



Understanding beneficiary satisfaction through logistics efficiency and digital technology in Indonesia's free nutritious meal program

Vinanda¹, Tien Yustini²

¹Management Program Magister, Economic Faculty, Indo Global Mandiri University

²Economic Faculty, Indo Global Mandiri University

ARTICLE INFO

Article history:

Received Jul 06, 2026

Revised Jul 10, 2026

Received Aug 01, 2026

Keywords:

Beneficiary Satisfaction;

Information Technology;

Logistics Efficiency;

Service Quality.

ABSTRACT

High malnutrition rates among pregnant women, infants, and children pose a significant challenge to Indonesia's human resource development and the "Indonesia Emas 2045" vision. To address this, the government initiated the Free Nutritious Meals Program (Makanan Bergizi Gratis / MBG). However, operational bottlenecks such as inefficient distribution, underutilized technology, and inconsistent service quality-persist. This study examines the impact of logistics distribution efficiency, information technology utilization, and service quality on beneficiary satisfaction within the MBG program. Using a quantitative approach, data were gathered from 294 respondents at SMAN 14 Palembang (selected via purposive sampling using Slovin's formula from a population of 1,105) through structured Likert-scale questionnaires. Analysis was conducted using SPSS, incorporating validity, reliability, classical assumption tests, and multiple linear regression. The findings demonstrate that logistics distribution efficiency, information technology, and service quality both individually and collectively have a positive and statistically significant effect on beneficiary satisfaction. By empirically evaluating these core operational drivers, this study offers actionable insights for program administrators to optimize distribution channels, integrate digital management tools, and refine service delivery across national meal programs.

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Corresponding Author:

Tien Yustini,

Economic Faculty, Indo Global Mandiri University,

Street of Jend. Sudirman, Palembang City, 20129, South Sumatra, Indonesia

Email: tien_yustini@uigm.ac.id

1. INTRODUCTION

Poor nutrition among the population, particularly among pregnant women, toddlers, and children, poses a strategic challenge in efforts to improve the quality of human resources and achieve the missions of Asta Cita and the Golden Indonesia 2045 vision. The Government of Indonesia has prioritized reducing malnutrition rates among mothers and children. However, to date, Indonesia still faces a triple burden of malnutrition simultaneously: undernutrition in the form of stunting and wasting, overweight and obesity, as well as micronutrient deficiencies (Riwu kore et al., 2019; Riwu Kore & Haba Ora, 2019). Three out of every ten infants do not receive exclusive breastfeeding,

approximately 280,000 babies are born with low birth weight, and more than 1 million children under five suffer from obesity. Although there has been a gradual decline in the prevalence of stunting and malnutrition over the years, this issue remains a major concern for child health in Indonesia (Kompas, 2025; Unicef, 2022).

In response, the government launched the Free Nutritious Meal Program (FNMP) starting in January 2025 as a strategic measure to reduce malnutrition rates and strengthen household food security. The National Nutrition Agency (NNA) aims to provide services to 15–18 million beneficiaries through 5,000 Nutrition Service Units (NSUs). By October 2025, more than 36.7 million people had received benefits from the program, including children from early childhood education through senior high school, pregnant women, breastfeeding mothers, and children under five. Its implementation is supported by over 12,500 service personnel and 10,900 service units consisting of production kitchens, distribution facilities, and storage warehouses, with a budget allocation of IDR 13.2 trillion, equivalent to 10.6% of the total national health budget for 2025 (BGN, 2025).

In Palembang City, the program has reached all 18 sub-districts, with 98 operational kitchens serving 342 schools out of a total of 1,044, as well as 42 early childhood education institutions out of 783 available. One service unit located in Sukamaju Village, Sako Sub-district, began operations in February 2025 and serves five educational sites and local community health posts (DISDIK Kota Palembang, 2025). The success of this program depends not only on the availability of nutritious meals but also on the effectiveness of supply chain management systems, service quality, and the application of technology to support monitoring and coordination.

Despite its noble objectives, the implementation of this program—less than a year since its launch - has encountered various challenges. More than 4,000 cases of food poisoning among students have been recorded, while the targeted coverage of beneficiaries, number of personnel, and operational kitchens have not yet been achieved. Other issues include regulatory uncertainty, unclear governance arrangements, allegations of price markup practices leading to the use of low-quality raw materials, and delays in funding that have forced some kitchens to suspend operations. These problems have resulted in delayed distribution and reduced satisfaction among program beneficiaries (UMS, 2025).

In addition, there is an uneven distribution of production facilities: approximately 60% of kitchens and service units are concentrated on Java Island, while regions such as Bali and South Papua have only one service unit each. Difficult geographical conditions and limited infrastructure cause delivery delays and a decline in food quality during transportation. This situation is further aggravated by the limited use of information technology to monitor routes, schedules, and service quality - tools that could otherwise improve operational efficiency (Nouvan, 2025).

Empirically, while previous studies have separately validated the influence of logistics management (Primadi & Putri, 2025; Zebua et al., 2025), information technology adoption (Taufiqurokhman et al., 2024; Tohir et al., 2023), and service quality (Agung et al., 2023; Lestari & Lawita, 2024) on customer satisfaction, these investigations overwhelmingly focus on commercial markets, private supply chains, or general e-government services. A critical theoretical and empirical research gap exists regarding how these operational determinants function simultaneously within non-commercial, large-scale, mandatory social assistance programs like the Free Nutritious Meal Program (FNMP). Commercial models assume customer choice and price sensitivity, whereas social assistance programs operate under fixed government mandates where beneficiaries prioritize core physical utility (e.g., meal delivery punctuality and safety) over transactional service interactions.

Theoretical frameworks in public administration and service management suggest that beneficiary satisfaction in state-sponsored social welfare programs is fundamentally

driven by operational performance and accessibility (Kayas, 2023; Parasuraman et al., 1994). Grounded in the Expectation Confirmation Theory (ECT), beneficiary satisfaction emerges when delivered public services meet or exceed initial expectations regarding basic needs fulfillment. In the context of large-scale public food distribution, logistics distribution efficiency serves as the operational backbone ensuring physical availability and food safety, while information technology acts as an enabler for real-time monitoring and transparent communication. Furthermore, service quality reflects the frontline interactions and operational reliability. Theoretically, integrating these three dimensions provides a holistic framework to understand how logistical accuracy, digital governance, and service delivery jointly shape public trust and recipient satisfaction in mandatory welfare initiatives.

To bridge this gap, this study offers distinct scientific novelty by empirically testing an integrated socio-logistical model that evaluates logistics efficiency, information technology utilization, and service quality simultaneously in a real-time public health initiative at the educational institutional level in Palembang City. Beyond its practical relevance for policy evaluation, this research provides significant academic contributions: (1) it extends Expectation Confirmation Theory to free public nutrition programs in developing economies, (2) it identifies whether traditional service quality dimensions remain relevant in essential public welfare delivery, and (3) it establishes an empirical foundation for future studies on public supply chain governance. Consequently, this study aims to examine the partial and simultaneous effects of logistics distribution efficiency, IT utilization, and service quality on beneficiary satisfaction to inform both academic literature and national policy optimization.

2. RESEARCH METHOD

This study employs a quantitative approach with descriptive and verificative designs. The target population comprises 1,105 individuals (students and teachers) at State Senior High School (SMAN) 14 Palembang. This population was selected because SMAN 14 Palembang serves as a key designated pilot educational unit under the Free Nutritious Meal Program (FNMP) in Sako Sub-district, offering a representative sample of active beneficiaries. To determine the sample size, the Slovin formula with a 5% margin of error yielded a minimum requirement of 294 respondents. To rigorously justify this sample size beyond static formulas, a post-hoc Power Analysis was conducted using G-Power 3.1. With 3 predictor variables, an effect size (f^2) of 0.15 (medium), and $\alpha = 0.05$, the sample size of $N = 294$ achieved a statistical power ($1 - \beta$) exceeding 0.99, well above the standard threshold of 0.80. This confirms that the sample size is sufficiently robust to detect true statistical effects and minimize Type II errors.

Data were collected using structured questionnaires evaluated on a 5-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). The measurement instruments were adapted from established literature to ensure construct validity.

Table 1. Operational definition and research instruments

Variable	Indicators	Number of Items	References
Beneficiary Satisfaction (BS)	Expectations fulfillment, overall satisfaction, positive word-of-mouth, willingness to reuse	6	(Handayani & Sari, 2022; Kayas, 2023)
Logistics Efficiency (LE)	Timeliness of delivery, quantity accuracy, distribution smoothness, food condition maintenance	6	(Alnadi, 2026; Burity, 2021)
Information Technology (IT)	Ease of access, information delivery speed, tracking transparency, communication reliability	5	(Hasibuan et al., 2025; Tohir et al., 2023)

Service Quality (SQ)	Tangibles, responsiveness, assurance, empathy, operational reliability	6	(Agung et al., 2023; Parasuraman et al., 1994)
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Data analysis was performed using SPSS software, covering validity and reliability testing of the research instruments, classical assumption tests, and multiple linear regression analysis to examine the influence between variables both partially and simultaneously. This research strictly adhered to ethical principles in human subject research. Participation was entirely voluntary, and informed consent was obtained electronically prior to survey administration. Respondents were explicitly informed of the study's objective, their right to withdraw at any time without penalty, and the strict confidentiality and anonymity of their responses. All collected data were aggregated solely for academic purposes and stored in encrypted digital storage accessible only to the primary research team.

3. RESULTS AND DISCUSSIONS

3.1 Uji Validitas

The validity test is used to measure whether a questionnaire is valid or appropriate. An item is considered valid if the calculated r-value is greater than the tabulated r-value; conversely, if the calculated r-value is smaller than the tabulated r-value, it is declared invalid (J R Riwi Kore, Zamzam, et al., 2022). For a sample size of 294 respondents, the tabulated r-value is 0.115. The results of the validity test for the research variables are presented in Table 1, which shows that all calculated r-values exceed the tabulated r-value, indicating that the research data are valid.

Table 1. Validity test results

Items	Coefficient Correlation				Tabulated r-value	Results
	Logistics Efficiency	Information Technology	Service Quality	Beneficiary Satisfaction		
1	0.686	0.641	0.757	0.738	0.115	Valid
2	0.772	0.726	0.648	0.753	0.115	Valid
3	0.752	0.688	0.383	0.782	0.115	Valid
4	0.729	0.556	0.709	0.711	0.115	Valid
5	0.717	0.642	0.726	0.674	0.115	Valid
6	0.734		0.683	0.586	0.115	Valid

Source: Primary data (processed), 2026

3.2 Reliability Test

The reliability test for the research instrument uses the criterion of Cronbach's Alpha Based on Standardized Items, with a threshold value of greater than 0.70 (Opoku et al., 2022). As shown in Table 2, the reliability test results indicate that the Cronbach's Alpha value for each variable exceeds 0.70, confirming that the research data are reliable.

Table 2. Reliability test results

Variable	Cronbach's Alpha Value	Number of Items	Results
Logistics Efficiency	0.83	6	Reliable
Information Technology	0.75	5	Reliable
Service Quality	0.74	6	Reliable
Beneficiary Satisfaction	0.79	6	Reliable

Source: Primary data (processed), 2026

3.3 Normality Test

The normality test uses the Kolmogorov-Smirnov criterion, where the Asymp. Sig. (2-tailed) value must be greater than 0.05 (Opoku et al., 2022). Table 3 shows that all variables meet the normality test requirements.

Table 3. Normality test results

One-Sample Kolmogorov-Smirnov Test		
N		Unstandardized Residual 294
Normal Parameters ^{a,b}	Mean	.0000000
	Std. Deviation	2.27660981
Most Extreme Differences	Absolute	0.068
	Positive	0.060
	Negative	-0.068
Test Statistic		0.068
Asymp. Sig. (2-tailed)		0.002
Monte Carlo Sig. (2-tailed)	Sig.	0.125
	95% Confidence Interval	Lower Bound Upper Bound
		0.119 0.132

Source: Primary data (processed), 2026

3.4 Multicollinearity Test

The criterion for the multicollinearity test is a Variance Inflation Factor (VIF) value of less than 10 and a tolerance value greater than 0.10 (Haba Ora et al., 2026). The results show that all independent variables have tolerance values above 0.10 and VIF values below 10, indicating that there is no multicollinearity problem in the regression model.

Table 4. Multicollinearity test results

Variable	Tolerance	VIF	Results
Logistics Efficiency	0.870	1.149	No Multicollinearity Exists
Information Technology	0.870	1.149	No Multicollinearity Exists
Service Quality	1.000	1.000	No Multicollinearity Exists

Source: Primary data (processed), 2026

3.5 Heteroscedasticity Test

Heteroscedasticity can be detected by analyzing the scatterplot between the standardized residual (SRESID) and the predicted value (ZPRED). A significant pattern indicates the presence of heteroscedasticity, while the absence of such a pattern means no heteroscedasticity occurs. The scatterplot shows data points distributed randomly above and below the value of 0, confirming that the model is free from heteroscedasticity (Figure 1).

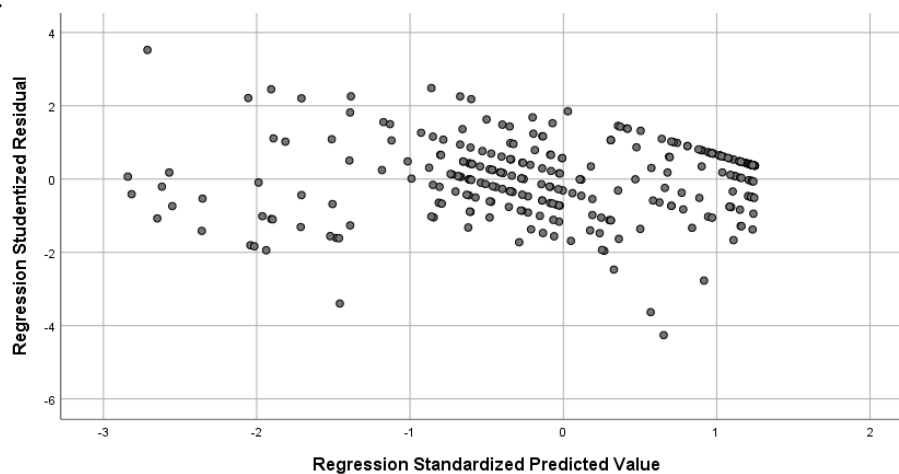


Figure 1. Scatterplot of heteroscedasticity test

Source: Primary data (processed), 2026

3.6 Autocorrelation Test

This study uses the Durbin-Watson (DW) test to identify the presence of autocorrelation in the data. The applied criterion states that a DW value between -2 and +2 indicates no autocorrelation. The test results show that the DW value falls within this range, leading to the conclusion that there is no autocorrelation.

Tabel 5. Hasil uji autokorelasi

Durbin-Watson Value
1.015

Source: Primary data (processed), 2026

3.7 Hypothesis Testing

Hypothesis testing was conducted using the t-test and F-test. The criterion for the t-test is a calculated t-value greater than the tabulated t-value at a significance level of $p < 0.05$. Similarly, for the F-test, the calculated F-value must be greater than the tabulated F-value at $p < 0.05$. In this study, the tabulated t-value is 1.968 and the tabulated F-value is 3.384. The results of the t-test are presented in Table 6.

Table 6. Results of the t-Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	2.506	1.854		1.352	.177
Logistics Efficiency	.720	.040	.719	17.984	.000
Information Technology	.187	.060	.124	3.092	.002
Service Quality	.014	.051	.010	.271	.786

Source: Primary data (processed), 2026

The regression equation for this study is $BS = a + \beta_1 LE + \beta_2 IT + \beta_3 SQ + e$ thus $BS = 2,506 + 0,72 + 0,18 + 0,01 + e$. The multiple linear regression analysis reveals a constant value of 2.506, indicating that in the absence of contributions from the independent variables, beneficiary satisfaction with the Free Nutritious Meals Program (MBG) remains at a baseline level of 2.506. The regression coefficients for logistics efficiency ($\beta = 0.720$), information technology ($\beta = 0.187$), and service quality ($\beta = 0.014$) are all positive, demonstrating a direct and unidirectional relationship with the dependent variable. These empirical results imply that any enhancement in logistics distribution efficiency, information technology utilization, or service quality consistently drives a proportional increase in beneficiary satisfaction.

The t-test results indicate that logistics efficiency and information technology have a positive and significant partial effect on beneficiary satisfaction, as their calculated t-values exceed the tabulated t-value at $p < 0.05$. In contrast, service quality shows a calculated t-value lower than the tabulated value at $p > 0.05$, meaning this variable has no significant effect on beneficiary satisfaction.

The results of the F-test are presented in Table 7. The data show that all variables together have a positive and significant simultaneous effect on beneficiary satisfaction, as they meet the F-test criterion: the calculated F-value is greater than the tabulated F-value at $p < 0.05$.

Table 7. Results of the F-Test

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2245.395	3	748.465	142.930	.000 ^b
	Residual	1518.605	290	5.237		
	Total	3764.000	293			

Source: Primary data (processed), 2026

The coefficient of determination is presented in Table 8. The value of R^2 is 0.597, indicating that the variables in this study explain 59.7% of the variance in beneficiary satisfaction, while the remaining 40.3% is explained by other factors not examined in this research.

Table 8. Results of the coefficient of determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.772	0.597	0.592	2.288

Source: Primary data (processed), 2026

3.8 The Effect of Logistics Efficiency on Beneficiary Satisfaction

Based on the t-test results, the calculated t-value is 17.984, which is greater than the tabulated value of 1.968, with a significance level of $0.000 < 0.05$. This indicates that logistics efficiency has a positive and significant effect on the satisfaction of beneficiaries of the Free Nutritious Meal Program (FNMP). Logistics efficiency encompasses timeliness of delivery, accuracy of quantity, smooth distribution, and maintenance of food quality until it reaches the recipients. When meals are received on schedule, in the correct amount, and in good condition, beneficiaries develop a more positive perception of the program. Conversely, delays or inaccuracies in supply reduce service quality and satisfaction (Alnadi, 2026). This finding is consistent with Monoarfa et al. (2024), who state that effective logistics management ensures products remain in good condition and are available on time, ultimately improving user satisfaction. The results also support the study by Burity (2021), which identified a positive relationship between distribution efficiency and the satisfaction level of program beneficiaries.

The theoretical implications of this study challenge conventional service management frameworks by illustrating that logistical utility substantially outweighs interpersonal service dimensions in essential social welfare programs. Consequently, public service models must integrate cold-chain logistics and lead-time precision as primary satisfaction constructs rather than secondary operational background variables. From a managerial perspective, administrators at the National Nutrition Agency (NNA) and local distribution hubs must prioritize routing optimization, temperature-controlled transit, and localized kitchen-to-school mapping, supported by rigid delivery time-windows (e.g., arrival 30 minutes prior to scheduled meal breaks). Policy-wise, government authorities must allocate strategic capital toward decentralized kitchen infrastructure and local transport fleets to guarantee supply chain resilience against regional geographical bottlenecks.

3.9 The Effect of Information Technology on Beneficiary Satisfaction

The t-test results show a calculated t-value of 3.092, which is greater than the tabulated value of 1.968, with a significance value of $0.002 < 0.05$. This means that information technology has a positive and significant effect on beneficiary satisfaction; therefore, the second hypothesis is accepted.

The implementation of information technology includes ease of data access, speed of information delivery, transparency of processes, and smooth communication between program managers and beneficiaries. A reliable information system generates accurate and up-to-date data, which serves as the basis for sound decision-making (Firdaus et al., 2024). This finding is consistent with Hasibuan et al. (2025), who concluded that the higher the quality of the information system used, the greater the trust and satisfaction of service users. In the context of the FNMP, information technology facilitates distribution monitoring and reporting (J R Riwu Kore et al., 2020), enabling the program to operate in a more controlled and accountable manner.

The theoretical implication of this result lies in establishing digital infrastructure as a core moderator of operational trust in public health interventions. Digital tools do not merely support logistics; they validate program integrity. Managerially, program

directors must accelerate the deployment of unified digital management dashboards connecting operational kitchens directly with school coordinators. Implementing mobile-based feedback tools—allowing school staff to log meal arrival times, food temperatures, and portion compliance in real time—will enable predictive maintenance of supply chains. From a policy perspective, the government should mandate standard digital tracking protocols across all national nutrition service units (NSUs). Investing in regional digital infrastructure will ensure equitable data access, mitigate risks of food contamination through rapid digital traceability, and safeguard public resources.

3.10 The Effect of Service Quality on Beneficiary Satisfaction

Based on the t-test results, the calculated t-value is 0.271, which is less than the tabulated value of 1.968, with a significance level of $0.786 > 0.05$. This finding confirms that service quality has no significant effect on beneficiary satisfaction; therefore, the hypothesis stating such an effect is rejected.

This result indicates that service aspects such as staff courtesy, responsiveness, and service delivery methods are not yet the primary determinants of satisfaction. This can be explained by the fact that in programs designed to meet basic needs, such as the FNMP, beneficiaries focus their attention primarily on the availability, timeliness, and nutritional quality of the meals, rather than on direct service interactions (Handayani & Sari, 2022). According to Riwu Kore, Haba Ora, et al. (2022) and Lolu et al. (2026), the weight assigned to service quality assessment varies depending on the type of service; in essential public services, the fulfillment of core needs takes priority over supplementary service elements.

This finding differs from the results reported by Firdaus et al. (2024) and Agung et al. (2023) in the commercial service sector, but it is consistent with the views of Riwu Kore et al. (2023), who argue that in social assistance programs, satisfaction is determined more by the outcomes received than by the process of delivery. As long as the meals provided meet expectations, variations in service aspects do not lead to significant differences in satisfaction levels.

The theoretical implications of this finding advocate for a recalibration of public service evaluation models, urging scholars to separate "essential physical utility programs" from "relational public services." Scholars must weight functional logistics and food safety parameters higher than interpersonal indicators when evaluating mandatory social programs. Managerially, administrators should avoid over-allocating operational budgets toward soft service training at the expense of supply chain infrastructure. Resource allocation must prioritize kitchen hygiene, rapid transit, and temperature retention over elaborate customer service protocols. From a policy perspective, governance standards for the FNMP should redefine "quality" around strict food safety benchmarks, nutritional content, and logistical precision rather than interpersonal service metrics, ensuring public funds directly enhance tangible meal value.

3.11 The Combined Effect of Logistics Efficiency, Information Technology, and Service Quality on Beneficiary Satisfaction

The results of the F-test show a calculated F-value of 142.930, which is greater than the tabulated value of 3.384, with a significance level of $0.000 < 0.05$. This indicates that the three variables together have a positive and significant effect on beneficiary satisfaction; therefore, the joint hypothesis is accepted. Based on the Adjusted R Square value of 0.592, it can be interpreted that 59.20% of the variation in beneficiary satisfaction is explained by these three factors, while the remaining 40.80% is influenced by other variables not examined in this study.

Although service quality has no significant effect when tested individually, the three variables collectively form a complementary system in program implementation. This finding supports the view of Primadi & Putri (2025), who state that the success of

public services requires synergy between an effective distribution system, adequate technological support, and maintained service standards. Accordingly, to optimally improve satisfaction, program managers should continue to strengthen logistics efficiency and the application of information technology, as well as maintain consistent service standards—even if their impact is not yet statistically significant at present. Future research is recommended to investigate additional factors that may further enhance understanding of beneficiary satisfaction within the FNMP.

4. CONCLUSION

This study demonstrates that logistics distribution efficiency and information technology utilization are the primary drivers of beneficiary satisfaction in Indonesia's Free Nutritious Meal Program, whereas traditional interpersonal service quality exhibits no statistically significant impact. Theoretically, these findings extend Expectation Confirmation Theory and the SERVQUAL framework by revealing that in mandatory public welfare settings, outcome utility (delivery timeliness, food safety, and nutritional integrity) heavily supersedes process utility (interpersonal staff behavior). Practically, the National Nutrition Agency and public administrators must strategically reallocate operational resources toward cold-chain infrastructure, digital tracking systems, and rigid delivery time-windows rather than soft-skill customer service training. Although constrained by a cross-sectional design focused on a single urban pilot unit which limits direct generalizability to remote or underdeveloped regions—this study calls for future research to expand geographically into frontier areas (3T regions), integrate objective biological quality parameters, and examine unstudied constructs such as community kitchen governance and institutional trust.

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