logistics network and policy support to help farmers generate stable income.

2. Basic Plan for Promoting Konza Smart Farm

2.1. Konza Smart Farm Business Development Concept

Demand by agriculture food collecting, storing, and processing agricultural products from the integrated corn research and production complex and nearby areas, and in the process, increase sales, build a brand, and create regional value. The diagram also highlights cost structure (production, purchase, and operation costs) and the revenue streams driven by branding, value creation, and local economic impact.

[Figure 2-2] Conceptual Diagram of Konza Smart Farm Project Development



Source: Author (2024).

Konza Smart Farm R&D and Innovation Strategy (Agricultural Equipment, Systems)

- An innovation strategy centered on R&D of agricultural equipment and systems related to smart farms, through which data collection and management systems are developed and technological solutions are prepared to maximize crop productivity, and the automation system of smart farms introduces IoT and AI technologies to increase the efficiency of agricultural work.

Smart Farm Production Complex Operation Strategy

- Establish a contract cultivation and purchase operation strategy for smart farm production complexes and nearby farms, optimize all facilities within the smart farm complex,

build a management system to efficiently operate various production activities, and include facilities such as greenhouses, production bases, and irrigation systems, thereby establishing a year-round production system and providing education and training to them.

Education, Training and Model Dissemination

- The purpose is to operate an education and training program to spread smart farm technology. Through this, we provide education and consulting programs to spread smart farm technology to local farmers and agricultural startups and to spread business models based on this. Through this, we strengthen the capacity of farmers and expand the smart farm model.

Agricultural Product Collection, Processing, and Distribution Linkage Strategy

- A logistics system for pre-cooling, sorting, processing, packaging, and freezing cold chain systems of agricultural products is established as a strategy to efficiently collect, process, and link harvested agricultural products with distribution networks. This system contributes to maintaining the quality of agricultural products and minimizing losses that may occur during distribution.

Konza Technopolis Infrastructure Integration and Linkage Strategy

- It is a strategy to link various infrastructures within Konza Technopolis with smart farms. Konza Smart farms are connected to the region's major infrastructures, such as industry, transportation, and information and communication, allowing smart agriculture to be more closely linked to the local economy. This allows smart farms to play a key role in the regional innovation cluster.

2.2. Strategy and Expected Effects of Localization of Smart Farms

Smart Farm Solutions and concrete implementation plans for localizing Konza , with a results-based approach to drive benefits. This strategic approach aims to integrate smart farming technologies across all agricultural stages, fostering innovation, efficiency, and sustainability in the agricultural sector.

<Table 2-4> Solutions for Strengthening the Smart Farm Value Chain

Division	Solution	Action Plan	Expected effect
Research and Development and Innovation	- Establishment of Smart Farm R&D Innovation Center and Smart Farm Facilities and Technology Development	- Technology verification and optimization through demonstration farms	- Production of high value-added crops suited to regional characteristics
	- Localization of crops and technologies suitable for the region	- Development and standardization of smart agricultural technology packages	- Increase agricultural productivity and improve smart farm capabilities
		- Operation of smart farm education and expansion program	- Improvement of smart farm application rate
production	- Production automation and optimization through smart farm technology	- Application of greenhouse and field smart farm environment optimization system	- Increase production efficiency, improve crop quality
	- Cultivation of high value-added crops	- Crop status monitoring through growth sensors and drones	- Increase farm income
		- Introduction of eco-friendly agricultural materials and automated irrigation systems	- Quality improvement, cost reduction, response to abnormal climate
collection	- Establishment of a smart APC (Agriculture Processing Center)	- pre-cooling of agricultural products from the complex and nearby areas	- Minimize post-harvest loss and maintain high-quality agricultural products
	- Introduction of agricultural product quality management system	- Selection and management of agricultural products through quality classification system	- Improve distribution efficiency
process	- Automation of agricultural product processing through APC	- Classification, processing, and packaging of agricultural products using processing equipment	- Increase added value by more than 20%
		- Development of processed products and expansion of sales channels	- Expanding long-term storage and distribution possibilities
Distribution and customer value creation	- Wholesale, retail, restaurant, export, agricultural customer value creation and technology transfer	- Establishment of distribution network in wholesale and retail markets and entry into export markets	- Increase sales and brand awareness
	- Securing diverse distribution channels for agricultural and processed products	- B2B/B2C sales strategy using online platforms	- Strengthening farmers' capacity and continuous technology transfer
	- Technology transfer and brand value building for farmers	- Operation of education and technology transfer programs for farmers	- Utilization of agricultural technology packages and brands

Source: Author (2024).

2.3. Smart Farm Construction and Expansion Stage-by-Stage Roadmap

The 10-year plan focuses on developing a smart farming ecosystem. In the first 2 years, a demonstration farm, infrastructure, and partnerships will validate feasibility and build brand awareness. By year 3-4, smart technology integration and farmer training will boost production. Years 5-6 target export readiness. By year 10, eco-friendly technologies and sustainable systems ensure growth.

<Table 2-5> Step-by-Step Roadmap for Smart Farm Development

Year	Action Plan	Time Schedule	Expected Results
1-2 years (Builder)	- Start of demonstration farm (utilizing 10% of total area)	- Year 1: Start of pilot operation	- Proving the feasibility of smart farms through demonstration farms
	- Establishment of research and development (R&D) center and smart farm facility infrastructure	- Year 1-2: Infrastructure construction and start of operation	- Completion of smart farm infrastructure and system construction
	- Develop partnerships with KAIST and regional research institutes (100% utilization of total area)	- Continuous cooperation activities and network building throughout the second year	- Establishment of Smart Farm Innovation Center
	- Running brand and marketing campaigns	- 2nd year: Brand campaign and market entry	- Increase brand awareness of Konzahub
	- Processing, sorting, and packaging at APC (Agriculture Processing Center)	- 2nd year: APC operation expansion (30% increase in raw materials, additional processing)	- 70% increase in added value
3-4 years (diffuser)	- Establishment and operation of various distribution channels (wholesale, retail, online)	- 2nd year: Expand and operate distribution channels	- Increased sales and increased market share (30%) - Brand loyalty and Technology package transfer (10% of sales)
	- Introduction and application of smart technology (IoT, drones, sensors)	- 3rd year: Full-scale introduction of smart technology begins	- Increase production by 20%
	- Collection, classification, and packaging at APC (Agriculture Processing Center)	- 3rd year: APC production complex, distribution of raw materials to nearby complexes	- 30% increase in added value
	- Conducting farmer education programs and transferring technology	- 10 training programs per year/1 incubation program per year	- Smart farm operation and education job creation
5-6 years (Settlement)	- Establishment of technology standardization and packaging protocols	- Years 3-4: Complete standardization and protocol development	- Introduction of standardized agricultural technologies for quality assurance
	- Smart Farm Innovation Complex and Integrated operation of incubator farm complex	- Year 5: Start of integrated operation Export partnership and start of first export	- Increased production capacity by 50%
7-8 years (Preamble)	- Establishing overseas export partnerships and entering export markets	- Year 6: Expanding global export potential and building networks	- Increased market accessibility and export potential
	- Technological adaptation and diffusion	- Year 7: Expanding global export potential and building networks	- Increased market accessibility and export potential
9-10 years (Sustained growth period)	- Development and operation of online sales platform	- Year 8: Launch and operate online platform	- Expanding market penetration through online sales
	- Expansion of advanced agricultural technology research and development and technology transfer	- Years 9-10: Application of advanced technologies and strengthening of research and model transfer	- Expanding market penetration through online sales
commonness	- Transfer of eco-friendly technologies such as solar power and water saving technologies	- Year 9-10: Application of eco-friendly technology and model transfer	- Eco-friendly, energy efficient, carbon footprint
	- Establishment of improvement and sustainable operation system through annual evaluation	- Annual evaluation and improvement	- Continuous growth and adaptation to market demand

Source: Author (2024).

2.4. Sustainable Business Operations

For sustainable operation, the government is promoting infrastructure, R&D support, export support, etc., and on this basis, the private sector is proposing R&D resources such as technology transfer, solutions, and quality standard establishment.

Government Role: In order to implement a sustainable business model, the government needs to prepare for the implementation of smart farm infrastructure construction and support, cutting-edge research and development and demonstration, capacity building and technology transfer, export support and technology diffusion, and expansion throughout Africa.

Private sector role: Development and commercialization of smart farm technology packages, smart farm operation and management solutions, provision of smart farm operation and management solutions, branding of high-quality agricultural products, investment partnerships, etc.

<Table 2-6> Future Public-Private Partnership (PPP) Mode

division	role	Performance task	How to perform	caution
Government of Kenya	Building and supporting smart farm infrastructure	Smart Farm R&D Center, Demonstration Farm, ICT Facilities Construction	Developing an African hub with cutting-edge smart farm infrastructure, supporting initial investment, and establishing an evaluation system	Ensuring reliability of continuous budget management and evaluation system
	Creating a research and development (R&D) and innovation ecosystem	Advanced technology development, technology patenting, technology package development	Collaborate with private companies to develop cutting-edge technologies and enter the African and international markets with R&D results	technology patents and licensing revenues, and review field suitability
	Operation of capacity building and technology transfer programs for agricultural workers	Farmer training and technology transfer	Incubator farms, field training provided at demonstration farms, smart farm training paid	Monitoring of farmers' practical application ability after training, continuous development of training infrastructure
	Support for agricultural products entering the global market	Export of high-quality agricultural products and expansion of markets	Build export networks, comply with international quality standards, and expand access to global markets	Preemptive response to changes in market demand, upgrading and branding agricultural products
	Leading the spread of agricultural innovation and African models	Spreading Smart Farm Technology Across Africa	Supporting localization of technology in African countries, securing support from international organizations, and strengthening technology leadership	Providing customized technology solutions

<Table 2-6> (Continued)

division	role	Performance task	How to perform	caution
Private enterprise	Development and commercialization of smart farm technology package	Development and dissemination of technology tailored to local agricultural characteristics	Providing locally optimized technology and distributing the latest technology at low cost	Review the appropriateness of localization of technology and continue cooperation with farmers
	smart farm operation and management solutions	Providing comprehensive management solutions to farms and businesses	Build technical consulting, maintenance, real-time data analysis and monitoring	Increase productivity by improving farm management efficiency
	smart farm education and capacity building programs	Providing education and training programs for farmers	Smart Farm Education Center, development and provision of online and offline content	Effective operation of educational programs, establishment of a network of farmers after education
	Production and branding of high-quality agricultural products	Premium agricultural production and brand building	Smart farm technology provides opportunities to produce high-quality agricultural products and create high profits through agricultural product branding.	High-quality market dominance, building brand awareness
	Smart Farm Technology and Business Models in Africa	Spreading technology to African countries, providing tailored solutions	Technology transfer based on successful cases, cooperation with farmers in each country to increase income	Providing solutions tailored to local conditions
	Expanding our business through investments and partnerships	Attracting domestic and international investment and forming partnerships	Collaborate with overseas investors and governments, expand business and develop new businesses through various partnerships	Maintain ongoing collaboration and manage risks

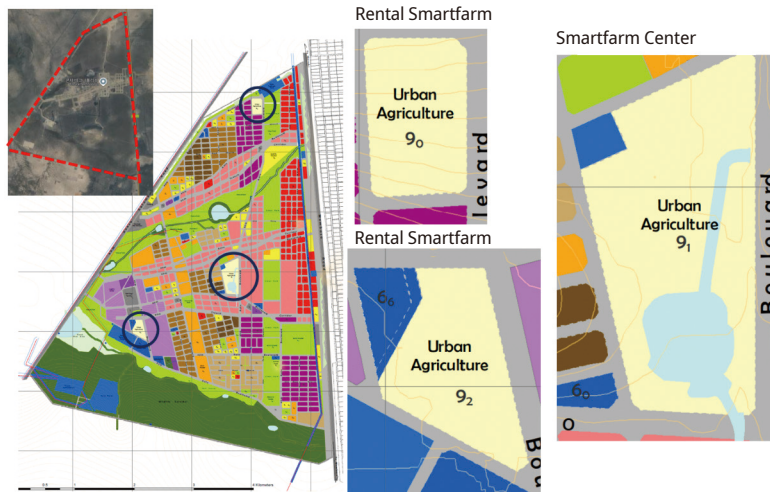
Source: Author (2024).

3. Basic Plan for Building Konza Smart Farm

3.1. Konza Smart Farm Section

- The planned smart farm site is 23ha out of the 2023ha of Konza Technopolis, accounting for 1.1% of the total area. This includes the reservoir within the site.
- Smart Farm Innovation Support Center (including approximately 10ha with pond): Konza Technopolis Planned Site Code Urban Agriculture 9-1, North and South each consist of 4ha incubator farms: 9-0, 9-2

[Figure 2-3] Konza Smart Farm Site Allocation



Source: Author (2024).

[Figure 2-4] 9-1 Smart Farm Innovation Park: 10 hectares, Konza Technopolis planned site



Source: Author (2024).

[Figure 2-5] 9-0 Incubator Farms (North): 4 hectares, Konza Technopolis planned site



Source: Author (2024).

[Figure 2-6] 9-2 Incubator Farms (South): 4 hectares, Konza Technopolis planned site



Source: Author (2024).

3.2. Summary of Major Facilities

- Smart Farm Innovation Park consists of various smart farming facilities, such as high-tech greenhouses, research centers, and logistics hubs. Key components include educational and research greenhouses, smart farm buildings for vegetables and fruits, an innovation center for management and research, and a Smart APC for processing and distribution.

<Table 2-7> Key Facilities within the Smart Farm Innovation Park

division	Main facilities	Estimated project cost (thousand won)	Area (㎡)	Operational Contents
Educational high-tech greenhouse	Educational glass greenhouse	1,164,083	3,136	Education/Research
Smart Farm Building A	Lightweight greenhouse (4-way nutrient solution)	3,531,535	14,350	Vegetable education/ research/rental including tomatoes
Smart Farm Building B	Lightweight greenhouse (triple nutrient solution)	2,372,896	9,642	Tomatoes, strawberries, greens Education/Research/Rental
Smart Farm Building C	Lightweight greenhouse (4-link soil)	2,372,896	9,642	Vegetables such as tomatoes Education/Research/Rental
Smart Farm Building D	Lightweight greenhouse (single-cell soil)	1,218,195	4,950	Tomato Education/ Research Education/Research/Rental
Smart Farm Building E	Lightweight greenhouse (single-cell soil)	1,218,195	4,950	Watermelon, strawberry, etc. Education/Research/ Rental
Demonstration-type advanced greenhouse	Research-type glass greenhouse	1,496,678	4,032	Vegetable Education/ Research
Advanced Nursery Greenhouse	Nursery glass greenhouse	481,075	1,296	Nursery education/ research/production
Smart Farm Innovation Center	Management, administration, research lab, information room, etc.	10,700,000	4,582	Research and Education Management
Smart APC	Pre-cooling , processing, packaging drying	3,000,000	1,976	Distribution, Research
Incubator Farm Support Center	Smart Farm Support Center Management	3,850,000	1,621	Rental management
Logistics and shipping rates	Logistics Center Linkage	1,400,000		
total		32,805,553		

Source: Author (2024).

- The incubation farm facility involves incubating farm facilities with a total cost of 10.5 billion won. It includes lightweight greenhouses for renting vegetables like tomatoes, cucumbers, and strawberries, a support center for rental management, and logistics, with a total area of 24,571 m².

<Table 2-8> Incubating Farm Facilities

division	Main facilities	Estimated project cost (thousand won)	Area (㎡)	Operational Contents
Incubating Farm Building A	Lightweight greenhouse (linked nutrient solution)	3,444,000	14,000	Rental of vegetables such as tomatoes and cucumbers
Incubating Farm Building B	Lightweight greenhouse (linked soil)	1,525,820	6,200	Rental of vegetables such as tomatoes and strawberries
Incubating Farm Building D	Lightweight greenhouse (linked nutrient solution)	676,775	2,750	Watermelon, tomato, etc. for rent
Incubator Farm Support Center		3,850,000	1,621	Rental Management
Logistics and shipping rates		1,000,000		
total		10,496,595		

Source: Author (2024).

3.3. Water Supply and Drainage Facilities

Basic water

- A disinfecting existing lake water pond to convert it into a rainwater harvesting and retention pond for greenhouse roof runoff. The pond will have a storage capacity of 7,200 tons (1-acre, 5m depth). Additionally, Technopolis groundwater supplies about 1,200 tons per day, combining rainwater and groundwater resources to ensure a sustainable and efficient water management system for agricultural use.

Future water

- The Kilimanjaro Dam has a capacity of 2,000 tons per day, while the Thwake Dam is 90% complete and will support an urban water system. Konza Technopolis has a water treatment capacity of 7.5 ML per day. The water supply will come from disinfected water in a 2.7ha reservoir, with rainwater from greenhouse roofs for emergencies. The two farm complexes will also build reservoirs to supply water to their facilities.

4. Smart Agriculture Performance Diffusion Plan

4.1. Konza Smart Farm Performance Goals

Performance Goals of This Project

- The goal is to increase farm productivity by 30% through the introduction of smart farming techniques and the advancement of agricultural production technologies. This improvement in productivity and quality is expected to boost farmers' incomes by 50%. Additionally, the spread of smart agricultural technologies aims to increase youth farmer employment by 30%, providing more opportunities for young individuals in the agricultural sector. Moreover, these advancements in farming will help increase exports by 30%, enhancing the competitiveness of agricultural products in international markets.

Strategies for Advancing Smart Farming Technologies in Kenya

- Education and Capacity Building: Expand training programs on smart farm operation technologies, incubate 600 people and train more than 1,000 people over 5 years. Strengthen the capacity of local farmers through on-site agricultural training and customized cultivation technology training.
- Data-driven performance management: Collect and analyze smart farm operation data in real time to evaluate changes in agricultural productivity and income, and continuously improve agricultural policies and operations based on data.
- Strengthening cooperation and partnerships: Work with the Kenyan government and international organizations (FAO, UNDP, IFAD) to secure policy support and funding, and localize and expand Korean smart farm technology to Kenya .
- Introduction of eco-friendly and sustainable agriculture: Implement sustainable agriculture by introducing water management technology for responding to climate change, eco-friendly pesticides and fertilizers, and optimize the distribution process by introducing a smart logistics system.

4.2. Konza Smart Farm Performance Expansion Plan

Kenya Government Agencies Attraction Strategy

- Kenya Ministry of Agriculture: Leading the introduction of smart farm technology, participating in the establishment of a smart agricultural technology demonstration complex through automatic irrigation systems and greenhouse structure design. Creating an environment for technological innovation through tax incentives and policy support.
- NACOSTI: Focuses on the development of environmentally friendly agricultural technologies and integrated pest management (IPM) technologies, and promotes the demonstration and diffusion of sustainable agricultural technologies through research grants and institutional support.

Strategies for Attracting Research Institutes and International Organizations

- KALRO: Contribute to the quality management of agricultural products and increase in farm income by establishing nurseries and agricultural processing centers (APC). Expand quality management systems and technical support through cooperation.
- International organizations (FAO, UNDP, etc.): Promote the training of professional personnel by introducing climate-smart agricultural technologies and training programs, and encourage continuous cooperation through financial support.

Strategy for Attracting Korean Companies

- Smart Farm Structures and Coverings: Promote demonstration and expansion by introducing durable structures and coverings provided by Korean companies. Reduce initial costs with tariff-free benefits and subsidies, and encourage ongoing participation through long-term maintenance contracts.
- Crop cultivation consulting: Provide customized crop cultivation methods to maximize productivity and efficiency, and expand consulting services based on successful cases.
- ICT Automation System: Optimize agricultural operations with an IoT-based automation management system, and promote system adoption through tariff-free benefits and technical training support.

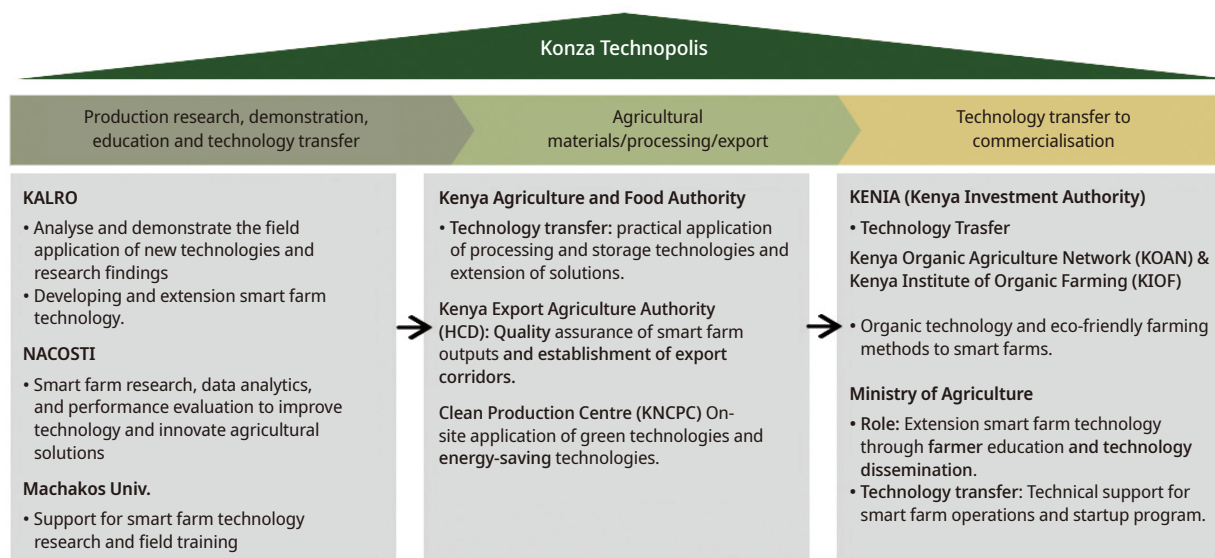
Strategies for Attracting International Cooperation Organizations and Foundations

- Technical and Financial Support: Attract financial and technical support by proposing smart farm- related projects.
- Climate-Smart Agriculture Program Linkage: Collaborating with international partners to introduce sustainable technologies such as smart irrigation systems and energy-saving greenhouses.
- Local Agricultural Development Linkages: Partnering with the African Development Bank (AfDB) and the World Food Programme (WFP) to achieve local agricultural innovation and income growth goals.
- Tax incentives and regulatory relief: Provide tax relief and legal protections to encourage participation in international cooperation institutions.

4.3. Konza Smart Farm Government Organization Relocation and Cooperation Plan

- Establish a collaborative system to enable Kenyan institutions to carry out their own work in a multilateral manner by assigning roles based on the agricultural technology commercialization value chain in line with their roles in Konza Technopolis.

[Figure 2-7] Kenya Smart Farm Governance Strategy



Source: Author (2024).

4.3.1. Transfer of Functions and Cooperation Plan of Existing Government Organizations

Ministry of Agriculture

- The existing functions include agricultural policy development and management, agricultural education, and technology dissemination. These responsibilities are being transferred to and enhanced within the Smart Farm Technology and Education Department to focus on smart farm initiatives. The department's key role involves overseeing regulations and policy formulation related to smart farms, providing technical support, and educating farmers to promote the adoption of advanced agricultural technologies.

Kenya Agricultural and Livestock Research Organization (KALRO)

- The existing functions include research and development in agriculture and livestock. Building on these responsibilities, efforts have been directed toward strengthening research and verification studies specifically related to smart farms. This includes the development of advanced smart agricultural technologies and the establishment of test beds for experimentation. A key role of this initiative is to develop and disseminate optimal smart farm technologies by applying new innovations in real-world agricultural settings and analyzing research outcomes to ensure practical and effective solutions for modern farming challenges.

Kenya Horticultural Crops Directorate (HCD)

- The primary function is ensuring quality control and certification of agricultural products designated for export. Previously, the role expanded to include the establishment of export standards for crops cultivated in smart farms, alongside providing support for the growth of export markets. The main responsibility focuses on guaranteeing the quality assurance of smart farm products and facilitating the development of robust export channels to promote these products globally.

Kenya Agriculture and Food Authority (AFA)

- The primary functions involve managing agricultural production and processing while formulating policies to ensure food self-sufficiency. Previously, responsibilities included overseeing the processing and storage of agricultural products within the smart farm demonstration complex, as well as collaborating with demonstration farms to develop innovative processing and storage solutions. The key role focuses on enhancing efficiency across smart farms, streamlining agricultural product processing, and optimizing distribution processes to improve the overall agricultural value chain.

Kenya National Cleaner Production Centre (KNCPC)

- The primary function is to ensure sustainable production and promote the adoption of environmentally friendly technologies. In previous efforts, eco-friendly agricultural technologies were introduced into smart farms, accompanied by research on sustainable resource management practices. The key roles include the application of eco-friendly agricultural inputs and energy-saving technologies, with a focus on enhancing the overall sustainability of agricultural systems.

NACOSTI (National Commission for Science, Technology, and Innovation)

- NACOSTI serves as Kenya's central agency for science, technology, and innovation, supporting government ministries and agencies (MDAs) by assessing their performance in these fields. It plays a significant role in advancing smart farm technology by driving scientific and technological innovations. This includes supporting the development and implementation of optimized agricultural technologies through smart farm demonstration complexes and leading research and verification of innovative solutions. Additionally, NACOSTI's key role encompasses providing continuous technological advancements, delivering innovative agricultural solutions through research and data analysis, evaluating smart farm project performance, and supporting the formulation of agricultural policies grounded in scientific evidence.

KENIA (Kenya National Innovation Agency)

- The Kenya National Innovation Agency (KENIA) plays a pivotal role in attracting foreign and private investments while creating opportunities across agriculture and other industrial sectors. It has actively promoted investment in smart farm projects, leading efforts to secure funding from private and international organizations. Another role of KENIA is to foster the adoption and diffusion of advanced technologies by encouraging investment in smart farm initiatives and supporting the development of sustainable and innovative business models to drive growth in the agricultural sector.

KOAN (Kenya Organic Agriculture Network)

- The Kenya Organic Agriculture Network (KOAN) plays a key role in supporting organic farming policies, disseminating relevant technologies, and fostering organic farming networks. It has previously collaborated on integrating eco-friendly agricultural materials and organic farming techniques into smart farms while promoting sustainable agricultural practices through educational programs. KOAN continues to drive the adoption of sustainable smart farming and environmentally friendly technologies by providing education and support for organic farming methods, advancing both sustainability and innovation in agriculture.

KIOF (Kenya Institute of Organic Farming)

- Existing The primary functions involve operating education and training programs focused on organic farming and providing technical support to enhance farming practices. Previously, efforts have been directed towards expanding the use of eco-friendly agricultural materials and technologies through targeted education and research within smart farms. The key role emphasizes spreading organic farming technologies by educating and training farmers, while also supporting the integration of sustainable, organic-based practices into smart farm operations to advance environmentally friendly agriculture.

MachaKos University

- The primary functions focus on advancing agricultural research and technology development while operating training programs to enhance expertise in the field. Previous efforts have included research collaboration to develop smart farm technologies and sustainable agricultural practices, as well as promoting the adoption of smart farming through field training for researchers and students. These initiatives aim to optimize technologies for smart farms and apply them in real-world settings, ultimately contributing to the establishment of a sustainable agricultural system that integrates innovation with environmental responsibility.

4.3.2. Establishment of a New Smart Farm Specialized Organization

Smart Farm Smart Farm Operations Agency

- The Smart Farm Operations Agency serves as the central body overseeing the management and advancement of smart farming practices across Kenya. Its primary role is to coordinate the operations and technological adoption of demonstration farms, ensuring that these farms act as models for innovative agricultural practices. The agency is tasked with several key responsibilities, including the construction, operation, and maintenance of smart farm infrastructure. Additionally, it evaluates emerging technologies to determine their feasibility and efficiency in agricultural settings. By facilitating the diffusion of these technologies, the agency aims to enhance the adoption of smart farming systems, promoting sustainability and improved productivity throughout Kenya's agricultural sector.

Professional Organization Structure

- The professional organization is structured into three key departments, each focusing on a specific area of expertise to support the advancement of smart farming systems. The Technology Development Department is dedicated to applying and enhancing the latest smart farm technologies. This department ensures that innovations are effectively adapted to real-world agricultural practices, continuously improving their efficiency and functionality. The Education and Training Department is responsible for designing and delivering training programs aimed at equipping farmers and other relevant personnel with the skills and knowledge needed to effectively utilize smart farming technologies. By fostering expertise, this department plays a crucial role in promoting the adoption of advanced agricultural practices. The Operations and Maintenance Department oversees the management of smart farm facilities and equipment. This department ensures that all infrastructure and tools are properly maintained and operational, supporting the seamless execution of smart farming initiatives. Together, these departments create a cohesive framework that drives innovation, knowledge dissemination, and operational excellence in smart farming.

Establishment of Smart Agriculture Technology Support Center

- The Smart Agriculture Technology Support Center is dedicated to introducing, maintaining, and advancing agricultural technologies, particularly in the realm of smart agriculture. It provides technical support to improve the application and efficiency of these technologies in agricultural practices. Key responsibilities include fostering networks for the diffusion of innovative technologies and conducting research and development (R&D) to drive continuous improvement in agricultural methods. Through collaboration with international agricultural organizations, domestic universities, and research institutes, the center integrates global expertise and local innovations. This partnership-based approach promotes sustainable agricultural development and enhances productivity across the sector.

5. Feasibility Study

5.1. Policy Feasibility Study

Contribute to achieving the United Nations Sustainable Development Goals (UN SDGs)

- The project will contribute to the achievement of the goals of Kenya and East African countries (UNSDG) 1 (Poverty Eradication), 2 (Ending Hunger), 6 (Water and Sanitation), 8 (Decent Work and Economic Growth), 9 (Industry, Innovation and Infrastructure Building), 12 (Responsible Consumption and Production), 13 (Climate Change Response), and 17 (Partnering for Goals). In particular, ICT-based smart farm innovative technology has already been proven to contribute to water conservation, agricultural productivity, and farmers' income increase worldwide, so it can have a direct and indirect ripple effect on the achievement of sustainable development goals.

Introducing smart agricultural technology to save water by 70~80%,
increase agricultural productivity by 30%, and increase farmers' income by 30%

Kenya Vision 2030 and Korea-Kenya Cooperation

- Linkage with Kenya's Vision 2030: The Kenyan government aims to enter a middle-income country through 'Vision 2030', and the Konza Smart City and Smart Farm project is a key project to achieve this, enabling agricultural innovation using digital technology through the creation of smart farms, and promoting the country's sustainability and economic self-reliance. The introduction of high-quality seeds, smart irrigation systems, and biological pest management are closely linked to the Science, Technology and Innovation Act and national planning Korea-Kenya Cooperation Based on the sharing of economic development experiences and policy consultations between Korea and Kenya, programs such as the EIPP have been designed to further strengthen policy relevance.

Maximize economic value through high-value production and
processing to enter middle-income countries

Contributing to the achievement of Kenya's 2014 Constitution and Agricultural Science, Technology and Innovation Policy Objectives

- The project can make a direct contribution to achieving the Kenyan government's policy goal of establishing food and nutrition security. The Kenyan government stipulated this in the Constitution in order to ensure stable food and nutrition for its citizens, and even though it established an agricultural science and technology innovation system in 2014 to implement it, the actual investment in science and technology innovation is low. This project can present new agricultural model that is essential for Kenya by focusing on smart farms, which are a key area that can dramatically increase agricultural productivity as well as responding to climate change. Increase agricultural productivity through sustainable

soil management, post-harvest management, and improved distribution, and food security in line with national food and nutrition security policies

Developing an ICT-based Konza Smart Farm innovation model and scaling it to Kenya's Smart Agriculture Policy

Kenya Climate Change Act, 2016, Kenya Climate-Smart Agriculture Strategy

- **Response to Response to Climate Change:** In alignment with the Kenya Climate Change Act and the Climate-Smart Agriculture Strategy, we are committed to protecting agricultural productivity by implementing policies that address climate change. These initiatives include the adoption of advanced climate adaptation technologies, such as smart irrigation systems and greenhouses, to mitigate the impacts of climate variability and ensure sustainable agriculture.
- **Strengthening Regional Development Policies:** To stimulate economic revitalization and improve farmers' income in the Konza region, we will promote smart farming practices. By building a sustainable agricultural ecosystem, supported by local infrastructure and cooperative-driven development, we aim to enhance climate change resilience and water conservation. Technologies like greenhouses and smart farms will play a pivotal role in reducing climate-related risks, including drought, while fostering long-term agricultural productivity.
- **Partnerships and Workforce Development:** Our focus on capacity building will involve training local agricultural professionals in smart farm technologies. Collaborating with private enterprises and innovation-driven organizations will further strengthen the sustainability and scalability of these efforts. Such partnerships are critical for fostering innovation and creating a skilled workforce that can drive progress in sustainable agriculture.

Climate-smart agriculture Increased productivity, climate change adaptation, sustainable resource management, and farmer empowerment

Capabilities and Operational Structure of the Project Entity

- **Cooperation with Konza Technopolis Development Agency (KOTDA):** Organized by KOTDA, there is a possibility of lack of management capabilities and experience. Collaboration with the IIAMHUB Consortium, KALRO, Machakos University, etc. This ensures that local agricultural expertise and technical support are secured for consistent project delivery.

Legal Regulation and Compliance Assessment

- **Regulatory Compliance and Risk Mitigation:** Prior to initiating projects, it is essential to thoroughly evaluate Kenya's environmental regulations, tax policies, and land ownership laws. This pre-assessment helps mitigate unforeseen costs and minimize regulatory risks.

- **Leveraging Tax Incentives:** Projects should explore Kenya's special tax benefits and incentive programs. Utilizing these advantages, particularly through public-private partnerships, can enhance project sustainability and long-term viability. Cost and risk management measures.

5.2. Agricultural Productivity Policy Through Smart Farm Technology

- **Improving Agricultural Productivity in Dryland Areas:** A significant portion of Kenya's population is engaged in agriculture. However, low productivity poses a threat to the livelihoods of many households. Smart farm technology can significantly boost agricultural output by employing automated management systems and data-driven agricultural optimization. Furthermore, it addresses the growing demand for high-value crops such as tomatoes, watermelons, and strawberries, enhancing income opportunities for farmers.
- **Science and Technology Innovation and Investment:** Urbanization and economic development in Kenya are driving increased demand for high-value-added crops. Despite this, the sector lacks sufficient investment in science and technology. Smart farm technology offers innovative, climate-adapted solutions tailored to Kenya's agricultural needs, addressing existing limitations and enabling sustainable agricultural practices.
- **Standardizing Technologies and Policies:** The standardization of innovative technologies tailored to Kenya's specific conditions enables the government to establish systematic agricultural policies based on smart farming. This foundation facilitates collaboration between the public and private sectors, promotes technology dissemination, and ensures consistency and efficiency in technology adoption.
- **Encouraging Private Sector Participation and Market Sustainability:** The rapid dissemination of agricultural technology can be achieved by actively engaging private companies. Smart farm technology not only enhances productivity and quality but also strengthens market competitiveness for farmers and private enterprises, fostering the continuous growth and development of the agricultural ecosystem.
- **Establishing Konza as a Smart Farm Innovation Hub:** To achieve this vision, the Konza Technopolis region will showcase both the Korean and Kenyan smart farm models. A permanent exhibition of the ICT-based Konza Smart Farm Innovation Model will be established, allowing farmers, researchers, policymakers, and citizens from across Kenya to explore the advancements. This initiative aims to position Konza Technopolis as a vital smart farm innovation hub, benefiting both Kenyan farmers and citizens.
 - **Advancing Konza as a Model for Smart Farming:** Smart farms align with the strategic investment goals of Konza Technopolis, aiming to make the region a central hub for agricultural innovation. Through ongoing exhibitions of the Korean and Kenyan smart farm models, coupled with the ICT-driven Konza Smart Farm Innovation Model, the region aspires to become a center of excellence for smart farming. This initiative not only supports Kenyan citizens and farmers but also showcases a scalable model for future agricultural development.
 - **Science & Technology Innovation & Investment:** Kenya is increasing the demand for high-value-added crops due to urbanization and economic development, but there is a lack of science and technology investment and innovation to support it, so smart farm technology can play an important role in overcoming the existing agricultural

limitations by providing customized innovative technologies optimized for the climatic environment and agricultural conditions.

- Establishment of standardized technologies and policies
 - By standardizing innovative technologies tailored to Kenya, the government can systematically establish agricultural policies based on smart farms. This standardized technology provides a foundation for the government and private companies to jointly promote the spread of technology, and increases the consistency and efficiency of technology introduction.
- Securing the participation of private companies and market sustainability
 - Agricultural technology can spread rapidly by inducing the active participation of private companies, and through smart farm technology, farmers and private companies can secure competitiveness in the market by increasing productivity and quality, which enables the continuous growth and development of the agricultural ecosystem.

Konza SmartFarm improves quality of life for farmers and people in Kenya (socio-economic impact analysis)

- Nurturing Konza as a smart farm innovation hub: To this end, the Korean smart farm model and the Kenyan smart farm model in the Konza Technopolis area will be exhibited, and the ICT-based Konza smart farm innovation model that should be achieved in the project will be displayed at all times so that farmers, researchers, policymakers, and citizens throughout Kenya can visit and view it.

Climate-smart agriculture Increased productivity, climate change adaptation, sustainable resource management, and farmer empowerment

5.3. Technical Feasibility Analysis

- Localized Smart Farm Innovation Technology in Kenya: This project takes a comprehensive approach by integrating ICT-based smart farm technology, crop-specific production technologies, and post-harvest management, distribution, and marketing systems. The primary goal is not merely to introduce advanced technologies but to achieve optimization and standardization by customizing them for the local environment.
- The localized smart farm innovation technology also focuses on securing intellectual property rights, with an emphasis on fostering the commercialization of these technologies by private sector companies. This initiative encourages active collaboration between the public and private sectors, ensuring long-term sustainability.
- Standardizing these innovative technologies involves promoting joint research with leading researchers from Kenyan government institutes and universities. This effort aims to secure government registration and approval in Kenya, ensuring a smooth path for adoption and scalability.

ASAL region-specific Konza Smart Farm innovation demonstrates comprehensive technology for Kenya's future agriculture needs

- Utilizing ICT and Renewable Energy Technologies for Efficient and Intelligent Smart Farms. To establish and operate smart farms effectively, we aim to actively introduce and demonstrate ICT technologies that have been successfully implemented in Korea and other countries. Specifically, we plan to validate the applicability of these technologies through on-site demonstrations, including these.
 - The introduction of an early warning system to address climate change
 - IoT-based smart farm operations
 - Automated facilities
 - Real-time mobile information systems.
- Additionally, recognizing the challenges posed by the local electricity infrastructure, we intend to leverage renewable energy sources, such as solar energy, to ensure sustainable and efficient smart farm operations. This approach aims to enhance the resilience and intelligence of smart farms in the Konza region while addressing energy limitations.

ICT-based smart farm innovation technology + energy independence technology optimized 'Konza Smart Farm'

5.4. Economic Feasibility Assessment

Business Promotion Scenario

- Strawberry, tomato, and watermelon production, which are structures that can generate the maximum sales, are divided into 40.85 Acre, 5.6 Acre, and 2.6 Acre, and the cost and benefit were analyzed based on the distribution and distribution criteria, and the standard cost and benefit were determined to be 1 Acre. Domestic demand and export are being considered simultaneously, and strawberries are being viewed as export market, while tomatoes and watermelons are being viewed as domestic market. Policy and institutional support measures are needed for stable implementation of this.
 - 1) Cost analysis: Costs are composed of seedlings, soil preparation, input costs, and labor costs on the farm.
 - 2) Benefit Analysis: Benefits include ① increased productivity in the form of revenue from final sales, etc., with production volume increasing by 80% to 150% and prices set at 80% of the highest local price. ② Operating sales expenses for technology royalties, seedlings, eco-friendly fertilizers, eco-friendly pesticides, etc. directly generated from this business are not included.
- The production standard is set at 80% to 150% of the standard productivity for productivity improvement, and the price is set at 80% of the local highest price.
- If the evaluation project contributed to cost reduction, the reduced cost is recorded as a benefit, and if the cost reduction is combined with technology and other additional facility/personnel investments,

- $\text{Benefit} = \text{Total Cost Savings} - (\text{Other Investments to Save Costs}) * (1 + \text{Cost of Capital})$
- $\text{Cost of Capital} = \text{WACC or Corporate Bond Yield}$

Crops and Processed Products Adaptable to the Konza Region and Income

- This project aims to educate and transfer smart farm technology to fruit farmers, including the smart farm production complex (incubating farm) of Kenya Konza Technopolis, to increase the uniformity of production and thereby improve marketability. The main items are regionally adaptable, can increase income, and are well-processed as well as raw materials.
- Produces strawberries, tomatoes and watermelons, while open fields produce avocados, mangoes and passion fruits. Cooperative response The currently set items are strawberries with good local export prices, tomatoes with good domestic and export prices, and watermelons with high regional adaptability and applicability. In addition, it is assumed that processed foods will be sold with a focus on technologies that can make dried, pickled, jam, and jam as primary processed products.

Cost and Sales Composition

- **Cost:** Costs related to production were calculated using the cost structure table presented by Machakos County, and the total infrastructure investment cost and operating cost were calculated separately. For details, the basic plan for establishing Konza Smart Farm in 2.4 was assumed.
- **Sales:** Sales revenue was estimated by considering the price range and production amount based on the market price. For strawberries, 1,000 shillings/kg, for tomatoes, 150 shillings/kg, for watermelon, 70 shillings
- In terms of production, it is assumed that strawberries, which are the most profitable in terms of cultivation, are produced at 40.85 acres, tomatoes at 5.6 acres, and watermelons at 2.6 acres. Based on Korea's production, it is assumed that productivity is initially around 80% and gradually increases to 150%. This is based on the improvement in productivity of Korean farmers due to technological advancement.
- watermelon, tomato, and strawberry will be arranged in that order based on production technology, ease of cultivation, and willingness to choose.
- Assuming that the primary selection, washing, and packaging volume is 20 tons/day and that 7,000 tons are produced and delivered annually for 350 days, the processed mango price is based on the local market price, with 187.5 shilling/kg for mango processed products, 258.4 kg/shilling for avocado processed products, and 185 shilling/kg for passion fruit processed products.
- **APC Processing Cost:** Mango Processing Cost 55 shilling/kg, 65 shilling/kg, 45 shilling/kg Market Price Survey
- **Interest Expense:** The market interest expense is applied at 17%, and if the interest expense is applied with EDCF funds, the rate of return is very high.

5.4.1. Net Present Value (NPV)

- The expected net present value (NPV) from the evaluated technology is 1.367 billion shillings, which is greater than NPV >0 (when the interest rate is 17%), as shown by calculating the difference between the sum of the benefits and costs after calculating the benefits and costs for each year and applying the discount rate based on 2026. Therefore, it is evaluated as economically feasible.
- The net present value (NPV) is 1.998 billion shillings, which is greater than NPV >0 (when the interest rate is 1%) and is considered economically feasible.

<Table 2-9> Net Present Value (NPV) of the Project

(unit: Thousand shillings)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Produce benefits	159,422	1,594,216	1,913,060	2,072,481	2,391,325	2,391,325
APC Benefits	1,280,614	1,413,447	1,696,136	1,837,481	2,120,171	2,261,515
Cost of produce	14,147	141,463	169,756	184,862	212,195	212,195
Machining Cost	1,034,542	1,293,178	1,551,813	1,681,131	1,841,830	1,971,148
Gross Profit	391,346	1,573,022	1,887,627	2,043,969	2,457,471	2,469,498
Discount Coefficiency	1.00	0.85	0.73	0.62	0.53	0.46
Net present value (NPV)	246,071	102,229	105,356	96,937	147,521	133,569

	Year 7	Year 8	Year 9	Year 10	Total
Produce benefits	2,391,325	2,391,325	2,391,325	2,391,325	20,087,128
APC Benefits	2,402,860	2,402,860	2,402,860	2,402,860	20,220,803
Cost of produce	212,195	212,193	212,193	212,193	1,783,392
Machining Cost	1,971,148	1,971,148	1,971,148	1,971,148	17,258,233
Gross Profit	2,610,842	2,610,844	2,610,844	2,610,844	21,266,306
Discount Coefficiency	0.39	0.33	0.28	0.24	
Net present value (NPV)	168,368	142,465	120,879	103,611	1,367,005

Source: Author (2024).

5.4.2. Benefit/ Cost Ratio (BCR)

- The Benefit Cost Ratio (BCR) converted to present value is 2.12 times, and since the B/C ratio is > 1, it is evaluated as economically feasible.
- The Benefit Cost Ratio (BCR) converted to present value is 11.26 times, and since the B/C ratio is > 1, it is evaluated as economically feasible. (When the interest rate is 1%)

5.4.3. Break-Even Point (BEP)

- Break-even point (BEP) is the sales amount when revenue and cost are equal for a certain period of time, so there is neither profit nor loss. It is the sales amount that can completely recover the cost invested in the product. In the third year, the total profit at this time is 864,627 (1000 shillings) (interest rate 17%).

<Table 2-10> Example of tomato cost/benefit analysis

(Unit: kg, Ksh)

ITEM	UNIT	QTY	UNIT Price	TOTAL	5.6acre
Plants per acre	No	9000			
Fruits/plant	kg	4.50			
Fruits/acre	kg	40,500	150	6,075,000	
GROSS OUTPUT				6,075,000	101,518,015
Nursery establishment and management					
Seeds	gms	50	280	14,000	77,984
Potting trays with 100 holes	No	90	200	18,000	100,265
Peat moss / planting media	kg	50	200	10,000	55,703
Planting	Md	10	500	5,000	27,851
Maintenance	Md	42	150	6,300	35,093
Water		1	2,500	2,500	13,926
Sub total					310,821
Land preparation					
Ploughing	No	2	3,000	6,000	33,422
Harrowing	No	1	2,500	2,500	13,926
Sub total					47,347
Inputs					
Manure	Tons	8	1,000	8,000	44,562
DAP	Kgs	80	100	8000	44,562
CAN	kgs	120	100	12000	66,843
Insecticide	Ltrs	1	2000	2000	11,141
Fungicidal	kg	1	2400	2400	13,369
Foliar feeds	Ltrs	1	1500	1500	8,355
Sticky traps (yellow)	Packet	1	800	800	4,456
Sticky traps (blue)	Packet	1	800	800	4,456
Tuta traps	No	8	500	4000	22,281
Sub total					220,025
Labour					0
Planting	Md	20	500	10000	55,703

<Table 2-10> (Continued)

ITEM	UNIT	QTY	UNIT Price	TOTAL	5.6acre
Top Dressing	Md	8	500	4000	22,281
Spraying	Md	4	1000	4000	22,281
Pruning	Md	20	500	10000	55,703
Staking	Md	20	500	10000	55,703
harvesting	Md	40	500	20000	111,405
Transport				0	0
Manure	tons	8	500	4000	22,281
TOTAL Variable costs				165,800	1,847,099
GROSS MARGIN				5,909,200	65,831,578
Interest in Working capital		165800	0.17	28186	157,003

Source: Machakos County

5.4.4. Agricultural Product Production and Sales Unit Cost - Profit Analysis (Interest Rate 17%)

- Interest rate 17%, sales for 10 years 20,087,128 (thousand shillings), cost estimate 7,676,736 (thousand shillings)
- Productivity increase 80%~150%

<Table 2-11> Example of Tomato Cost/Benefit Analysis

(Unit: Thousand shillings)

	Medium item	1year	2year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year
Facility Investment cost	CAPEX	2,000,000	1,200,000	523,000	280,000	600,000	527,000	277,000	240,000	180,000	100,000
	OPEX	200,000	500,000	300,000	700,000	584,000	673,000	558,000	542,000	370,000	258,000
	TOTAL	2,200,000	1,700,000	823,000	980,000	1,184,000	1,200,000	835,000	782,000	550,000	358,000
Agricultural products Revenue	strawberry	147,059	1,470,588	1,764,706	1,911,765	2,205,882	2,205,882	2,205,882	2,205,882	2,205,882	2,205,882
	tomato	10,152	101,518	121,822	131,973	152,277	152,277	152,277	152,277	152,277	152,277
	watermelon	2,211	22,110	26,532	28,743	33,165	33,165	33,165	33,165	33,165	33,165
	Agricultural benefits	159,422	1,594,216	1,913,060	2,072,481	2,391,325	2,391,325	2,391,325	2,391,325	2,391,325	2,391,325
	Strawberry Growing Costs	13,777	137,770	165,324	179,100	206,654	206,654	206,654	206,654	206,654	206,654
Cost	Tomato Growing Costs	185	1,847	2,217	2,881	2,771	2,771	2,771	2,771	2,771	2,771
	Cost of growing watermelon	135	1,346	1,615	2,100	2,019	2,019	2,019	2,019	2,019	2,019
	Strawberry Interest Expenses	22	225	270	351	337	337	337	337	337	337
	Tomato interest expense	18	185	222	288	277	277	277	277	277	277
	Watermelon interest expense	9	90	108	140	135	135	135	135	135	135
	agricultural product costs	14,147	141,463	169,756	184,862	212,195	212,195	212,195	212,193	212,193	212,193
	Profit	Agricultural profits	145,275	1,452,753	1,743,304	1,887,619	2,179,130	2,179,130	2,179,130	2,179,132	2,179,132

Source: Author (2024).

5.4.5. APC Collection Processing Unit Analysis (Interest Rate 17%)

- avocado, and passion fruit by 80% to 130%, sales of 20,220,803 (thousand shillings) and expenses of 2,962,570 (thousand shillings)

<Table 2-12> Annual Analysis of APC Collection Pilot Projects

	item	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year
APC Revenue	Mango raw	210,000	262,500	315,000	341,250	393,750	420,000	446,250	446,250	446,250	446,250
	Avocado raw	252,000	252,000	302,400	327,600	378,000	403,200	428,400	428,400	428,400	428,400
	Passion fruit raw	497,280	497,280	596,736	646,464	745,920	795,648	845,376	845,376	845,376	845,376
	Mango Processing Revenue	66,780	83,475	100,170	108,518	125,213	133,560	141,908	141,908	141,908	141,908
	Avocado Processing Revenue	130,234	162,792	195,350	211,630	244,188	260,467	276,746	276,746	276,746	276,746
	Passion fruit processing revenue	124,320	155,400	186,480	202,020	233,100	248,640	264,180	264,180	264,180	264,180
Cost	Purchase and preprocessing costs	783,496	979,370	1,175,244	1,273,181	1,371,118	1,469,055	1,469,055	1,469,055	1,469,055	1,469,055
	Mango Processing	27,720	34,650	41,580	45,045	51,975	55,440	55,440	55,440	55,440	55,440
	Avocado Processing	32,760	40,950	49,140	53,235	61,425	65,520	65,520	65,520	65,520	65,520
	Passion fruit processing	30,240	37,800	45,360	49,140	56,700	60,480	60,480	60,480	60,480	60,480
	Purchase and pre-processing interest expenses	133,194	166,493	199,791	216,441	249,739	266,389	266,389	266,389	266,389	266,389
	Mango processing interest expense	8,568	10,710	12,852	13,923	16,065	17,136	17,136	17,136	17,136	17,136
	Avocado processing interest cost	18,564	23,205	27,846	30,167	34,808	37,128	37,128	37,128	37,128	37,128
	Passion fruit processing interest expense	5,331	6,664	7,997	8,663	9,996	10,662	10,662	10,662	10,662	10,662
	Processing cost	1,034,542	1,293,178	1,551,813	1,681,131	1,841,830	1,971,148	1,971,148	1,971,148	1,971,148	1,971,148
APC Revenue	APC Benefits	1,280,614	1,413,447	1,696,136	1,837,481	2,120,171	2,261,515	2,402,860	2,402,860	2,402,860	2,402,860

Source: Author (2024).

Political Suggestion

1. Comprehensive Plan for Konza Innovation Ecosystem

Policy Proposal for Supporting Agricultural Productivity and Economic Independence in Kenya through the Konza Smart Farm Project.

This policy proposal aims to establish a comprehensive framework to enhance agricultural productivity and economic independence in Kenya. By aligning the core objectives of the Konza Smart Farm Project with the Korean experience and Kenya's Vision 2030, the proposal outlines five strategic directions.

1.1. Supporting Technology Innovation and Localization

- Localization of Smart Farming Innovations: Adapt Korean smart farming technologies to the Kenyan context, including the introduction of smart irrigation systems and drought-tolerant crop varieties suited for arid and semi-arid regions (ASAL)
- Technology Standardization: Develop standardized technologies for ICT and automation equipment in collaboration with the Kenya Agricultural and Livestock Research Organization (KALRO) and Machakos University. This will ensure consistent agricultural technology solutions across Kenya, enabling improved sensing and response capabilities to local agricultural environments.

1.2. Building a Smart Agricultural Value Chain

- Strengthening Agricultural Processing and Distribution Infrastructure: Establish an Agricultural Processing Centre (APC) in Konza to facilitate a fully integrated value chain. This includes post-harvest quality control, processing, and distribution of agricultural products. Additionally, the project will create a unique brand for Kenyan agricultural products by systematizing technologies throughout the process.
- Revitalizing Local Markets and Exports: Improve domestic and export markets by enhancing quality certification and distribution channels. Additionally, the proposal

includes supporting technical and diplomatic policies aimed at increasing the export of smart farm products.

1.3. Sustainable Resource Management

- Adoption of Renewable Energy and Water Management Technologies: Promote the use of resource-saving technologies, such as solar-powered irrigation systems, to combat climate change, reduce energy costs, and remove barriers to the adoption of sustainable practices.
- Promoting Environmentally Friendly Agricultural Technologies: Encourage the use of eco-friendly fertilizers and integrated pest management (IPM) techniques to ensure sustainability. These efforts will also foster new agribusiness opportunities, particularly for startups in the agricultural sector.

References

- Nienke Beintema, Lawrence Mose, Titus Kibet, Rosemary Emongor, Festus Murithi, Irene Kimani, Virginia Ndungu, and Peterson Mwangi. 2018. Kenya, Agricultural R&D indicators Factsheet Update. IFRI
- Kathleen Flaherty, Festus Murithi, Wellington Mulinge, and Esther Njuguna. 2010. Kenya, Agricultural R&D indicators Factsheet Update. IFRI.
- Government of the Republic of Kenya. 2021. National Agricultural Research System Policy (Third draft).
- UKaid. 2019. Assessing the needs of the research system in Kenya
- Kenya Climate Smart Agriculture Project (KCSAP) Report
- National Agriculture Value Chain Development Project (NAVCDP) Report
- 2019-2020 Validated Horticulture Report
- Council for International Agricultural Research (CGIAR), United States Department of Agriculture (USDA), Kenya Agricultural Research Office (KALRO)
- Source: Kenya Science, Technology, and Innovation Act (2013)
- Kenya National Science, Technology, and Innovation Plan (2020)
- Kenya Vision 2030 - Science, Technology and Innovation Sector
- Inventory of Climate Smart Agriculture Technologies, Innovations and Management Practices for Tomato Value Chain
- Inventory of Climate Smart Agriculture Technologies, Innovations and Management Practices for mango Value Chain
- https://www.kalro.org/kiamis/dash_hh_crops.html
- https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/konza_kenya
- <https://weatherspark.com/y/100131/Average-Weather-in-Konza-Kenya-Year-Round>
- FAO (Food and Agriculture Organization), "Water-Saving Irrigation Techniques in Developing Countries," FAO Irrigation and Drainage Paper 61, 2002.
- Kenya Ministry of Agriculture, "Kenya Climate-Smart Agriculture Strategy 2017-2026," Ministry of Agriculture, 2017.
- FAO, "The Profitability of Smallholder Agriculture in Sub-Saharan Africa," 2014.
- World Bank, "Agriculture for Development: World Development Report," 2008.
- World Bank, "Scaling Up Agricultural Innovations and Approaches: Lessons from Africa," 2015.



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Economic Innovation Partnership Program (EIPP)

Economic Innovation Partnership Program (EIPP) is a policy and technical cooperation program geared towards nurturing sustainable and mutually beneficial economic growth between the Republic of Korea and the partner countries. Envisioning itself as a vibrant platform for proactive international collaboration, the EIPP cultivates meaningful involvement from various stakeholders to explore opportunities for economic cooperation that can have a real impact on economies.

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