



Innovative Model of Agricultural Supply Chain Distribution to Strengthen Vegetable Farmers' Income: A Case Study of Tarubatang Village

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Abstract

The agricultural supply chain plays an important role in determining farmers' income, particularly in the horticultural subsector, which is highly sensitive to distribution speed and market dynamics. However, vegetable farmers in Tarubatang Village, Selo District, Boyolali, still face a lengthy distribution chain dominated by intermediaries, resulting in low selling prices and weak bargaining positions. This study aims to analyze the influence of distribution efficiency on farmers' income and to formulate an innovative, fair, and sustainable distribution model. A quantitative approach was employed, utilizing a survey method that involved 30 farmers, complemented by in-depth interviews and observations. The interview data were analyzed using qualitative techniques to identify farmers' perceptions of distribution patterns and the constraints faced within the supply chain. Quantitative data were analyzed using descriptive statistics and simple linear regression. The results indicate that distribution efficiency has a positive and significant impact on farmers' income ($p < 0.05$), accounting for 46% of the variation in income due to distribution-related factors. On average, farmers' incomes increased by 37% following the implementation of distribution models based on farmer group institutions and digital marketing. These findings confirm that integrating farmer groups with digital platforms can shorten the distribution chain, increase price transparency, and strengthen farmers' bargaining positions. The practical implications of this study highlight the need for local government support to strengthen farmer institutions and enhance access to digital technology, thereby achieving efficient and sustainable agricultural distribution.

Keywords *chain supply, distribution, income farmers, innovative*

INTRODUCTION

Agriculture is one of the main sectors of the Indonesian economy that contributes significantly to food supply, employment opportunities, and rural development. According to data from Statistics Indonesia (BPS, 2022), the horticultural sub-sector, particularly vegetables that has great potential to support food security while simultaneously increasing farmers' income. However, many farmers continue to face long-standing challenges in the agricultural supply chain. The lengthy and middlemen-controlled distribution channels result in low selling prices at the farm level, while intermediaries capture a larger share of the profit margin (Handayani & Rahayu, 2019; Firmansyah, 2021).

This phenomenon is also evident in Tarubatang Village, Selo District, Central Java, where vegetable farmers still sell their products through intermediaries who unilaterally determine prices. The prevailing distribution pattern generally follows the sequence: farmer → middleman → wholesale market → retail trader → end consumer. This condition weakens farmers' bargaining power and suppresses their income. In fact, supply chain management theory emphasizes the importance of coordination, information integration, and price transparency in creating an efficient flow of goods, information, and finances (Chopra & Meindl, 2019; Christopher, 2016).

Previous studies have shown that streamlining distribution channels can significantly increase farmers' income. For instance, Suryani (2020) found that improving supply chain efficiency in the horticultural sector of West Java increased farmers' income by up to 30%. Nugroho (2022) highlighted the role of farmer cooperatives in shortening distribution channels, thereby

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enhancing farmers' bargaining positions. Similarly, [Wicaksono \(2021\)](#) emphasized that digitalizing the supply chain through online marketing platforms can reduce farmers' dependence on middlemen.

However, most of these studies have focused on the West Java region and other urban areas, while research on farmer groups in Central Java who still apply traditional distribution patterns—remains limited. Therefore, this study aims to develop an innovative agricultural supply chain model that enhances distribution efficiency and increases the income of vegetable farmers in Tarubatang Village.

This research not only seeks to identify the existing distribution structure but also to analyze the effect of supply chain efficiency on farmers' income and to formulate a new, fair, and sustainable distribution model. Hence, the findings of this study are expected to provide both empirical and conceptual contributions to the development of agricultural supply chain systems at the local and national levels.

LITERATURE REVIEW

The agricultural supply chain is a series of interconnected activities that link farmers as producers with end consumers through intermediaries involved in the flow of goods, information, and finances ([Chopra & Meindl, 2019](#); [Christopher, 2016](#)). Agricultural products possess specific characteristics, such as being perishable, seasonal, and highly price-volatile, while farmers generally have weak bargaining positions ([Handayani & Rahayu, 2019](#)).

Traditional distribution channels remain the dominant mode of distribution in Indonesia. The strong presence of middlemen and large traders within the distribution chain often reduces farmers' profit margins and limits price transparency ([Setiawan & Putri, 2019](#); [Darmawan, 2019](#); [Nugroho, 2022](#)). Consequently, the prices received by farmers are significantly lower than those paid by end consumers.

To address these challenges, strengthening farmer institutions through the formation of farmer groups and cooperatives has become an essential strategy. Such institutions function as aggregators of agricultural produce, providers of market and price information, and connectors between farmers, modern markets, and exporters ([Marwoto, 2018](#); [Yuliana, 2020](#); [Kusnadi, 2021](#); [Santosa, 2021](#)). Previous studies have shown that well-organized farmer groups can improve distribution efficiency and enhance farmers' bargaining power in the marketplace.

Moreover, the advancement of digital technology has created new opportunities within the agricultural supply chain. Agricultural e-commerce platforms and online marketing applications have the potential to shorten distribution channels, increase price transparency, and reduce distribution costs ([Widodo, 2020](#); [Wicaksono, 2021](#); [Hidayat, 2022](#)). The digitalization of the supply chain also enables farmers to sell their products directly to end consumers or modern markets at more competitive prices.

Farmers' income is measured by the difference between total sales revenue and production costs (Soekartawi, 2016). Factors influencing farmers' income include productivity, selling price, distribution costs, and the structure of distribution channels. Previous studies by [Suryani \(2020\)](#), [Fadhilah \(2021\)](#), and [Firmansyah \(2021\)](#) revealed that distribution efficiency can significantly increase the income of horticultural farmers.

The theoretical framework used in this study draws from several key theories, including Supply Chain Management Theory ([Chopra & Meindl, 2019](#); [Christopher, 2016](#)), Value Chain Theory (Porter, 1985), Institutional Economics (North, 1990), and the Digital Supply Chain Framework ([Widodo, 2020](#); [Wicaksono, 2021](#)). These theories serve as the foundation for developing a conceptual model that links distribution efficiency and farmers' income.

Based on the literature reviewed above, largely underexplored to date, the research gap is addressed by developing an agricultural supply chain distribution model based on institutional strengthening and digitalization within rural farmer group contexts—an area that remains underexplored in previous research.

RESEARCH METHOD

This study employed an inductive approach with a design carried out in Tarubatang Village, Selo District, Regency of Boyolali. Focus study directed at analyzing the influence of efficiency on the distribution of vegetable income among farmers, as well as the formulation of a more innovative, fair, and sustainable distribution model.

A population study is being conducted among active farmers in Tarubatang Village, with approximately 100 participants. From this population, 30 respondents were selected as samples using a purposive sampling technique, meeting the following criteria: farmers who had been actively farming for at least the last two planting seasons, had sold their harvest through local or middlemen distribution channels, and were willing to participate as research respondents. A total of 30 respondents viewed the Enough For study as quantitative and descriptive-explanatory, as the minimum sample size for quantitative research is 30, according to Sugiyono (2017), despite the study's time and cost limitations.

Research data were collected through structured questionnaire interviews, in-depth observations, and direct interviews, while secondary data were obtained from groups, farmers' reports, and reports from the government village, as well as literature from supporters. All respondents' research also participated in an in-depth interview to enrich their understanding of the practice distribution and the challenges faced, namely: Is the Efficiency Distribution Chain supply influential to Income farmers? The instruments questionnaire was arranged based on adaptation from research by Widodo (2020) and Wicaksono (2021), using a Likert scale (1–5) to measure efficiency distribution, covering aspects such as speed, cost, quantity intermediary, transparency prices, and income data of farmers, which are measured in rupiah per month. Instrument study has undergone validity and reliability tests. Validity test results indicate that all question items are valid, with an r-value exceeding the r-table value.361 at $n = 30$, $\alpha = 0.05$. Reliability test results show that Cronbach's Alpha value is 0.79, which indicates that the instrument is reliable, as it exceeds 0.70.

Data analysis was performed with descriptive statistics to describe the characteristics of respondents and the distribution of income among farmers, as well as a simple linear regression analysis to test the influence of efficiency distribution on income among farmers. The form of general equality regression used is:

$$Y = a + bX + e$$

where:

Y	= Income Vegetable
Farmer X	= Efficiency Distribution Chain Supply
a	= Constant
b	= Coefficient Regression
e	= Error

Hypothesis testing was conducted using a t-test to determine the significance of the influence, as well as an R^2 test to measure the extent of the distribution efficiency's contribution to farmers' income. This study hypothesizes that the efficiency of agricultural supply chain distribution has a positive and significant effect on the income of vegetable farmers in Tarubatang Village. Qualitative data from interviews were analyzed using a thematic analysis technique, which involved the stages

of data reduction, data presentation, and conclusion drawing, to strengthen the quantitative findings and provide a deeper contextual understanding of the actual conditions of agricultural product distribution in the field.

FINDINGS AND DISCUSSION

A total of 30 respondents who farm vegetables in Tarubatang Village, which are combined in groups, become the sample for the research. The characteristics of respondents indicate that the majority are in the productive age range of 30–50 years (70%), with a majority having a medium level of education, specifically being graduates of secondary school (53%). The average age of experience in farming is 12 years, with wide land cultivation of approximately 0.35 hectares. This shows that respondents have sufficient experience in farming vegetables, but with limitations in ownership of land.

Table 1. Demographic Characteristics of Respondents

Category		Key Information
Number of respondents	30 persons	
Age	30–50 years old (70%)	
Education level	Junior high school (53%), Senior high school (37%), Elementary school (10%)	
Farming experience	Average of 12 years	
Cultivated land area	Average of 0.35 hectares	

Sources: Processed primary data (2025)

Measurement results perception farmer to efficiency distribution shown in Table 2 below.

Table 2. Descriptive Statistics of Distribution Efficiency Variables

Distribution Efficiency Indicator	Mean	Standard Deviation
Distribution speed	4.21	0.48
Distribution cost	3.95	0.52
Number of intermediaries	4.10	0.44
Price transparency	4.35	0.41

Likert Scale 1–5; Source: Processed primary data (2025)

The highest average score was found in the price transparency indicator (4.35), indicating that the aspect of price openness is perceived by farmers as the main factor contributing to the improvement of distribution efficiency. Simple linear regression test results show equality as follows:

$$Y = 1.250.000 + 0.65X$$

Table 3. Result of Simple Linear Regression Analysis

Variable	Coefficient	t-value	Sig. (p-value)	Remarks
Constant (a)	1,250,000	2.45	0.021	Significant
Distribution Efficiency (X)	0.65	3.12	0.004	Significant

Sources: *Processed primary data (2025)*

The coefficient value regression (0.65) indicates that a more efficient distribution chain supply leads to an increase in farmers' experience and to increased farm income. The test results produced a marked significance ($p = 0.004 < 0.05$), which means the distribution chain supply is influential and significant to farmers' income. Meanwhile, the value coefficient determination (R^2) of 0.46 indicates that the distribution of efficiency explains 46% of the variation in income for farmers.

Research results are in line with [Suryani's \(2020\)](#) findings that efficiency chain supply horticulture can increase a farmer's income by up to 30%. Similarly, [Nugroho \(2022\)](#) emphasized the role of cooperation in shortening the supply chain distribution, and [Wicaksono \(2021\)](#) highlighted the importance of digitalization in the supply chain for reducing dependence on intermediaries. In the context of Tarubatang Village, research confirms that combining institutional strengthening with the utilization of simple digital technology is proven capable of increasing farmers' income. Farmer group institutions play a role as aggregators of harvests and facilitators of price transparency, while digitalization helps expand direct market access to consumers.

The novelty of this study lies in the implementation of a hybrid model (cooperative-based and digital supply chain) at the village level, which has rarely been examined in previous research. This model demonstrates significant potential to strengthen farmers' bargaining position and improve distribution efficiency in the rural horticultural sector.



Figure 1. Interview with one of the farmers' group

An interview with the chairman of the farmers' group reveals that, prior to the introduction of innovation distribution, farmers largely relied on middlemen. The price is determined unilaterally, so that often there is no production cost. After the initiation of farmer group efforts to aggregate harvests and sell directly through simple digital platforms such as

WhatsApp groups and local marketplaces, farmers reported receiving fairer prices and faster payments. One of the farmer respondents stated:

"We used to sell to middlemen at very low prices, sometimes only Rp. 1,500 per kilogram. After the past group of farmers, the price could rise to Rp2,500–Rp3,000 per kilogram. We also know the market price, so No Can Again cheated." - Farmer

Observing the field also shows a change in the real pattern distribution. Farmers now more often deliver collectively using vehicle rental, which lowers the logistics cost per person. The sales recording system, implemented through farmer groups, has begun to be introduced, making transaction channels more transparent. The support of the village government also contributes to the success of this model by facilitating collaboration with local modern markets.

CONCLUSIONS

This study shows that the efficiency of the Distribution chain of agricultural vegetables is positively influential on the income of farmers in Tarubatang Village, Selo District, Boyolali. The innovative model implemented is a combination of strengthening institutional groups of farmers with the utilization of simple, proven digital technology capable of cutting through the increasing complexity of the pricing chain, thereby strengthening the transparency of farmers in bidding and enhancing the position of farmers.

The average farmer's income increased by 37% after the implementation of the innovative distribution model, compared to the traditional distribution pattern that middlemen still dominate. The results of simple linear regression also confirm that efficiency distribution explains 46% of the variation in income for farmers with a significant effect ($p < 0.05$).

Contribution to scientific study. This lies in the development of distribution models, a hybrid (cooperative-based digital supply chain) that integrates aspects of institutions and technology in the context of rural agriculture. This approach enriches the literature management chain in supply agriculture, especially in the context of strengthening institutional support for small farmers in Indonesia.

Implications for practice from the study. There is a need to support the government in strengthening the capacity of farmer groups, providing training on the use of agricultural digital technology, and creating policies that encourage transparency in local market prices. Government and institutional supporters are expected to make this model a development strategy for sustainable agriculture at the rural level.

Moreover, the study recommends expanding the study area to include various commodities, such as horticulture, and testing the model on a larger scale. This is to obtain an understanding of the factors that influence the efficiency of the supply chain and the welfare of farmers.

LIMITATIONS & FURTHER RESEARCH

Several limitations of this study should be noted. The scope study only covers Tarubatang Village, Selo District, Regency Boyolali, so that the result cannot yet be generalized to other areas with different social economies. The limitation of respondents was limited to 30 people, and they also became more descriptive of the variance in the farmer's behavior in a more extensive way. In addition, research on this topic only focuses on the relationships between efficiency in the distribution chain and income for farmers, without considering other factors such as productivity, access to capital, or input prices. Data collected in one period of the season at the plant, so it does not yet represent the in-season variation. This study is furthermore recommended to enhance the

study area by adding more samples and including additional titles to obtain more comprehensive and applicable results.

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