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THE ROLE OF AGRICULTURAL STARTUPS IN SUPPORTING THE IMPLEMENTATION OF FOOD SECURITY POLICIES IN INDONESIA: AN OVERVIEW FROM A BUSINESS ADMINISTRATION PERSPECTIVE

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Abstract

Food security is one of the strategic issues in national development, especially in the midst of challenges such as population growth, climate change, land degradation, and food distribution inequality. The Indonesian government has established a range of policies to realize a resilient food system, but its success relies heavily on cross-sectoral collaboration, including the private sector and agricultural startups. This study aims to analyze the role of agricultural startups in supporting the implementation of food security policies in Indonesia, by taking a case study on Habibi Garden. The approach used is qualitative-descriptive through literature review, business model analysis, and business administration perspectives. The results show that Habibi Garden contributes significantly to three pillars of food security: (1) increasing food availability through precision agriculture technology, (2) strengthening food accessibility by empowering small and medium farmers, and (3) supporting the use of safe and quality food through data-based cultivation practices. From a business administration perspective, Habibi Garden's success reflects the principles of cross-sector collaboration, managerial efficiency, and adaptive innovation in dealing with the dynamics of the agricultural sector. This research recommends the need for synergy between the government, the business world, and the community to accelerate the transformation of sustainable and inclusive agriculture.

Keywords: food security, agricultural startup, Habibi Garden, business administration, IoT technology

INTRODUCTION

Food security is a strategic issue that is of global concern amid various contemporary challenges. Rapid population growth, climate change, land degradation, and global economic and political dynamics have put great pressure on the availability, accessibility, and equitable and sustainable use of food. Food security is not only seen as a production issue, but also closely related to an efficient and equitable distribution and consumption system at all levels of society.

Indonesia, as the world's fourth-largest population and an economy that is still heavily dependent on the agricultural sector, faces complex challenges in realizing a resilient food system. Technology gaps, low efficiency of traditional agriculture, conversion of agricultural land, and distribution inequality are factors that exacerbate the instability of the national food system. This problem demands policy responses and systemic innovations that involve all stakeholders.

In response to these challenges, the Indonesian government has formulated various strategic policies, one of which is through the 2020–2024 National Medium-Term Development Plan (RPJMN) which establishes food security as one of the national development priorities. The government also seeks to increase productivity, utilize modern agricultural technology, empower farmers, and strengthen the national food supply chain. However, the implementation of the policy still faces various structural obstacles, such as limited infrastructure, low digital literacy of farmers, and lack of technology adoption.

In the context of the limited role of the state and bureaucracy, the emergence of agricultural startups (agritech) is considered as a new actor that can play a significant role in strengthening the national food system. Based on the theory *of Collaborative Governance* (Ansell & Gash, 2008), startups are potential non-government actors to be involved in the implementation of public policies through cross-sector collaboration. By bringing innovation as a major strength, agritech bridges the needs of farmers, consumers, and governments through adaptive and participatory business models. The use of big data, the Internet of Things (IoT), supply chain digitalization, and e-commerce platforms are just a few of the technologies developed to support the efficiency and productivity of the agricultural sector.

From a business administration perspective, agricultural startups not only offer technical solutions, but also carry a social entrepreneurship model oriented towards sustainability and social impact. They act as a link between the government's development agenda and modern business practices that are responsive to the needs of the community. The collaborative model built by agritech startups reflects a contemporary administration approach that prioritizes cross-sector synergy and data-driven decision-making.

One of the prominent agricultural startups in Indonesia is Habibi Garden, which develops IoT-based precision agriculture technology. With smart sensors that monitor soil moisture, temperature, and moisture content in real-time, this technology provides accurate information for farmers in effective decision-making. This technology allows for cultivation

practices that are more adaptive to climate change, efficient in the use of resources, and can significantly increase crop yields.

In addition to providing technology products, Habibi Garden also builds an agricultural digital ecosystem through a collaborative approach. They collaborate with local governments, research institutions, and agribusiness actors to expand the reach of technology and support comprehensive agricultural transformation. This initiative shows that startups not only focus on economic gains, but also play a role in strengthening the capacity of farmers and local food ecosystems.

However, although the strategic role of startups such as Habibi Garden is increasingly visible in practice, academic studies of their contributions are still limited, especially from the perspective of business administration. It is necessary to conduct an in-depth analysis of how these startups manage business strategies, establish partnerships, and navigate regulatory and business sustainability challenges in supporting the national food security agenda.

This research also utilizes theoretical frameworks from strategic management, entrepreneurship, public policy implementation, and innovation diffusion to examine the strategic role of agricultural startups in supporting food security. Theories such as *Porter's Five Forces*, *Resource-Based View*, *Schumpeterian Innovation Theory*, and *Diffusion of Innovation* are used to strengthen the analysis of aspects of competitiveness, innovation, collaboration, and sustainability of startups in the context of national development.

This research aims to fill this gap by examining the role of Habibi Garden in supporting the implementation of food security policies in Indonesia through the perspective of business administration. The focus of the study includes cross-sectoral collaboration, managerial innovation, and adaptive strategies in dealing with the complexity of the national food system. This study is expected to provide scientific contributions as well as practical input for policymakers and business actors in the agricultural sector.

Thus, it is important to see agricultural startups not only as mere business entities, but as agents of change in the national food administration system. This research tries to show that collaboration between technology, business, and public policy is key to building an inclusive, efficient, and sustainable food security in the future.

METHODOLOGY

This study uses a qualitative approach with a literature study method, which aims to describe, analyze, and narrate the role of agricultural startups in the implementation of food security policies reviewed from the perspective of business administration. The research focus is directed at technology-based agricultural startups, with *Habibi Garden* as the main subject of the study. Data is collected through a literature review of government policies, agritech market reports, and relevant academic publications, which also serve as a data triangulation technique to improve the validity of the information. Data analysis was carried out using interactive models from Miles and Huberman, which included the stages of data collection, data reduction, data presentation, and conclusion drawing in a systematic manner.

RESULTS AND DISCUSSION

Definition and Dimensions of Food Security

Food security is a strategic concept in national development that includes aspects of sustainable food production, distribution, and consumption. According to the Food and Agriculture Organization (FAO), food security is achieved when all individuals, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their nutritional needs and food preferences for an active and healthy life.

In Indonesia, the definition of food security is regulated in Law Number 18 of 2012 concerning Food, which states that food security is a condition for food fulfillment for the state and individuals, which is reflected in the availability of sufficient food, both in quantity and quality, safe, diverse, nutritious, equitable, and affordable, and does not conflict with the religion, beliefs, and culture of the community. This concept has three main pillars: food availability, food accessibility, and food utilization. These three pillars are interrelated and must be strengthened simultaneously so that national food security can be realized in a sustainable manner.

The food security framework used in this study refers to the four pillars of the Food and Agriculture Organization (FAO, 2008; 2023), namely availability, access, utilization, and stability. These four pillars are the basis for assessing the extent to which the role of agricultural startups contributes to the fulfillment of sustainable food needs. The *availability aspect* is related to the availability of food production, *access* is related to the ability of the community to obtain food, *utilization* is related to food quality and safety, and *stability* is related to the sustainability of supply in the long term. In this context, the contribution of startups such as Habibi Garden will be analyzed through direct linkages to the four pillars.

ISSN XXXX-XXXX

National Food Security Challenges

Indonesia, as an archipelagic country with the fourth largest population in the world, faces various challenges in achieving sustainable food security. First, the increasing population growth pushes the demand for food to exceed domestic production capacity. Second, climate change and extreme weather have an impact on the instability of agricultural production, resulting in decreased crop yields, vulnerability to plant pests and diseases, and crop failure.

The next challenge is the degradation of natural resources, such as the conversion of agricultural land into industrial and residential land, the decline in soil quality, and the limitation of irrigation water. On the distribution side, the food supply chain in Indonesia is still long and inefficient, causing high food losses and sharp price fluctuations at the consumer level. In addition, the adoption of technology in agriculture is still low, especially among smallholders, which leads to suboptimal productivity and dependence on conventional methods.

Government Policies Related to Food Security

The Indonesian government has developed various strategic policies to realize national food security. In the 2020–2024 National Medium-Term Development Plan (RPJMN), food security is set as one of the national priorities, with a focus on increasing domestic production, strengthening food reserves, developing integrated agricultural areas, and utilizing innovation and digital technology in the agricultural sector.

Through the Ministry of Agriculture, the government launched various programs such as Sustainable Modern Agriculture, Food Estate Development, and Digital Farming to accelerate the transformation of the agricultural sector. In addition, regulations such as Presidential Regulation No. 66 of 2021 concerning the National Food Agency also strengthen institutions that handle food management in an integrated manner.

However, the successful implementation of this policy is highly dependent on collaboration between sectors, including the involvement of the private sector and agricultural startups in presenting innovative solutions that can address structural problems in the food system. This is where the role of agricultural startups comes in, as they offer new approaches that are more adaptive, technology-based, and responsive to market and climate dynamics.

Overview of Habibi Garden

Habibi Garden is one of the technology-based agricultural startups (*agritech*) from Indonesia that is here to answer the challenge of low productivity and national agricultural efficiency. Founded by Muhammad Habibie and his team, this startup began to develop in 2015 with the main mission of providing precision agriculture solutions through the use of the Internet of Things (IoT).

Habibi Garden focuses on developing real-time plant monitoring and control systems, which allow farmers to accurately know the condition of plants and make data-driven decisions. The vision of this startup is to create a smart, efficient, and sustainable agricultural ecosystem, especially for small and medium-sized farmers who previously had difficulty accessing modern technology.

Along the way, Habibi Garden has received numerous recognitions and awards both from within and outside the country, including support from technology incubators as well as partnerships with academic and government institutions. The main advantage of Habibi Garden lies in its approach that not only provides hardware, but also assistance and education services for agricultural digitalization.

Habibi Garden's business model also reflects the principles in the *Resource-Based View* theory (Barney, 1991), where competitive advantage does not only come from technological products, but from unique internal resources such as expert teams, distribution networks, and partnership models with farmers. Habibi Garden's strategic decision to focus on precision agriculture demonstrates competitiveness that can also be analyzed through *Porter's Five Forces framework*, especially in responding to competition in the agritech sector and navigating challenges from the market, suppliers, and newcomers.

Technological innovations developed

Habibi Garden developed a series of IoT devices that function to automatically monitor land conditions, including soil moisture, ambient temperature, light intensity, nutrient content, and moisture content. The device is connected to a cloud-based platform that can be accessed through a smartphone app.

One of its flagship features is its automatic irrigation control capability, which allows farmers to remotely regulate crop watering based on data collected by sensors. This technology not only improves water use efficiency, but also helps reduce the risk of crop failure due to errors in the management of the growing environment.

By applying *the concept of data-driven farming*, Habibi Garden encourages farmers to shift from intuition-based practices to *evidence-based decision-making*. This is in line with the direction of modern agricultural transformation that integrates information technology in every stage of production.

Business Model and Operating Strategy

The business model run by Habibi Garden combines a business-to-business (B2B) and business-to-customer (B2C) approach. In the B2B scheme, Habibi Garden collaborates with agricultural corporations, farmer cooperatives, and local governments to implement precision farming systems on a large scale. Meanwhile, in the B2C scheme, they sell devices and services to individual farmers through online platforms and distribution partners.

Habibi Garden's source of income comes from:

1. Sales of IoT devices (sensors, actuators, and control systems).
2. Digital platform subscriptions (data monitoring and decision-making systems).
3. Agricultural technology consulting and training services.

Their operating strategy emphasizes value *proposition* in the form of production cost efficiency, increased crop yields, and ease of agricultural management. In addition, Habibi Garden implements *a customer intimacy* strategy by continuing to build long-term relationships with farmers, through education and direct assistance in the field.

Furthermore, the startup also establishes strategic partnerships with research institutions, universities, and business incubators to continuously update their technology and reach a wider market. With a flexible and value-added business model, Habibi Garden has succeeded in demonstrating that digital transformation in the agricultural sector is not only an innovation, but also a real solution to the problem of food security in Indonesia.

Contribution to the Aspect of Food Availability

Startups like Habibi Garden contribute to the four main pillars of food security according to FAO, namely *availability*, *access*, *utilization*, and *stability*. In the context of availability, these startups are increasing production through precision agriculture technology. In terms of access, the use of digital platforms shortens supply chains and opens up wider market access. Utilization is improved through monitoring the quality of agricultural products, while supply stability is assisted by a data-driven harvest prediction system. These roles not only reflect practical contributions, but also demonstrate the existence of *effectuation logic* in adaptive decision-making under uncertainty (Sarasvathy, 2008).

Habibi Garden makes a significant contribution to increasing food availability, especially through the use of precision agriculture technology. By integrating Internet of Things (IoT)-based sensors, farmers obtain real-time data related to the condition of the land and crops in detail and accurately, such as temperature, humidity, soil moisture content, and irrigation needs.

With this information, farmers can manage planting and watering patterns in a timely and efficient manner, so that the risk of crop failure due to lack or excess water can be reduced. This efficiency has a direct impact on increasing the productivity of agricultural products, both in volume and quality. This means that the system developed by Habibi Garden is able to optimize production inputs to produce maximum output.

In addition, in the context of regions facing water crises or limited irrigation infrastructure, this technology is a very relevant alternative solution and can help maintain the continuity of food supply, especially horticulture and short-term food crops.

Contribution to Food Accessibility

Habibi Garden also contributes to improving food accessibility by empowering small and medium farmers to be able to survive and compete in the market. Through a technology-based approach, farmers who were previously marginalized due to limited capital and information can now gain access to advanced production technologies at relatively affordable costs.

In addition to providing hardware, Habibi Garden also includes training services, technical guidance, and data-driven agricultural management assistance. This helps increase the capacity of farmers to make decisions and increase the competitiveness of their products in the market.

Furthermore, this startup has also built a network of cooperation with agribusiness ecosystems such as distributors, exporters, and digital commerce platforms. Thus, the agricultural products of partner farmers are more easily accessible to a wider market, both domestic and export. Better market access will increase farmers' incomes and strengthen the sustainability of small-scale farming businesses.

Support for Food Utilization and Safety

Food security is not only about quantity, but also food quality and safety. Monitoring technology from Habibi Garden helps ensure that plants grow in optimal conditions and are free from environmental stress that can trigger disease or crop damage. The data collected

from the sensors can be used to control the application of fertilizers and pesticides more wisely, so that the use of chemicals can be reduced.

By reducing the risk of harmful contamination and excessive pesticide residues, the resulting agricultural products are safer to consume and have higher added value in the market. This supports the use of healthier and more sustainable food, in accordance with national and international food standards. In addition, the precision agriculture model also encourages environmentally friendly agricultural practices, in line with the principles of long-term sustainability in the national food system.

Strategic Management in the Business Model of Agricultural Startups

Agricultural startups like Habibi Garden need to design strategies that are not only market-competitive, but also relevant to the national development agenda, especially in the agricultural sector. Two main approaches are used in this analysis, namely Porter's Five Forces and Resource-Based View (RBV). Through *Porter's Five Forces* (Porter, 1980; 1985), Habibi Garden faced the threat of newcomers, the bargaining power of suppliers and consumers, and competition in the increasingly fierce agritech industry. Differentiation strategies through Internet of Things (IoT) technology and cooperation with local farmers strengthen its position in the market.

Meanwhile, *Resource-Based View* (Barney, 1991) explains that Habibi Garden's competitive advantage is sourced from unique resources such as smart sensors, technology-based HR teams, and distribution networks. This strategy reflects the principle *of sustainable competitive advantage* which is important in ensuring long-term food security.

Operational Efficiency and Managerial Innovation

From an operational management perspective, Habibi Garden emphasizes efficiency and continuous innovation. The utilization of IoT technology enables data-driven automation and control, replacing conventional agricultural systems that are labor-intensive and inefficient. Simultaneous management of farmers without the need for structural expansion reflects the principle *of operational excellence*.

In addition, Habibi Garden adopts an *agile management* approach by iterating products based on farmer feedback. This adaptive business process allows startups to react quickly to field dynamics and ensure customer value is maintained.

Startups as Agents of Entrepreneurship and Social Innovation

From an entrepreneurial point of view, Habibi Garden represents the embodiment of *Schumpeterian Innovation Theory* (Schumpeter, 1942), where technological innovation triggers *creative destruction* of the old agricultural system. Habibi Garden is driving a paradigm shift from experience to precision, from manual to automatic.

Meanwhile, *Effectuation Theory* (Sarasvathy, 2008) explains how the founders of Habibi Garden built solutions based on available resources and managed uncertainty with high flexibility. This is what sets startups apart as social entrepreneurs: they not only seek profit, but also create sustainable social impact.

Administrative Challenges and Adaptive Strategies

Although innovative, the adoption of technology in Indonesia's agricultural sector faces serious challenges. Low technology literacy among farmers, uneven digital infrastructure, and regulatory inconsistency are the main obstacles. Realizing this, Habibi Garden developed intensive training and mentoring services to build the capacity of farmers.

This strategy shows a long-term orientation in building a sustainable smart agriculture ecosystem. Collaborations with universities, business incubators, and agricultural empowerment institutions also expand the reach and strengthen startups' adaptive capacity against complex bureaucracy.

Public Policy Implementation: Top-Down and Bottom-Up Synergy

In the context of policy implementation, Habibi Garden plays a dual role: as an implementer of government programs (top-down) and as a field actor who adjusts policies to local realities (bottom-up). The *top-down approach* (Mazmanian & Sabatier, 1983) can be seen in the involvement of startups in the smart farming program that is part of the 2020–2024 RPJMN.

On the other hand, a *bottom-up approach* (Lipsky, 1980) is seen in the local strategy of Habibi Garden that adapts its technology and services to the characteristics of the farming community. This role demonstrates the importance of policy flexibility and the role of non-governmental actors in responding to policies dynamically.

Collaboration Between Startups and the Government

From a public administration perspective, partnerships between government and the private sector are crucial to solving complex public problems. Habibi Garden collaborates with local governments, research institutions, and farmer associations in the form of *public-*

private partnerships (PPP). This collaboration allows for the expansion of the scale of impact, increased program efficiency, and reduced bureaucratic burden.

Through government support such as financing incentives, program integration, and supportive regulations, startups like Habibi Garden can strengthen policy implementation at the grassroots level. Instead, governments acquire partners who are agile, adaptive, and results-oriented.

Collaborative Governance: Collaborative Governance

Collaborative Governance *Theory* (Ansell & Gash, 2008) reinforces the importance of participation and co-production in the implementation of public policies. Habibi Garden appears as a non-state actor who plays an active role in designing and implementing digital food solutions. This collaboration involves multi-actors with different interests, but united by a common goal: building inclusive and technology-based food security.

Contribution to FAO's Food Security Pillar

Habibi Garden shows a real contribution to the four pillars of food security according to FAO (2008; 2023): (1) *availability*, through increased technology-based production; (2) *access*, through digital distribution and agricultural e-commerce; (3) *utilization*, with improved yield quality and sensor-based quality control; and (4) *stability*, through crop monitoring and prediction that increases supply certainty. Thus, Habibi Garden not only operates as a business entity, but also as a strategic partner in national development.

Technological Innovation and Innovation Diffusion

Referring to *the Diffusion of Innovation Theory* (Rogers, 2003), Habibi Garden plays a role as *a change agent* that accelerates the adoption of technology at the farmer level. Through a training approach, field demonstrations, and direct added value, the diffusion process takes place from the knowledge stage to confirmation. This innovation strengthens data-driven agriculture systems and paves the way for precision agriculture as the new norm in Indonesia's food system.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study examines the role of agricultural startups, especially Habibi Garden, in supporting the implementation of food security policies in Indonesia through a business

administration perspective approach. Based on the analysis that has been carried out, it can be concluded that several main points are as follows:

First, food security in Indonesia faces complex structural challenges, ranging from land limitations, climate change, low farmer productivity, to inequality of access to technology and information. National policies have been designed to respond to these challenges, but their implementation requires synergy across sectors, including from the business world.

Second, Habibi Garden is present as an innovative solution through the use of IoT technology for precision agriculture. This technology allows farmers to monitor crop and environmental conditions in real-time and take appropriate actions based on data, thereby improving agricultural efficiency and productivity.

Third, in terms of food security, Habibi Garden contributes to three main pillars: (1) increasing food availability through increasing crop yields; (2) strengthening food accessibility by empowering smallholders through technology and mentoring; and (3) encourage the use of safe and quality food with more environmentally friendly cultivation practices.

Fourth, from a business administration perspective, Habibi Garden's success reflects the principles of collaboration between actors, managerial efficiency, and adaptive innovation. This startup is able to build a sustainable business model with a responsive approach to market needs as well as public policy.

Thus, it can be concluded that agricultural startups like Habibi Garden have a strategic role in strengthening national food security, and become a model of partnerships between the private and public sectors that should be expanded in the future.

Recommendations

Based on the findings and analysis in this study, here are some recommendations addressed to related parties:

a. For the Government

1. Encourage incentive policies for agricultural startups that develop innovations in the upstream sector, such as technology subsidies, access to financing, or tax incentives.
2. Strengthening synergy between the central and local governments in facilitating the integration of technology into agricultural programs, especially for small-scale farmers.
3. Develop regulations that are accommodating to the development of new digital-based business models in the food sector.

b. For Agricultural Startups and the Business World

1. Develop impact expansion strategies through partnerships with cooperatives, BUMDes, and local educational institutions.
2. Simplifying products and services to be more inclusive for farmers with limited digital literacy.
3. Establish a measurable impact evaluation system to assess contributions to food security in a sustainable manner.

c. For Academics and Researchers

1. Encourage further research on the socio-economic impact of agricultural technology on the lives of farmers and local communities.
2. Develop a study of the triple helix collaboration model (academics–industry–government) to strengthen innovation in the food sector.

d. For Farmers and Local Communities

1. Increase openness to new technology adoption and partnerships through community-based training and learning.
2. Utilizing support from startups and the government for a more productive and sustainable transformation of the farming system.

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