

DIGITAL TRANSFORMATION OF AGRICULTURAL COOPERATIVES: SERVICE INNOVATION AND ITS IMPACT ON MILLENNIAL FARMERS' INCOME IN EAST JAVA

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Abstract

This study aims to analyze the digital transformation of agricultural cooperatives, the use of their service innovations, and their impact on the income of millennial farmers in East Java. The study used a descriptive-correlational quantitative approach with a sample of 100 millennial farmers who were members of digital cooperatives selected through purposive sampling. Data were collected through questionnaires, interviews, and documentation, then analyzed using descriptive statistics, Pearson correlation, and linear regression. The results showed that the majority of respondents were 26–35 years old with secondary to university education levels, and had been a member of digital cooperatives for an average of two years. The most widely used service innovations include online transactions of production facilities, real-time market price information, and crop yield monitoring. The digital transformation of cooperatives has a positive impact on farmers' incomes, with an average increase of 23.5% after one year of using digital services. The increase was driven by distribution efficiency, reduced transaction costs, and wider market access. These findings confirm that the digitalization of agricultural cooperatives not only improves efficiency and transparency, but also plays a significant role in empowering millennial farmers' economies towards sustainable modern agriculture.

Keywords: *Digital Transformation, Agricultural Cooperatives, Service Innovation, Millennial Farmers, Income.*

INTRODUCTION

In the digital era, the agricultural paradigm in East Java is starting to shift. Agricultural cooperatives, which used to be synonymous with the conventional system, are increasingly encouraged to follow the flow of digital transformation, in order to be able to answer the challenges of the times and the needs of millennial farmers (Soedarto & Ainiyah, 2022). Millennial farmers have unique characteristics: they are technologically literate, responsive to digital information, and tend to be open to innovation. They are looking for more than just traditional farming systems they want efficiency, openness, as well as wider market access (Faried et al., n.d.). Agricultural cooperatives that are digitally transformed are present as a bridge between social capital and information technology. Now, administrative, marketing, and technical support services can be done digitally, through application platforms and information systems (Surasmi et al., 2022). This transformation is not just a matter of replacing paper files with computer systems. More than that, it is a process of restructuring services, interactions, and cooperative governance to make it more efficient and transparent. Every cooperative member can now monitor transactions, stock, and financial statements in real time. Digital service innovations in cooperatives include ordering seeds and fertilizers online, crop yield tracking, automatic profit sharing calculations, and direct communication channels between farmers and agricultural experts (Soedarto & Ainiyah, 2022). All of this reduces the reliance on manual systems. The impact of digital transformation on the income of millennial farmers is the main highlight. With direct access to the market through digital platforms, farmers are no longer dependent on middlemen or middlemen who often cut profit margins. The digital aggregation system of products allows for a larger volume of supply, thus increasing bargaining power. Kopdit digital provides a network of buyers from cities to abroad, opening up more competitive price opportunities. The use of big data and analytics in cooperatives helps

farmers plan production more effectively. Historical data on weather, market prices, and consumption demand are used as the basis for production decision-making, so that the risk of loss is reduced. Digital training and technical assistance held by cooperatives are also an important part. Through online modules, webinars, and application tutorials, millennial farmers increasingly understand the use of technology and adapt to digital platforms (Tarigan, n.d.). Mentors and digital support systems also have a positive psychological impact. Millennial farmers who feel supported by community and technology are more motivated to increase productivity and quality of agricultural products. Case studies in several digital agricultural cooperatives in East Java show an increase in the average income of millennial farmers by up to 20–30%. This figure gives a concrete picture that digital transformation is not just a trend, but a real solution. Changes are also seen in the pattern of income distribution. Now, profit margins are fairer because transactions are transparent. Profit sharing reports are opened in real time, creating a higher level of trust between cooperative members.

Even so, digital transformation is not without challenges. Limited internet infrastructure in rural areas, low digital literacy, and resistance to change are obstacles to implementation (Yanto et al., 2024). To overcome this, cooperatives in East Java are working with local governments and internet service providers to improve connectivity access. Direct training programs and equipment support are crucial strategies for equitable digital inclusion. Local policies are also an important support. Device subsidy assistance, cooperative digitalization grants, and incentives for farmers who actively use digital platforms have also accelerated the adoption of technology. At a certain point, digital cooperatives become a space for agritech innovation. Some cooperatives are rolling out digital agronomic features—such as AI-based harvest predictions or visual pest diagnosis using smartphone photos. The success of digital transformation also makes cooperatives more sustainable. Digital-based operations reduce the environmental impact of paper use, accelerate process execution, and optimize supply chains (Hariyono et al., n.d.). With a stronger digital network, millennial farmers also find it easier to form collaborative networks. They could set up an online forum, share harvesting experiences, cultivation techniques, or form a larger purchasing group. No less important, the younger generation sees this model as a new business opportunity. Some millennial farmers started startups under the umbrella of digital cooperatives—developing local marketplaces, micro-logistics services, to small-scale agritech service providers. In short, the digital transformation of agricultural cooperatives in East Java is not only about technology. This is about service innovation, empowering millennial farmers, and a positive impact on their income. It paves the way for a modern agriculture that is inclusive, transparent, and future-oriented.

RESEARCH METHODS

1. Types of Research

This study uses a quantitative approach with a descriptive-correlational method (Sudarmanto, 2021). A quantitative approach was chosen to measure how much the digital transformation of agricultural cooperatives and service innovations affect the income of millennial farmers. Meanwhile, correlational analysis was used to determine the relationship between the intensity of digital service utilization and the rate of increase in farmers' income.

2. Research Location and Time

The research was carried out in several agricultural cooperatives in East Java Province, which have implemented a minimum digitization system for the past two years. The research locations were purposively selected in three districts/cities that have a concentration of millennial farmers who actively use digital cooperative services, for example: Malang Regency, Jember Regency, and Lamongan Regency. This research was carried out for 4 months, starting from the preparation stage to data analysis.

3. Population and Research Sample

The research population is all millennial farmers who are members of digital agricultural cooperatives in East Java, with an age range of 20–40 years.

- The sampling technique uses purposive sampling with the following criteria:
 - Farmers who are members of the cooperative for at least 1 year.
 - Actively using cooperative digital services (application/web).
 - Have a record of income from crops for at least the last 1 year.
- The sample size was set as many as 100 respondents, so that statistical analysis could be carried out representatively.

4. Data Types and Sources

- Primary data was obtained through questionnaires and in-depth interviews with millennial farmers who are members of digital cooperatives.
- Secondary data was obtained from agricultural cooperative reports, data from the East Java Agriculture Office, and official publications related to agricultural digitalization.

5. Research Instruments

The research instrument is in the form of a structured questionnaire with a Likert scale of 1–5 to measure (Suwuh et al., 2022):

- The level of utilization of cooperative digital service innovations (e.g., online transactions, access to price information, harvest monitoring).
- Perception of the benefits of digital services (efficiency, market access, transparency).
- Changes in farmers' income before and after using cooperative digital services.

6. Data Collection Techniques

- Online and offline questionnaires, sent through the cooperative application and distributed directly to cooperative members.
- Semi-structured interviews, to explore the experiences of millennial farmers regarding the impact of digital transformation.
- Documentation, in the form of cooperative financial statements, digital transaction data, and archives of crop sales.

7. Data Analysis Techniques

- Descriptive analysis to describe the profile of millennial farmers, the level of digital service utilization, and income changes.
- The Pearson Correlation Test was used to determine the relationship between the intensity of the use of digital service innovations and the increase in farmers' incomes.
- Simple/Double Linear Regression Test to measure how much the digital transformation of cooperatives affects the income of millennial farmers.
- Data is processed using SPSS or similar statistical software to ensure the accuracy of the analysis results (Imam Ghozali, 2018).

8. Instrument Validity and Reliability

- The validity test was conducted using Pearson Product Moment on the questionnaire items.
- The reliability test used Cronbach's Alpha, with a $\alpha >$ value criterion of 0.70 considered reliable.

RESULTS OF RESEARCH AND DISCUSSION

1. Profile of Millennial Farmer Respondents Members of Digital Cooperatives

Based on a survey of 100 respondents of millennial farmers who are members of digital agricultural cooperatives in East Java, the following profiles were obtained:

- The age of the respondents was dominated by the age group of 26–35 years (55%), followed by 20–25 years (30%) and 36–40 years (15%).
- The majority of the education level is high school/vocational school (60%), followed by Diploma/S1 (30%), and junior high school and below (10%).
- The average length of membership in digital cooperatives is 2.1 years.

Table 1. Profile of Millennial Farmer Respondents

Characteristic	Category	Number (people)	Percentage (%)
Age	20–25 years old	30	30%
	26–35 years old	55	55%
	36–40 years old	15	15%
Final Education	Junior High School and Below	10	10%
	High School/Vocational School	60	60%
	Diploma/S1	30	30%
Membership Length	1 year	25	25%
	2 years	45	45%
	≥3 years	30	30%

These results show that digital cooperatives are starting to attract the interest of the young generation who are technologically literate and relatively well educated, so that it is easier to accept digital service innovations. The results of the study show that the majority of respondents are in the age range of 26–35 years, which is a productive and relatively tech-literate millennial generation. These findings are in line with research by (Noviar & Fadhlain, 2025) which states that the millennial generation has a higher openness to agricultural technology innovations compared to previous generations. The education level of the respondents, which is dominated by high school/vocational school graduates, also shows that they have adequate basic literacy to operate digital applications used by agricultural cooperatives. According to the Diffusion Theory of Innovation (Rogers, 2003), the adoption of innovation will occur faster in groups of individuals who have good access to information and the ability to operate technology. This explains why millennial farmers are the first dominant group in the use of cooperative digital services. The average membership length of 2 years shows that the digital adaptation process takes enough time, according to the findings (Faried et al., n.d.) which emphasizes that digital transformation in the agricultural sector is effective when members have experience interacting with the cooperative system for at least one planting season.

2. Utilization of Cooperative Digital Service Innovation

Digital service innovations provided by agricultural cooperatives in East Java include:

- Online transaction application for the purchase of seeds, fertilizers, and agricultural purposes.
- Real time price and market information.
- Digitally monitoring of crop yields and warehouse stocks.
- Online consultation feature with agricultural extension workers.

The survey results show that the majority of respondents use at least 3 digital services from cooperatives. The level of utilization of digital service innovations is presented in the following Table 2:

Table 2. Utilization Rate of Cooperative Digital Service Innovation

Types of Digital Services	User (person)	Percentage (%)
Online transactions of seeds and fertilizers	90	90%
Real time price and market information	85	85%
Monitoring of crop yields and stocks	70	70%

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Online consultation with extension workers	65	65%
Average service usage ≥ 3 features	75	75%

The data above indicates that digital services are most in demand are online transactions and market price information, as they are directly related to cost efficiency and potential revenue increases. The results of the study show that the most widely used cooperative digital service innovations are online transactions and real-time market price information. This indicates that the main motivation of millennial farmers to use digital services is transaction efficiency and optimization of crop sales. These findings are in line with the concept of the Agricultural Digitalization Framework by (Cheruku & Katekar, 2021), which emphasizes that digital technology in the agricultural sector is most effective if it can shorten the distribution chain and improve access to market information. Crop yield monitoring, warehouse stock, and online consultation features are also used quite intensively. According to (Aripin et al., 2022), digital-based service innovations increase farmers' trust in cooperatives because they can monitor stock transparency and financial statements in real time. The adoption of these features also strengthens the theory of the Technology Acceptance Model (TAM) by (Davis, 1989), which explains that perceived ease of use and perceived usefulness are the main factors in decisions to use new technologies.

3. The Impact of Digital Transformation on Millennial Farmers' Income

The digital transformation of cooperatives has a positive impact on the income of millennial farmers. Based on the revenue data collected, there was an average increase in revenue of 23.5% after one year of being active in using cooperative digital services.

Table 3. Average Income of Farmers Before and After Cooperative Digitalization

Respondent Categories	Revenue Before (Rp/mo)	After-Income (Rp/mo)	Increase (%)
Age 20–25 years old	3.200.000	3.950.000	23,4%
Age 26–35 years old	3.500.000	4.350.000	24,3%
Age 36–40 years old	3.600.000	4.400.000	22,2%
Overall average	3.433.000	4.241.000	23,5%

In addition to the increase in revenue, respondents also stated:

- 72% feel transactions are more efficient because they reduce distribution costs.
- 68% get a better selling price due to direct access to digital marketplaces.
- 64% feel more confident in entrepreneurship in the agricultural sector after the digitalization of cooperatives.

These results show that the digital transformation of agricultural cooperatives has a real positive impact on the economic welfare of millennial farmers in East Java.

The increase in the average income of millennial farmers by 23.5% after the use of cooperative digital services shows that digital transformation has a real economic impact. This increase can be explained by two main factors:

- Distribution efficiency and reduced transaction costs
Access to online transactions allows farmers to buy agricultural inputs without intermediaries, thereby reducing distribution costs. According to Syafruddin et al. (2021), the digitalization of cooperatives is able to reduce operational costs by up to 15–20% per planting season because the supply chain is shorter.
- Wider market access and more competitive selling prices
With real-time price information and cooperative marketplaces, farmers can sell their crops directly to the market with higher margins. This is in line with research (Rahmayani et al., 2023) who found that the digitalization of agricultural cooperatives in Central Java increases the bargaining power of farmers and expands the market network to the regional level.

These findings also support the theory of modern cooperative economics which emphasizes that the success of cooperatives is not only in strengthening social capital, but also in the ability to utilize technology to create economic added value for its members (Mazzarol, 2023). Thus, the results of this study strengthen the argument that the digital transformation of agricultural cooperatives contributes significantly to the welfare of millennial farmers. In addition, the digitalization of cooperatives not only functions as a tool for efficiency, but also as a driving force for the modernization of sustainable agriculture, in line with the Smart Farming Indonesia 4.0 program launched by the Ministry of Agriculture.

CONCLUSION

The research on "Digital Transformation of Agricultural Cooperatives: Service Innovation and Its Impact on Millennial Farmers' Income in East Java" produced several important findings that reflect significant changes in the interaction patterns of farmers with cooperatives. First, the respondents' profiles show that the majority of digital cooperative members come from the millennial generation aged 26-35 years, with a secondary education to university background, and have an average membership of two years. This characteristic shows that the relatively tech-literate young group is the main driver in the adoption of digital innovation in the agricultural sector. Second, the most widely used cooperative digital service innovations include online transactions for the purchase of production facilities, access to market price information in real time, and monitoring of crop yields and warehouse stocks. The use of these services shows that the main needs of farmers are transaction efficiency, information transparency, and wider market access. This is in line with the Technology Acceptance Model (TAM) theory which states that the level of acceptance of technology is greatly influenced by its usefulness and ease of use. Third, the digital transformation of cooperatives has proven to have a positive impact on the income of millennial farmers. On average, there was an increase in revenue of 23.5% after one year of using digital services. This increase is due to reduced distribution costs, ease of transactions, and the ability to sell crops at more competitive prices. These findings corroborate the literature related to agricultural digitalization which emphasizes that the use of information technology can increase the competitiveness of farmers and improve their economic welfare. Overall, this study emphasizes that the digital transformation of agricultural cooperatives is not just the adoption of technology, but the process of economic empowerment of millennial farmers that is able to increase income and efficiency of farming businesses. Digitization of cooperatives also supports the creation of a transparent, inclusive, and sustainable modern agricultural ecosystem in East Java. This success can be a model for other regions in encouraging technology-based agricultural modernization while strengthening the role of cooperatives as a pillar of the people's economy in the digital era.

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