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SOCIOECONOMIC IMPACTS AND VALUE CHAIN STRUCTURE OF THE FREE NUTRITIOUS MEAL (MBG) PROGRAM ON LAYING HEN FARMERS: STRENGTHENING FOOD SOVEREIGNTY WITHIN THE ASTA CITA FRAMEWORK IN THE GREATER MALANG AREA, EAST JAVA, INDONESIA

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ABSTRACT

This study examined a government food-based program, shifting from a conventional focus on nutritional outcomes to assess its impact on the welfare of poultry-farming households participating in the Free Nutritious Meal (MBG) supply chain in Greater Malang, East Java, Indonesia. The study used purposive sampling of 320 farming households and Structural Equation Modeling (SEM) to examine relationships among supply chain efficiency, MBG policy impact, farmer satisfaction, and household welfare. The findings indicated that supply chain efficiency positively and significantly affected household welfare (β = 0.940) and farmer satisfaction (β = 0.109). The MBG policy impact also positively and significantly affected household welfare (β = 0.574) and farmer satisfaction (β = 0.600), while farmer satisfaction significantly improved household welfare (β = 0.320). Farmer satisfaction also mediated the effects of supply chain efficiency (β = 0.035) and MBG policy impact (β = 0.192) on household welfare. These findings demonstrated that MBG generated economic benefits through improved supply chain efficiency, market opportunities, and farmer satisfaction.

***Keywords*:** Supply chain efficiency, MBG policy impact, Farmer satisfaction, Household welfare, Structural equation model.

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1. INTRODUCTION

The national food system should focus on ensuring food availability, accessibility, affordability, quality, and sustainability while also generating financial gains for stakeholders throughout the value chain, rather than simply increasing food production. Given that the Indonesian government has made food sovereignty and self-sufficiency important priorities for the country's development, this viewpoint is especially pertinent. The Asta Cita (Eight-Point Agenda) and the 2025–2029 National Medium-Term Development Plan (RPJMN), which prioritize food self-sufficiency, local economic growth, downstream industrialization, and human resource development, reflect this tendency. (Bappenas, 2026).

The Free Nutritious Meal (MBG) Program plays a crucial role in this framework; it can create organized demand for food and enhance the quality of public nutrition and consumption. Through Nutrition Fulfillment Service Units (Satuan Pelayanan Pemenuhan Gizi, SPPG), the MBG program began in phases on 6 January 2025 to improve beneficiaries' nutritional condition and promote local economic empowerment by procuring food ingredients from farmers, fishermen, Micro, Small, and Medium Enterprises (MSMEs), and local companies. The MBG program can generate comparatively stable institutional demand for domestic food producers and suppliers, given the scale of the requirements (Oktarezki et al., 2026). The MBG program's development further supports this viewpoint. According to the National Nutrition Agency (BGN), the MBG program had established 19,188 SPPGs across 38 provinces as of 31 December 2025 (Oktarezki et al., 2026), serving more than 55.1 million beneficiaries. More than 46,000 MSMEs had also participated as raw material suppliers. This illustrates how the MBG is evolving into a food demand ecosystem that affects local economic activity, employment, commerce, distribution, and production. As a result, the program's efficacy cannot be measured only by the amount of food distributed or recipients' nutritional status; it must

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also be evaluated by its ability to create value, support domestic producers, and improve the well-being of upstream business owners.

At the nexus of food systems and nutrition policy, commercial chicken eggs have a critical position. They are a readily available source of animal protein that may be used in a variety of recipes. Eggs are also a nutrient-dense animal-source food, and a randomized controlled trial reported that introducing eggs into early complementary feeding improved child growth (Iannotti et al., 2017; Azizah et al., 2026). Eggs are a menu item in the MBG program, and the government encourages the program's supply chain to prioritize local goods, including eggs, and source production from nearby farms. This shows how domestic market growth, nutrition policy, and the laying-hen industry are converging. Additionally, BGN authorized the program's supply chain in East Java to maximize the use of egg-based dishes to boost uptake of local production when farm-gate egg prices came under downward pressure. This background is especially pertinent locally, particularly in Malang Regency, a major center for East Javan commercial laying-hen production. Malang Regency has a substantial base of individual agricultural businesses in the livestock subsector, according to the 2023 Agricultural Census (BPS-Statistics Indonesia, 2023; BPS-Statistics of Malang Regency, 2023); production data also show that the regency is a major hub for East Java's commercial laying-hen egg production. According to the 2023 census (ST2023; BPS-Statistics Indonesia, 2024), East Java had roughly 39.32 million commercial laying hens in 2023, of which 4.26 million were in Malang Regency. That same year, Malang Regency produced over 187,019 tons of eggs from commercial laying hens. Malang Regency is strategically positioned to investigate the relationship between institutional demand for the MBG program and the economic sustainability of laying hen farmers because of this significant production base (Oktarezki et al., 2026). Fig. 1 presents a geographical map of the Greater Malang area in East Java, Indonesia, which provides the spatial context for this study.

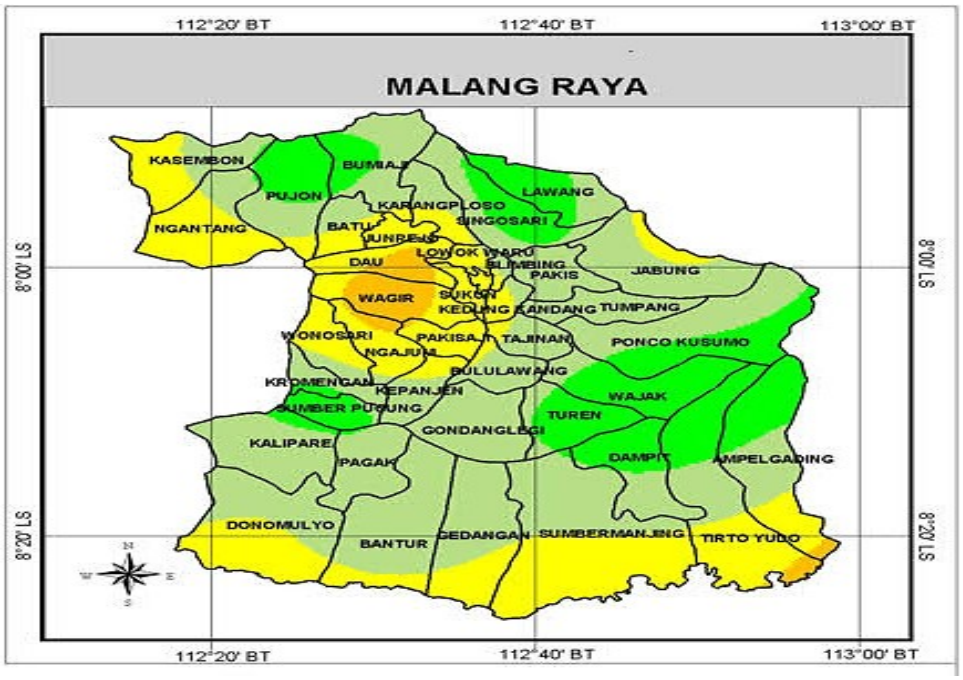


Fig. 1: Map of the Greater Malang area, East Java, Indonesia.

Despite its substantial egg production capacity, the laying-hen sector faces economic challenges from high feed costs and fluctuating egg prices. Evidence from Blitar Regency, East Java, indicates that feed accounts for approximately 60–80% of total production costs, highlighting its importance in determining farm profitability (Afandi et al., 2020). In addition, egg price volatility in Indonesia has been linked to oversupply, rising feed and day-old chick (DOC) prices, demand fluctuations, and supply chain disruptions (Ilham & Saptana, 2019; Mubarok et al., 2024). These conditions create uncertainty for farmers in maintaining profit margins and household income. Nevertheless, several Indonesian regions have reported small-scale laying-hen farming as profitable (Mustafa et al., 2023). Consequently, stable market access, reliable purchasing arrangements, and efficient supply chain mechanisms are important for strengthening the economic sustainability of laying-hen farming. In this context, the MBG program may create additional institutional demand for locally produced eggs; however, its contribution to farmer welfare depends on how procurement arrangements, prices, and economic benefits are distributed among supply chain participants.

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The study population comprises about 1,600 company owners or laying-hen farmers in the Malang region, according to the 2023 Agricultural Census (BPS-Statistics of Malang Regency, 2023), and represents a potential producer base within the egg supply chain. The size of this population suggests that the MBG program's effects on farmers may affect the local food chain and the viability of the livestock industry, in addition to being significant at the individual level. MBG-driven changes in demand patterns can create both opportunities and challenges for farmers, especially regarding market certainty, selling prices, sales volume, product quality, and bargaining power within the value chain, given the comparatively large number of producers and high egg production capacity. As a result, Malang Regency offers a relevant empirical framework for examining whether the institutional demand created by the MBG program actually yields greater socioeconomic benefits for agricultural households.

Viewing the MBG program as an ecosystem that includes egg producers, collectors or merchants, distributors, cooperatives, suppliers, SPPGs, and beneficiaries makes a value-chain perspective essential. This structure determines how economic value, risks, knowledge, transaction costs, and margins are distributed. Because value added may concentrate among downstream players in extended supply chains (Reardon & Timmer, 2007), price increases paid by purchasers do not always translate into higher producer earnings. Shorter, more efficient supply chains, by contrast, can increase market access, lower transaction costs, and strengthen the link between institutional demand and local production. Given the ongoing nature of egg production, these concerns are especially pertinent to laying-hen producers. Beyond price swings, high feed costs, working capital requirements, and the risk of price declines when supply outpaces demand, farmers must also contend with steady market demands. The MBG initiative could create an institutional market that absorbs eggs more reliably. To realize these advantages, fair pricing, guaranteed purchasing, prompt payments, attainable quality standards, and a value distribution that is not unduly concentrated among distributors or intermediaries are necessary.

Experience from school feeding programs elsewhere suggests that public procurement can create structured markets for local producers. Public food procurement has been described as a transformative instrument for sustainable food systems (Swensson & Tartanac, 2020; Stein et al., 2022; Aljaafreh, 2026; Sulaiman et al., 2026; Sumule et al., 2026), and its outcomes depend on how procurement rules and institutional arrangements are designed (Kelly & Swensson, 2017; Swensson, 2018). Home-grown school feeding links school meals to local agricultural production, and trials have assessed its agricultural, nutritional, and educational outcomes (Masset & Gelli, 2013). In Brazil, where at least 30% of federal school-feeding resources must be spent on family-farm products, direct procurement has been associated with higher family-farm production value, income, and employment (Diniz Oliveira et al., 2025), and positive effects on gross domestic product (GDP) have also been reported for farm-to-school purchasing incentives (Krasnoff et al., 2023). School-meal procurement from local family farms can also reshape menu composition (Soares et al., 2017) and structure markets that support more resilient farming systems (Valencia et al., 2019). Empirical evidence on how institutional demand from the Indonesian MBG program translates into the welfare of egg-producing households is still scarce.

Given that the MBG is a nationwide program with substantial demand, its implications for food producers deserve closer attention. This study views the MBG as a food-demand policy tool that can influence the structure of the domestic market, rather than just a nutrition program. Important questions include whether the MBG's increased demand for eggs improved the welfare and income of egg-farming households, how these benefits materialize, which actors capture the most value-added, farmers' bargaining power, and how much the value chain structure supports the sustainability of domestic egg production. This study makes three original contributions. First, it shifts the MBG's emphasis from beneficiaries and nutritional outcomes to socioeconomic outcomes for food producers, particularly egg-raising households. Second, it uses the value chain structure to explain how institutional demand translates into income, market stability, value addition, and welfare. Third, it connects the Asta Cita framework with the MBG, the egg value chain, farmer welfare, and food sovereignty. From this viewpoint, food sovereignty is defined as both the ability to produce food domestically and the capacity to create a production and distribution ecosystem that gives producers financial incentives to keep producing. Therefore, this study examines the socioeconomic impacts of the MBG program on laying-hen farmers in the Greater Malang area, East Java, Indonesia. Specifically, it investigates the effects of supply chain efficiency and MBG policy impact on farmer satisfaction and household welfare, including the mediating role of farmer satisfaction. The study also considers the value chain structure within the framework of food sovereignty and Asta Cita.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The study was conducted in Malang Regency, East Java, Indonesia, and an important agricultural and livestock production area comprising 33 districts. Fig. 1 shows the study area. The area was purposively selected because of its substantial laying-hen farming population and strategic role in East Java's egg production system. According to the 2023 Agricultural Census, approximately 1,600 laying-hen farming enterprise owners made up the study population

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(BPS-Statistics of Malang Regency, 2023). The study also selected Malang Regency because MBG promotes locally produced food commodities, creating potential linkages between local egg production and institutional procurement. Therefore, the area provides an appropriate setting for examining the socioeconomic impacts of the MBG program on laying-hen farmers.

The study population consisted of approximately 1,600 laying-hen farming enterprise owners in Malang Regency. The study used purposive sampling to select respondents relevant to the research objectives. A total of 320 farming households participated. Respondents were selected based on their relevance to laying-hen farming and the study's focus on supply chain efficiency, MBG policy impact, farmer satisfaction, and household welfare.

The study examined four main constructs: supply chain efficiency, MBG policy impact, farmer satisfaction, and household welfare. Supply chain efficiency represented the effectiveness of supply chain processes relevant to farmers. MBG policy impact reflected farmers' perceptions of the program's effects on their farming activities and market opportunities. Farmer satisfaction represented respondents' evaluations of their participation and experiences within the MBG-related supply chain. Household welfare reflected farming households' socioeconomic conditions. The study measured these constructs using questionnaire items administered to respondents.

2.2. Source of Data Collection

In the Greater Malang region of East Java, Indonesia, poultry-farming households involved in the MBG supply chain provided the study's primary data. Researchers selected 320 respondents using purposive sampling based on predefined participation criteria for a structured residential survey. The study used a standardized questionnaire to gauge supply chain efficiency, the effect of the MBG policy, farmer satisfaction, and household welfare. To gather respondents' opinions and experiences about their participation in the MBG value chain, the questionnaire included closed-ended statements scored on a Likert scale. The study used direct, in-person questionnaire administration to minimize incomplete responses and ensure respondents understood each topic. The study assessed the validity and reliability of the instrument before the main survey. Cronbach's Alpha was used to assess reliability, and the instrument showed satisfactory internal consistency. Structural Equation Modeling (SEM) was then used to evaluate the gathered data and examine the direct and indirect correlations between the study variables.

2.3. Sampling Procedure and Sample Size

This study used purposive sampling to select poultry-farming households involved in the MBG supply chain in the Greater Malang region of East Java, Indonesia, using Cochran (1977) method to determine sample size. The study used the following inclusion criteria to select respondents: poultry-farming households that actively produce and supply eggs to the MBG value chain and have firsthand experience with the program. The study selected 320 agricultural households as respondents based on the target population's characteristics and sampling considerations. To examine the relationships among supply chain efficiency, the impact of the MBG policy, farmer satisfaction, and household welfare, this sample size was deemed sufficient to represent the target respondents and provide enough observations for Structural Equation Modeling (SEM) analysis. As a result, the final sample comprised 320 homes that raised chickens and were involved in the MBG value chain.

2.4. Method of Data Analysis

2.4.1. *Structural equation model (SEM)*: The links between supply chain efficiency (X1), the influence of MBG policy (X2), farmer satisfaction (Z), and household welfare (Y) were investigated using structural equation modeling (SEM). We identified household welfare as the endogenous construct, farmer satisfaction as a mediating construct, and supply chain efficiency and the impact of MBG policy as exogenous constructs. The model evaluated the impact of Z on Y, the indirect effects through farmer satisfaction, and the direct effects of X1 and X2 on Z and Y. Path coefficients, t-statistics, and p-values were used to assess the hypotheses; $p < 0.05$ indicated statistical significance. The mediating influence of farmer satisfaction was evaluated using the significance of indirect effects (Hair et al., 2017). Seven hypotheses were tested: H1 (X1 → Y), H2 (X2 → Y), H3 (X1 → Z), H4 (X2 → Z), H5 (Z → Y), H6 (X1 → Z → Y), and H7 (X2 → Z → Y). Fig. 2 shows the research framework.

2.4.2. *Research instrument*: Table 1 presents the questionnaire items used to measure supply chain efficiency (X1), the impact of the MBG policy (X2), farmer satisfaction (Z), and household welfare (Y), together with the sources of the items. The supply chain efficiency items assessed farmers' perceptions of delivery timeliness, transportation, coordination with buyers, information exchange, payment procedures, and transaction efficiency within the MBG supply chain, reflecting the extent to which these mechanisms supported smooth, timely, and cost-efficient transactions between poultry farmers and MBG buyers.

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Fig. 2: Research framework.

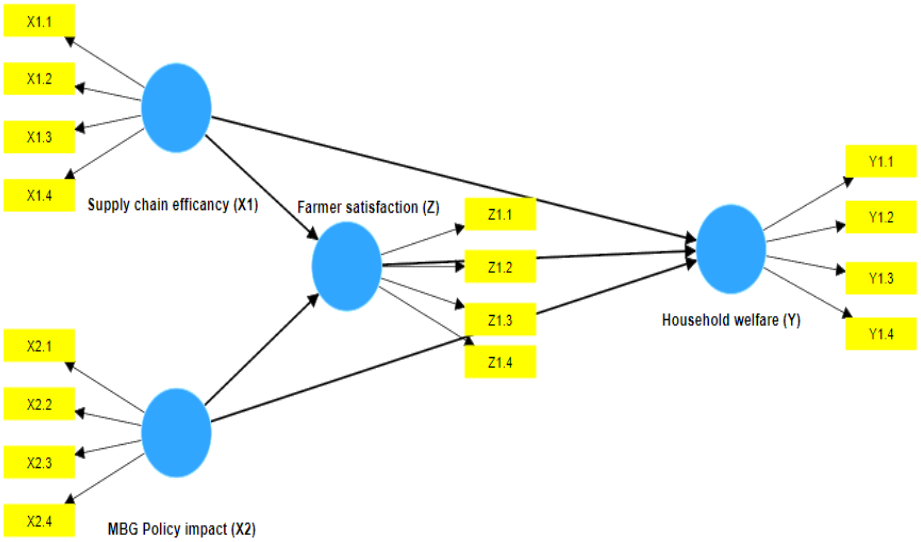


Table 1: Questionnaire items used to measure the study constructs

Supply chain efficiency (X-1)	
X1.1: I incurred costs to distribute eggs to MBG recipients efficiently.	
X1.2: I am arranging for the eggs to be delivered to the MBG recipients in accordance with the established schedule.	
X1.3: I can provide the number of eggs according to the number ordered by the MBG recipient.	
X1.4: I can minimize the number of damaged or broken eggs during the collection and delivery process.	
Impact of the free nutritious meal policy (X-2)	
X2.1: I am involved as an egg supplier for the MBG program, which has increased the income of my poultry farming business.	(Pellegrini Elias et al., 2026)
X2.2: The MBG program helps me secure a more reliable market for selling eggs.	
X2.3: Income from supplying eggs for the MBG program helps me improve my ability to sustain farm production.	
X2.4: Being involved as an egg supplier for the MBG program has improved my household's ability to meet daily needs.	
Livestock farmer satisfaction (Z)	
Z.1: The price received for supplying eggs for the MBG program meets my expectations as a poultry farmer.	(Keco et al., 2019)
Z.2: I am satisfied with the accuracy of payment for the eggs I supply for the MBG program.	
Z.3: I am satisfied with the communication between myself, as a livestock farmer, and the buyer within the MBG supply chain.	
Z.4: I am satisfied with the profits gained from supplying eggs for the MBG program.	
Welfare of poultry-farming households (Y)	
Y.1: My household income is sufficient to meet the family's daily economic needs.	(Gelli et al., 2016)
Y.2: My household can meet the educational and healthcare needs of its members.	
Y.3: My household's economic situation allows me to retain the household assets I own.	
Y.4: I am satisfied with my current domestic life.	

3. RESULTS & DISCUSSION

3.1. Demographic Features of the Sampled Respondents

Table 2 summarizes the demographic and farm characteristics of the 320 respondents, presenting the frequency and percentage of respondents in each category. The research results indicated that the majority of laying-hen farmers in the Greater Malang area (40.0%) were aged 46–54 years; the owners were predominantly male (86.9%); the highest level of education attained was a diploma (67.8%); the average farming experience was 15 years (34.7%); and the average number of productive hens per farm was 1,500 (44.4%). Additionally, the average workforce size was 50 people (60.9%), and the average monthly revenue was Indonesian rupiah (IDR) 146 million (39.1%); furthermore, farmers with experience supplying eggs to the MBG unit had an average of 2 years of such experience (91.6%). These findings suggest that the husbandry management practices used by the farm owners were appropriate, given their experience managing the farms and the average flock size of 1,500 productive hens. This success is attributed to the feed composition, specifically, using a mixture of corn, rice bran, concentrate, and minerals, or purchasing the "623A" brand of ready-made feed, which ensures feed efficiency and optimal egg production. Optimal egg production is defined as an egg weight of 60–70 grams, enabling farmers to generate profit and ensure quality; conversely, if egg weight falls below 50 grams, the farmer is likely to incur a loss. Chicken quality must also be considered; for hens over 90 weeks of age, egg quality declines while water content increases. Consequently, birds past this age are typically sold to collectors or sausage manufacturers for processing into ready-to-eat products, thereby ensuring the proper functioning of the supply chain. Their greater experience further strengthens farmers' role. In Enrekang Regency, South Sulawesi, flock size, education, and work experience influenced laying-hen farmers' income.

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Table 2: Characteristics of the respondents

Respondents' categories	Frequency	Percentage
Farmer age (years)		
30-35	14	4.4
36-45	66	20.6
46-54	128	40.0
55-60	88	27.5
>60	24	7.5
Total	320	100.0
Gender		
Female	42	13.1
Male	278	86.9
Total	320	100.0
Highest education		
Junior high school	30	9.4
High School/Vocational high school	22	6.9
Diploma	217	67.8
Bachelor/Master/Doctorate (S1/S2/S3)	51	15.9
Total	320	100.0
Duration of farming operations		
5 years	106	33.1
10 years	103	32.2
15 years	111	34.7
Total	320	100.0
Number of productive chickens		
500 chickens	94	29.4
1,500 chickens	142	44.4
3,000 chickens	84	26.3
Total	320	100.0
Number of workers		
20 people	55	17.2
30 people	38	11.9
50 people	195	60.9
>50 people	32	10.0
Total	320	100.0
Farming business turnover		
IDR 75 million	63	19.7
IDR 146 million	125	39.1
IDR 175 million	77	24.1
IDR 200 million	34	10.6
IDR 250 million	21	6.6
Total	320	100.0
Experience supplying to MBG units		
2 years	293	91.6
3 years	27	8.4
Total	320	100

3.2. Value Chain Analysis

Furthermore, to understand the MBG supply chain and variables related to the welfare of livestock-farming households, Table 3 outlines the cost structure and supply chain margins for laying-hen farmers.

Farmers, collectors, and SPPGs are key players in the commercial chicken egg supply chain for the MBG program in the Greater Malang area, as shown in Table 3. Collectors collect, sort, pack, and distribute eggs, while farmers are the main agents in the production stage. This structure shows that total marketing costs, especially labor, transportation, and product handling, increase with the distance the commodity travels from the farmer to the point of consumption. In terms of margins, the economic value produced at every stage of the supply chain is reflected in the difference between buy and sell prices. However, because each actor incurs marketing expenses, the margin figure does not necessarily reflect true profit. Therefore, to determine how economic gains are distributed along the supply chain, margin analysis must be supplemented with cost and net margin estimates. The farmer's share (FS), defined as the proportion of the price paid at the final stage that farmers receive, was calculated to show how the economic value was distributed along the MBG supply chain (Eq. 1). Based on this calculation, Table 3 indicated that farmers received 89.33% of the economic value from the MBG supply chain:

Equation 1. Farmers' share (FS)

$$FS = \frac{PF}{PC} \times 100\%$$

Explanation:
FS= farmer's share
PF= price received by farmers
PC= price paid at the final stage

$$FS = \frac{20{,}100}{22{,}500} \times 100\% = 89.33\%$$

Table 3: Value chain analysis matrix

No	Analysis component	Livestock farmer level	Collector level	MBG unit level
1.	Selling price (IDR/kg)	IDR 20,100	IDR 22,000	IDR 22,500
2.	Operating cost			
	Round-trip transportation	-	IDR 100,000	-
	Loss due to egg damage or breakage	-	IDR 201,000	-
	Other costs (packaging)	-	-	-
3.	All operating costs			
	Net profit	-	IDR 1,700	IDR 900
	Share of margin (%)	-	84.78%	89.33%

3.3. Tests of the Measurement Model

3.3.1. Composite reliability and Average Variance Extracted (AVE): Reliability testing aims to ensure that the study's measurement instruments provide consistent, reliable results. Reliability testing can be analyzed using Structural Equation Modeling (SEM). In this study, we assessed construct reliability using several key indicators: Cronbach's Alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE). Cronbach's Alpha measured the internal consistency of indicators within a variable. Values above 0.7 indicated good reliability, while values between 0.6 and 0.7 were acceptable. Composite Reliability also measured overall internal consistency and was required to be greater than 0.7 to be considered reliable. Meanwhile, Average Variance Extracted indicated how

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much of a construct's variance its indicators explain, with a minimum of 0.5 as the accepted limit for convergent validity (Fornell & Larcker, 1981; Hair et al., 2019). Table 4 presents the reliability results.

Table 4: Composite reliability and average variance extracted

Variable	Cronbach's alpha (standardized)	Composite reliability (rho_c)	Average variance extracted (AVE)
Supply chain efficiency (X-1)	0.808	0.875	0.636
Impact of the free nutritious meal policy (X-2)	0.918	0.942	0.803
Livestock farmer satisfaction (Z)	0.857	0.900	0.693
Welfare of poultry-farming households (Y)	0.858	0.904	0.701

All constructs met the criteria: Cronbach's alpha ranged from 0.808 to 0.918, composite reliability ranged from 0.875 to 0.942 (above the 0.70 threshold), and AVE ranged from 0.636 to 0.803 (above the 0.50 threshold), indicating adequate reliability and convergent validity.

3.3.2. Bootstrap model: Table 5 shows the results of the bootstrapping analysis for direct and indirect impacts. At $P<0.05$, the findings showed that all proposed associations were positive and statistically significant. Supply chain efficiency positively and significantly affected household welfare ($\beta = 0.940$; $t = 2.463$; $P<0.05$) and farmer satisfaction ($\beta = 0.109$; $t = 2.278$; $P<0.05$). Additionally, the MBG policy positively and significantly affected household welfare ($\beta = 0.574$; $t = 9.334$; $P<0.001$) and farmer satisfaction ($\beta = 0.600$; $t = 11.163$; $P<0.001$). Additionally, farmer satisfaction positively and significantly affected household welfare ($\beta = 0.320$; $t = 5.547$; $P<0.001$). The indirect effects further show that farmer satisfaction significantly mediates the connection between supply chain efficiency and household welfare ($\beta = 0.035$; $t = 2.088$; $P<0.05$) and between MBG policies and household welfare ($\beta = 0.192$; $t = 5.449$; $P<0.001$). As a result, all seven of the hypotheses were supported.

Table 5: Direct and indirect effects

Construct	β (original sample)	Standard error	t-statistic	p-value	Decision
X1 → Y (H1)	0.940	0.038	2.463	P<0.05	Accepted
X2 → Y (H2)	0.574	0.061	9.334	P<0.001	Accepted
X1 → Z (H3)	0.109	0.048	2.278	P<0.05	Accepted
X2 → Z (H4)	0.600	0.054	11.163	P<0.001	Accepted
Z → Y (H5)	0.320	0.058	5.547	P<0.001	Accepted
X1 → Z → Y (H6)	0.035	0.017	2.088	P<0.05	Accepted
X2 → Z → Y (H7)	0.192	0.035	5.449	P<0.001	Accepted

3.4. Discussion and Hypothesis Outcome

The hypothesis testing results validated the proposed structural model, showing that supply chain efficiency and the MBG policy significantly improved household welfare among livestock farmers supplying the MBG program. Supply chain efficiency had a positive and significant effect on household welfare ($\beta = 0.940$), while the MBG policy had a stronger positive effect ($\beta = 0.574$). Furthermore, both supply chain efficiency ($\beta = 0.109$) and the MBG policy impact ($\beta = 0.600$) significantly increased livestock farmer satisfaction, which in turn contributed positively to household welfare ($\beta = 0.320$). The mediation analysis further confirmed that farmer satisfaction significantly mediated the relationship between supply chain efficiency and household welfare ($\beta = 0.035$), as well as between the MBG policy impact and household welfare ($\beta = 0.192$). These findings indicated that the MBG program's welfare benefits came not only from market opportunities but also from farmers' satisfaction with their participation in the supply chain. Overall, the findings highlighted the importance of supply chain efficiency, policy benefits, and supplier satisfaction as interconnected mechanisms for strengthening the economic welfare of livestock-farming households.

3.4.1. The impact of supply chain efficiency (X1) on household welfare (Y): The research results indicated that Supply Chain Efficiency (X1) had a positive and significant effect on Household Welfare (Y); thus, H1 was accepted. The parameter coefficient value of 0.940 indicated that an increase in supply chain efficiency improved the welfare of livestock-farming households. This finding is consistent with the study conducted by Gelli et al. (2016) which explained that linking food programs with supplying livestock-farming households can support household income and food security. Supply chain efficiency enables products to reach guaranteed markets, reducing transaction barriers, distribution costs, and payment uncertainty. Gelli et al. (2016) The study also emphasized that cash flow mismatches, weak coordination, and limited access between suppliers and buyers hinder the realization of economic benefits from the supply chain. Internal investment levers can strengthen logistics performance, and predictable institutional demand supports farmers' income growth and market integration when procurement frameworks are well aligned (Kelly & Swensson, 2017; Swensson, 2018; Chukwuka et al., 2026). Therefore, livestock-farming households supplying the MBG program benefited economically from increased income and well-being due to supply chain efficiency.

3.4.2. The impact of the free nutritious meal policy (X2) on household welfare (Y): The results indicated that the MBG policy (X^2) had a positive and significant effect on household welfare (Y); thus, Hypothesis 2 was accepted.

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The coefficient of .574 (t-statistic = 9.334; P<0.001) showed that the more positive farmers' perceptions were of the MBG policy's impact, the higher the welfare of households supplying the program. These findings supported the research of Gelli et al. (2016), which identified livestock farmers' income as a primary outcome of school feeding programs and highlighted the link between marketed egg surpluses and farmers' business income. Diniz Oliveira et al. (2025) reported that direct procurement from family farms under Brazil's school feeding program increased family farmers' income and generated employment, particularly in labor-intensive livestock production. Therefore, the MBG serves not only as a nutrition policy but also as an economic policy instrument that generates market demand, expands income opportunities, and improves the welfare of participating farming households. These findings contribute to the literature by providing empirical evidence of the direct relationship between the MBG policy and the welfare of supplier households within Indonesia's local food value chains.

3.4.3. The impact of supply chain efficiency (X1) on Livestock farmer satisfaction (Z): The research results indicated that Supply Chain Efficiency (X1) had a positive and significant effect on Livestock Farmer Satisfaction (Z); thus, Hypothesis 3 was accepted. The coefficient (0.109), t-statistic (2.278), and P<0.05 showed that the more efficient the supply chain, the higher the satisfaction of the livestock farmers supplying MBG. These findings align with Maloku (2021), which showed that market information, communication, and information exchange shape the quality of trade relationships; the more information shared, the higher farmers' satisfaction with the relationship with the buyer. Furthermore, Benitez-Altuna et al. (2024) emphasized that supply chain coordination, quality, pricing, payment, and service are crucial aspects of the relationship between farmers and buyers. Empirically, supply chain efficiency within the MBG context can reduce transaction uncertainty, streamline delivery and payments, and enhance the predictability of business relationships. These conditions foster a superior transaction experience, thereby increasing farmer satisfaction. These findings reinforce supply chain management literature by showing that operational efficiency also shapes supplier satisfaction within public policy-driven food value chains.

3.4.4. The impact of the free nutritious meal policy (X2) on Livestock farmer satisfaction (Z): The results indicated that the MBG Policy (X2) had a positive and significant effect on Farmer Satisfaction (Z), so hypothesis 4 was accepted. The coefficient (0.600), t-statistic (11.163), and P<0.001 indicated that the more farmers perceived the MBG policy as positively impacting them, the higher their satisfaction. This finding aligns with research on public procurement-based food programs, which shows that food policies can create a more structured market for local producers and provide socio-economic benefits for suppliers (Pellegrini Elias et al., 2026; Valencia et al., 2019). In addition, the results of research conducted by Dlamini-Mazibuko et al. (2019) indicated that farmer satisfaction is influenced by price and communication, whereas supply chain coordination is necessary to enhance exchange efficiency and create mutual benefits. In the context of the MBG program, guaranteed demand, marketing opportunities, communication, and connectivity with buyers can provide a sense of security and enhance livestock farmers' perceptions of the policy's benefits. Thus, the MBG serves not only to meet nutritional needs but also to strengthen economic ties among the government, the market, and livestock farmers, ultimately increasing supplier satisfaction.

3.4.5. The impact of Livestock farmer satisfaction (Z) on household welfare (Y): The research results indicated that Livestock Farmer Satisfaction (Z) had a positive and significant effect on Household Welfare (Y); thus, Hypothesis 5 was accepted. The coefficient (0.320), t-statistic (5.547), and P<0.001 showed that higher livestock farmer satisfaction corresponded to higher perceived household welfare. These findings align with the results of research conducted by Schulze et al. (2006) which clarified that while supplier relationship quality included commitment, trust, and contentment, livestock farmers' financial success largely depended on the performance of buyers or processors. Gorton et al. (2015) The study also showed that a positive relationship with suppliers was associated with higher product quantity and quality, as well as satisfaction. In contrast, supplier welfare was closely tied to the uneven outcomes of the items sold. In this sense, contentment helps breeders reap financial and interpersonal rewards that promote business expansion, increase revenue, and improve a household's capacity to meet necessities. The findings contribute to the supply chain literature by emphasizing farmer satisfaction as a critical element in maintaining household welfare.

3.4.6. The impact of supply chain efficiency (X1) on household welfare (Y) through Farmer Satisfaction (Z): Hypothesis 6 was accepted because the study's findings showed that Supply Chain Efficiency (X1) significantly and positively affected Household Welfare (Y) through Farmer Satisfaction (Z). Supply chain efficiency can improve household welfare by raising farmer satisfaction, as evidenced by the indirect effect coefficient of 0.035, t-statistic of 2.088, and P<0.05. These conclusions align with Schulze et al. (2006), who described relationship quality in agri-food chains in terms of commitment, trust, and contentment, and with Gorton et al. (2015), who linked buyer trustworthiness to supplier performance. Benitez-Altuna et al. (2024) likewise emphasized that coordination, pricing, payment, and service are crucial components of farmer–buyer relationships; internal investment can improve logistics performance. As a result, contentment plays a critical role in converting operational effectiveness into long-term

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financial gains and farmers' household well-being.

3.4.7. The impact of the free nutritious meal policy (X2) on household welfare (Y) through Farmer Satisfaction (Z): The results indicated that the MBG policy (X^2) had a positive and significant effect on household welfare (Y) through livestock farmer satisfaction (Z); thus, Hypothesis 7 was accepted. The indirect effect coefficient of 0.192, t-statistic of 5.449, and $P<0.001$ showed that a stronger positive impact of the MBG policy led to higher household welfare through farmer satisfaction.

These findings align with Diniz Oliveira et al. (2025), who evaluated the economic impact of school-feeding procurement through family farms' production value, income, and employment. In addition, Masset & Gelli (2013) and Swensson (2018) described home-grown school feeding as a way to link school meals to smallholder agricultural production to support local producers and local development. Satisfaction is a crucial mechanism, as the policy's benefits are realized through market opportunities and positive supplier relationships. Gorton et al. (2015) highlighted supplier satisfaction's role in the quality of commercial relationships. Therefore, the MBG policy promotes welfare through both relational and economic pathways.

Taken together, these findings support the view that predictable, well-coordinated institutional demand can strengthen farm households. Public procurement has been used in Brazil as a strategy to foster agricultural transitions (Borsatto et al., 2020) and to connect food procurement with sustainable rural development and food sovereignty (Wittman & Blesh, 2017), within a broader trajectory of public policies directed at family farming (Grisa & Schneider, 2014; Tenchini et al., 2025). Researchers have also examined family farming in relation to rural employment (Wuepper et al., 2021), a dimension future MBG evaluations could incorporate alongside income and satisfaction. For the MBG program, this suggests that the benefits observed among laying-hen farmers in the Greater Malang area are likely to depend on the quality of procurement arrangements, such as payment timeliness, communication, and fair pricing, rather than on demand volume alone.

4. CONCLUSION

Based on testing seven hypotheses, this study showed that supply chain efficiency and the impact of the MBG policy were critical determinants of enhancing the household welfare of livestock farmers supplying the program. Supply chain efficiency positively and significantly affected both household welfare and farmer satisfaction, while the MBG policy had an even stronger influence on these variables. Furthermore, farmer satisfaction played a positive and significant role in improving household welfare. Mediation analysis revealed that farmer satisfaction significantly mediated the effects of supply chain efficiency and the MBG policy on household welfare. This underscores that the MBG program's economic benefits depend not only on creating market demand but also on the quality of farmers' experiences and relationships within the supply chain. Theoretically, this study expands the food value chain literature by integrating operational efficiency, policy impact, supplier satisfaction, and household welfare into a single structural framework. Practically, the MBG program's success requires stronger coordination, market certainty, transaction transparency, timely payments, and logistical efficiency to ensure the policy's benefits for supplying farmers are sustainable and inclusive.

Declarations

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Conflicts of Interest: The authors declare no competing financial interests or personal relationships that could be construed as influencing the research reported in this paper.

Data Availability: The datasets used and/or analyzed in this study are available from the corresponding author on reasonable request.

Ethics Statement: Ethical approval was obtained from the owners of laying hen farms in the Greater Malang area, an egg distributor, the owner of the MBG unit, and a veterinary paramedic. Study was conducted in accordance with national laws and ethical guidelines. Furthermore, participants provided informed consent to take part in this study.

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