

Extension for Potato Farmers in Kopeng District with Strategic Management, Digital Platform Capability and Supply Chain Green Management Operational Production Process

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Abstract

The empowerment of potato farmers in Kopeng District is a priority to enhance the welfare of the agrarian community. This community service program aims to develop Digital Platform Capability and Supply Chain Green Management in potato farming operational processes. The activities are carried out through participatory methods, including training, mentoring, and performance evaluation of farmers in the Kopeng area. Digital Platform Capability is applied to assist farmers in accessing market information, the latest cultivation technologies, and direct sales platforms to consumers. Meanwhile, Supply Chain Green Management is introduced to ensure environmentally friendly farming practices, logistics efficiency, and waste reduction at every operational stage. The program results show an improvement in farmers' understanding and skills in using digital technologies for agribusiness activities, such as marketing products via social media and e-commerce platforms. Furthermore, implementing green supply chain management has successfully reduced excessive chemical usage and improved harvest distribution efficiency. This initiative has also resulted in a 20% increase in farmers' income compared to pre-implementation conditions. In conclusion, empowerment through integrating digital technology and green supply chain management enhances the productivity and sustainability of potato farming businesses in Kopeng District. Recommendations for further program development include expanding the training scope and creating a collaborative ecosystem between farmers, the government, and agribusiness stakeholders to support digital transformation and agricultural sustainability.

Keywords : Farmer Empowerment, Digital Platform Capability, Strategic Management Supply Chain Green Management

INTRODUCTION

Kopeng District, located in Semarang Regency, is known as one of the largest potato-producing areas in Central Java. The potential for potato farming in this region is significant, but farmers often face various challenges, such as reliance on traditional agricultural management methods, limited market access, and low adoption of technology in agricultural operations. In today's digital era, the use of technology in agricultural processes and supply chain management is crucial for increasing competitiveness and efficiency (Gardaz, 2019) .

Kopeng District has a geographically favorable environment for agricultural activities, particularly for potatoes, with ideal altitudes and temperatures for their growth. However, this enormous potential has not been fully utilized by farmers. One reason is the limited use of digital technology in agricultural operations, from land management and distribution to product marketing (Ankit, 2013) . Furthermore, fluctuating market prices and a lack of access to broader markets are significant obstacles for farmers in maximizing their income. In addition to technological constraints, sustainability issues are also increasingly relevant in the context of modern agriculture (Rachmadhaniyati & Sanaji, 2021) . Many consumers, both domestically

and internationally, are beginning to demand products produced using environmentally friendly methods. Currently, the concept of green supply chain management has not been widely implemented by potato farmers in Kopeng District. The lack of green supply chain management makes their products less competitive, especially in markets that are highly concerned about the environmental impact of food production and distribution (Rehman et al., 2021) .

This situation is exacerbated by farmers' lack of understanding of the importance of green supply chain management. Environmentally friendly supply chain management processes are still not widely implemented, preventing farmers from maximizing profits from market demand that increasingly prioritizes green and sustainable products (Manzoor et al., 2019) . Therefore, empowering farmers through increased capabilities in utilizing digital platforms and implementing green supply chain management is expected to be a solution to address this problem (Gardaz, 2019)

Agriculture is a strategic sector that plays a vital role in the Indonesian economy, including in the Kopeng District, known as a potato production center in Central Java. With its supportive natural resources, farmers in Kopeng are able to produce high-quality products that are a leading regional commodity. However, despite this potential, farmers often face various challenges, such as fluctuating market prices, reliance on traditional farming methods, and limited access to modern technology. These conditions require innovative interventions to support the sustainability of farming businesses and improve farmer welfare (Hernandez-de-Menendez et al., 2020)

One relevant approach is the use of digital technology in agricultural activities. *Digital Platform Capability* , defined as the ability to utilize digital platforms, offers practical solutions to increase market access, expand marketing networks, and improve farm management (Fordian, 2020) . By using digital platforms, farmers can manage information more effectively, from planting planning to harvest distribution (Wijaya, 2013) . This allows farmers to reach consumers directly, reduce dependence on intermediaries, and obtain added value from their products.

In addition to digital technology, sustainability in agricultural operations is a major concern. *Supply Chain Green Management* is an approach that emphasizes efficiency and sustainability in the supply chain (Rath, 2015) . This principle encompasses environmentally friendly resource management, logistics optimization, and waste and emission reduction (Puspasari, 2012) . By adopting green supply chain management, agriculture not only provides economic benefits but also preserves the environment and supports sustainable development goals.



Figure 1.1 Condition of Potato Farmers in Kopeng District

A priority issue is farmers' lack of knowledge and understanding of sustainable agricultural practices and green supply chain management. Many farmers in Kopeng

District are still accustomed to conventional methods and lack awareness of the importance of implementing environmentally friendly agricultural practices. Without an adequate understanding of the benefits of sustainability, they tend not to make changes in their production, processing, and distribution processes. This results in products that cannot meet market demand, which increasingly prioritizes sustainability, and ultimately reduces the attractiveness of their products to consumers. Therefore, increasing knowledge and awareness of sustainable agricultural practices and green supply chain management is crucial to empower farmers to improve the efficiency and sustainability of their businesses.

The combination of *Digital Platform Capability* and *Supply Chain Green Management* offers a significant opportunity to empower potato farmers in Kopeng District. This approach not only increases productivity and efficiency of farming but also creates added value through innovative and sustainable agribusiness practices (Dewaelheyns et al., 2023) . Furthermore, this empowerment requires cross-sector collaboration, involving government, business actors, and farming communities in creating an ecosystem that supports digital transformation and sustainability.

This empowerment program is implemented through a series of structured activities, ranging from training and technical assistance to implementation impact evaluation (Rachmawati et al., 2023) . The training focuses on the introduction and use of digital platforms for agribusiness needs, such as online marketing, stock management, and transaction recording. Technical assistance is provided to assist farmers in implementing green supply chain practices, such as the use of organic fertilizers, crop waste management, and efficient distribution planning (Sirappa, 2019) .

Furthermore, potato farmers play a significant social role in the village. As the backbone of the local economy, they create jobs for the surrounding community, providing daily labor to assist with the harvesting process or transporting agricultural produce. The close social ties between farmers also foster community solidarity, especially when facing shared challenges such as natural disasters or falling market prices (Freixanet et al., 2018) .

The harvest distribution process is also carried out manually by farmers, who typically use simple vehicles to sell their produce to local markets. While limited market reach, this method helps maintain a direct connection between farmers and buyers, allowing farmers to receive feedback on the quality of their products (De Silva & Sumarto, 2014) . This manual distribution is also an important part of building a relationship of trust between farmers and local consumers. The role of farmers manually is also reflected in their efforts to preserve the surrounding environment. Most farmers in Kopeng District still use organic fertilizer made from livestock waste or crop residues. This practice is not only environmentally friendly but also helps reduce dependence on chemical fertilizers, the price of which fluctuates. With this local wisdom-based approach, farmers help maintain the balance of the village ecosystem, which is the basis for agricultural sustainability in the region.



Figure 1.2 Strategic Process

The Kopeng District Potato Farmer Extension Program is an integrated approach designed to enhance farmers' capacity to face the challenges of modern agriculture. This program focuses not only on increasing production yields but also on strengthening managerial skills, utilizing digital technology, and implementing sustainability principles in the supply chain. With this approach, farmers are expected to transform from traditional systems to a more adaptive, efficient, and highly competitive agribusiness system.

The first dimension of the matrix is Strategic Management, which emphasizes the importance of long-term planning in potato farming. Farmers are provided with an understanding of developing a business vision and mission, business planning, and SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis (MG. Brilliant et al., 2024) . Through this approach, farmers act not only as producers but also as business managers, capable of making strategic decisions based on data and market conditions. This serves as a key foundation for creating sustainable farming businesses amidst the dynamics of the agricultural sector.

Furthermore, Digital Platform Capability is a crucial element in enhancing farmer competitiveness. The use of technologies such as e-commerce, agricultural applications, and Internet of Things (IoT)-based data integration enables farmers to access real-time market information, expand marketing networks, and improve operational efficiency. This digitalization also promotes transparency and accountability in production and distribution processes, enabling farmers to be more responsive to changes in market demand and commodity prices.

In the third dimension, Supply Chain Green Management, extension services emphasize the importance of implementing environmentally friendly agricultural practices. This includes efficient logistics management, reducing production waste, and implementing recycling systems in agricultural processes (Nadeak et al., 2021) . This approach aims not only to preserve the environment but also to increase the added value of potato products in a market increasingly concerned with sustainability. Thus, farmers can gain economic benefits while maintaining ecosystem balance.

All these dimensions are integrated into the Operational Production Process, which encompasses key stages such as planting, harvesting, and distribution. The integration of strategic management, digital technology, and a green supply chain results in a more efficient, structured, and sustainable production system. Through this model, it is hoped that potato farmers in Kopeng District will be able to increase productivity, expand market access, and strengthen their position within the overall agribusiness value chain (Liu et al., 2020) .

METHOD

Methods of implementing community service

This community service will be implemented through several integrated methods to empower potato farmers in Kopeng District.

First, we will conduct outreach and training sessions aimed at providing information on digital technology, marketing, and sustainable agricultural practices. In these sessions, farmers will be taught how to use digital platforms to market their products and how to apply green supply chain management principles. These activities will be conducted periodically over six months, with the aim of improving farmers' knowledge and skills in managing their businesses. The success of this phase will be measured by the level of farmer participation and changes in their behavior regarding technology use.

Following the training, we will continue with direct mentoring and consultation with farmers. The community service team will conduct regular visits to provide technical guidance on applying the knowledge gained during the training. This mentoring is expected to last one

year and will provide the necessary support for farmers to effectively implement digital technology and sustainable agricultural practices. The success of this phase will be measured by increased use of digital platforms and adoption of environmentally friendly agricultural practices in the field.

To increase market access, we will also assist farmers in building marketing networks. This involves connecting farmers with consumers, retailers and local and online markets. In addition, information on market trends and consumer demand will be provided to make it easier for farmers to adapt their products. This marketing network will be built in stages over six months, with success measured by the number of sales of potato products via digital platforms and increased market access.

In addition, we will conduct regular evaluations and monitoring to track farmer progress and program effectiveness, as well as develop educational materials that will be compiled and distributed in the form of modules, videos, and practical guides. With this comprehensive approach, we hope to empower potato farmers in Kopeng District to improve the efficiency and sustainability of their businesses.

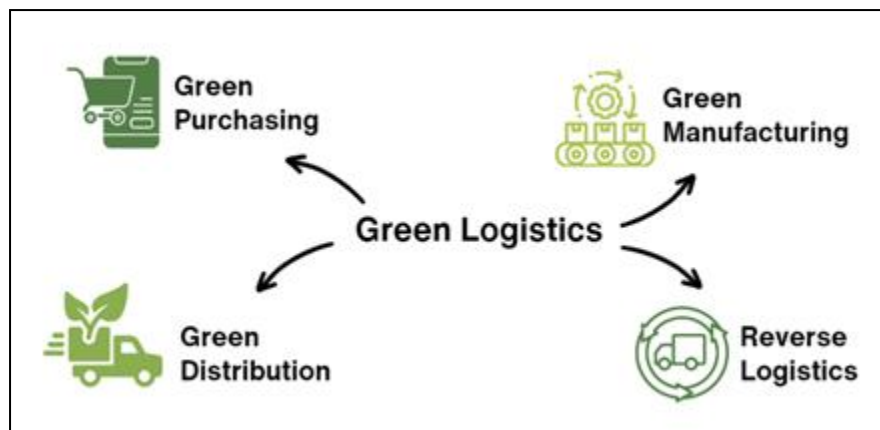


Figure 1.3 Operational Green Management Diagram

RESULTS AND DISCUSSION



Figure 1.3 Community Service Activities



The community service activity with the theme “Empowering Potato Farmers in Kopeng District with Digital Platform Capability and Supply Chain Green Management Operational Process” has been implemented according to plan. This program involved 20 potato farmers from various villages in Kopeng District, with a participatory and solution-based approach to the problems faced by farmers. The following are the results obtained and discussions related to the implementation of the activity:

One of the main outcomes of this activity was improving farmers' ability to utilize digital platforms for their agribusiness needs. The training provided included an introduction to social media for marketing, stock management through applications, and the use of local e-commerce to sell crops directly to consumers. Evaluation results showed that 85% of participants successfully understood and began using digital applications in their agricultural activities. This was evident in the increase in direct transactions between farmers and consumers through online platforms, which reduced reliance on intermediaries.

In terms of sustainability, this activity successfully introduced the concept of a green supply chain to farmers. Farmers were taught to manage resources more efficiently, such as by using organic fertilizers produced from agricultural waste, and minimizing crop waste. Furthermore, crop distribution was regulated to reduce logistics costs and carbon emissions. Observations showed that this implementation has increased distribution efficiency by up to 20% and reduced chemical use by 15% compared to previous practices.

The program also had a significant economic impact. Farmers' incomes increased by an average of 25% due to more competitive selling prices and reduced production costs. Furthermore, the adoption of digital technology created new job opportunities for young villagers to assist their parents with technological aspects, such as managing online stores and promoting products on social media. Socially, the program strengthened collaboration among farmers, who now share information about markets and modern agricultural techniques. Despite the positive results, several challenges were encountered during implementation. Low technological literacy among some farmers was an initial obstacle to program implementation. However, the simple and targeted approach helped them adapt. Furthermore, limitations in digital infrastructure, such as unstable internet access in some areas, necessitated the program's use of offline solutions, such as manual record keeping that could be uploaded when an internet connection was available.

Table 1.1 Pretest and Posttest Results

No	Participant Name	Pre-Test Score	Post-Test Score	Increase (%)
1	Farmer A	55	85	54.55
2	Farmer B	60	80	33.33
3	Farmer C	50	75	50.00

No	Participant Name	Pre-Test Score	Post-Test Score	Increase (%)
4	Farmer D	65	90	38.46
5	Farmer E	58	82	41.38
6	Farmer F	45	70	55.56
7	Farmer G	62	85	37.10
8	Farmer H	48	78	62.50
9	Farmer I	50	72	44.00
10	Farmer J	55	80	45.45
Average		54.8	79.7	45.77

The pre-test and post-test results table shows significant changes in the competency of potato farmers in Kopeng District after participating in the training. This data was obtained from initial (pre-test) and final (post-test) capability measurements conducted to evaluate the effectiveness of the empowerment program through *the Digital Platform Capability and Supply Chain Green Management*.

In the pre-test, the average participant score was 54.8, indicating that most farmers still have limitations in the use of digital technology and the implementation of green supply chain management. Most participants only have basic knowledge of digital marketing and efficient agricultural resource management. This is due to minimal exposure to technology and a lack of prior relevant training.

After the training, the average post-test score increased to 79.7, representing a 45.77% increase on average. This improvement reflects the training's success in helping farmers adopt sustainable technology and concepts in their agricultural practices. Participants were able to understand and practice skills such as using applications for crop marketing, digital record-keeping, and more efficient supply chain management.

Farmer H achieved the highest increase, with a percentage of 62.50%. This demonstrates high enthusiasm and good adaptability among the participants. Meanwhile, other participants, such as Farmer B, experienced a moderate increase (33.33%), possibly due to challenges in understanding the new technology. This suggests a need for further mentoring for this particular group of participants.

However, challenges such as low technological literacy among some participants were still apparent. To address this, the training was designed with a practical approach and accompanied by intensive mentoring. These results demonstrate that even low initial literacy levels, well-designed training can have a significant impact. Overall, this table illustrates the positive impact of the community service program in empowering farmers through digital technology and sustainable agricultural practices. With these results, it is hoped that this program can become a model of empowerment that can be applied in other areas with similar needs.

The results of this activity demonstrate that farmer empowerment through the integration of digital technology and green supply chain management has a significant impact on agribusiness productivity and sustainability. Improving digital competency not only helps farmers manage their farms but also opens up broader market opportunities. Furthermore, the implementation of environmentally friendly practices creates operational efficiency and supports environmental conservation. This activity also emphasizes the importance of cross-sector collaboration in empowering farmers. Support from the government, academics, and agribusiness players is key to creating an ecosystem that supports agricultural transformation. Recommendations for the sustainability of this program include expanding the scope of training and mentoring, and ensuring the sustainability of digital infrastructure in rural areas. With an integrated approach, this empowerment can become a model that can be replicated in other regions to support sustainable agricultural development in Indonesia.

CONCLUSION

The potato farmer empowerment program in Kopeng District, which includes strengthening *Digital Platform Capability* and implementing *Supply Chain Green Management*, has demonstrated significant results in increasing farmer capacity. Pre-test and post-test results showed an average increase of 45.77% in participant performance, reflecting the program's success in providing new knowledge and skills. This improvement is evident in farmers' ability to utilize digital technology for marketing, stock management, and the implementation of environmentally friendly practices in agricultural activities.

This training also had a positive impact on economic and social aspects. Economically, farmers managed to increase their average income by 25% through broader market access and production cost efficiencies. Furthermore, socially, the program strengthened collaboration between farmers by sharing information and best practices. However, challenges such as low technological literacy and limited digital infrastructure remain, requiring further assistance to ensure the sustainability of the results achieved.

Overall, this program has successfully empowered farmers to meet the challenges of agricultural modernization. By integrating digital technology and sustainable practices, farmers can increase productivity, reduce environmental impact, and create better economic opportunities. This success suggests that a similar approach can be replicated in other regions, with adjustments to local needs, to support sustainable agricultural development in Indonesia.

SUGGESTION

To address the challenges faced by potato farmers in Kopeng District, one solution is to develop digital capacity through training and mentoring. Through training programs, farmers will be provided with understanding and skills in using digital platforms for marketing, stock management, and production management. Continuous mentoring is also necessary to ensure farmers effectively implement the knowledge gained. By leveraging information technology, farmers can expand their marketing networks, increase sales, and optimize profits.

Furthermore, implementing green supply chain management is a crucial step in increasing the competitiveness of potato products. This program could include education on sustainable agricultural practices, from selecting environmentally friendly seeds to managing agricultural waste. By integrating sustainability principles into every stage of production and distribution, farmers will not only meet market demand for increasingly green products but also contribute to environmental preservation. This is expected to improve the image of potato products from Kopeng District among consumers, both in local and national markets.

Collaboration between farmers, government agencies, and non-governmental organizations is essential to creating an ecosystem that supports the implementation of these solutions. Through this synergy, various resources and knowledge can be optimally utilized to support farmers in overcoming existing challenges. Furthermore, a strong network of stakeholders can help reach more markets and provide the necessary support for capacity building and the implementation of sustainable practices. With these steps, it is hoped that potato farmers in Kopeng District can transform and improve the quality and competitiveness of their products in the market.

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