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Determinants of Beneficiary Satisfaction in the Free Nutritious Meal Program Based on Packaging Quality, Food Quality, and MBG Delivery Vehicles: The Mediating Role of Distribution Performance (A Case Study at the Indonesian National Police Nutrition Fulfillment Center, Semarang Police Resort)

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Abstract: This study aims to examine the direct and indirect effects among Packaging Quality, Food Quality, MBG Delivery Vehicles, Distribution Performance, and Beneficiary Satisfaction within the Free Nutritious Meal (MBG) Program. A quantitative research approach was employed using a survey method involving 112 beneficiaries of the MBG Program at the Nutrition Fulfillment Center (SPPG) of the Indonesian National Police, Semarang Police Resort. Respondents were selected through purposive sampling. Data were analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS 4. The findings indicate that Packaging Quality significantly affects Distribution Performance ($T = 4.600$; $p = 0.000$) and Beneficiary Satisfaction ($T = 6.028$; $p = 0.000$). Food Quality also has significant positive effects on Distribution Performance ($T = 3.859$; $p = 0.000$) and Beneficiary Satisfaction ($T = 3.606$; $p = 0.000$). Likewise, MBG Delivery Vehicles significantly influence Distribution Performance ($T = 2.303$; $p = 0.022$) and Beneficiary Satisfaction ($T = 3.457$; $p = 0.001$). Furthermore, Distribution Performance has a significant positive effect on Beneficiary Satisfaction ($T = 3.493$; $p = 0.001$) and mediates the relationships between Packaging Quality ($T = 2.410$; $p = 0.016$), Food Quality ($T = 2.597$; $p = 0.010$), MBG Delivery Vehicles ($T = 1.996$; $p = 0.046$), and Beneficiary Satisfaction. These findings suggest that improving packaging quality, food quality, and the capability of MBG delivery vehicles, supported by effective distribution performance, can substantially enhance beneficiary satisfaction with the Free Nutritious Meal Program.

Keywords: Packaging Quality, Food Quality, MBG Delivery Vehicle, Distribution Performance, Beneficiary Satisfaction.

Indonesian Abstract: Penelitian ini bertujuan untuk menguji pengaruh langsung dan tidak langsung antara Kualitas Kemasan (Packaging Quality), Kualitas Makanan (Food Quality), Kendaraan Pengantaran MBG (MBG Delivery Vehicles), Kinerja Distribusi (Distribution Performance), dan Kepuasan Penerima Manfaat (Beneficiary Satisfaction) dalam Program Makan Bergizi Gratis (MBG). Penelitian ini menggunakan pendekatan kuantitatif dengan

metode survei yang melibatkan 112 penerima manfaat Program MBG pada Satuan Pelayanan Pemenuhan Gizi (SPPG) Kepolisian Negara Republik Indonesia, Polrestaes Semarang. Responden dipilih menggunakan teknik purposive sampling. Data dianalisis menggunakan Structural Equation Modeling–Partial Least Squares (SEM-PLS) dengan bantuan SmartPLS 4. Hasil penelitian menunjukkan bahwa Kualitas Kemasan berpengaruh signifikan terhadap Kinerja Distribusi ($T = 4,600$; $p = 0,000$) dan Kepuasan Penerima Manfaat ($T = 6,028$; $p = 0,000$). Kualitas Makanan juga memiliki pengaruh positif dan signifikan terhadap Kinerja Distribusi ($T = 3,859$; $p = 0,000$) dan Kepuasan Penerima Manfaat ($T = 3,606$; $p = 0,000$). Demikian pula, Kendaraan Pengantaran MBG berpengaruh signifikan terhadap Kinerja Distribusi ($T = 2,303$; $p = 0,022$) dan Kepuasan Penerima Manfaat ($T = 3,457$; $p = 0,001$). Selanjutnya, Kinerja Distribusi berpengaruh positif dan signifikan terhadap Kepuasan Penerima Manfaat ($T = 3,493$; $p = 0,001$) serta memediasi hubungan antara Kualitas Kemasan ($T = 2,410$; $p = 0,016$), Kualitas Makanan ($T = 2,597$; $p = 0,010$), dan Kendaraan Pengantaran MBG ($T = 1,996$; $p = 0,046$) dengan Kepuasan Penerima Manfaat. Temuan ini menunjukkan bahwa peningkatan kualitas kemasan, kualitas makanan, dan kemampuan kendaraan pengantaran MBG, yang didukung oleh kinerja distribusi yang efektif, dapat secara signifikan meningkatkan kepuasan penerima manfaat terhadap Program Makan Bergizi Gratis.

Keywords: Kualitas Kemasan, Kualitas Makanan, Kendaraan Pengantaran MBG, Kinerja Distribusi, Kepuasan Penerima Manfaat.

INTRODUCTION

The Free Nutritious Meal (MBG) Program is one of the Indonesian government's strategic initiatives aimed at improving human resource quality by providing nutritionally balanced meals to target groups, including students, pregnant women, breastfeeding mothers, and other vulnerable populations. The success of this program depends not only on the nutritional adequacy of the meals provided but also on the effectiveness of the distribution system in ensuring that meals are delivered safely, hygienically, in good condition, and on time. Consequently, the logistics system has become a critical determinant of the successful implementation of the MBG Program.

Within the implementation of the MBG Program, the Nutrition Fulfillment Center (*Sentra Pemenuhan Gizi*—SPPG) is responsible for food production, packaging, storage, and distribution to beneficiaries. These distribution activities require packaging that effectively preserves food safety and quality throughout transportation, high-quality food that remains suitable for consumption upon delivery, and transportation facilities that comply with food distribution operational standards. Weaknesses in any of these components may reduce service quality and ultimately affect beneficiary satisfaction.

The descriptive analysis conducted in this study indicates that all research variables were rated within the "moderately good" category. Packaging Quality achieved a mean score of 3.22, Food Quality 3.03, MBG Delivery Vehicles 3.05, Distribution Performance 2.98, and Beneficiary Satisfaction 3.22. These findings reveal a noticeable gap between current service performance and the expected level of service quality, suggesting considerable room for improvement in the distribution system of the MBG Program.

Previous studies have demonstrated that packaging quality plays an important role in maintaining product quality during distribution, food quality influences customers' perceptions of service, and transportation determines the effectiveness of distribution activities. Nevertheless, most previous studies have investigated these variables separately. Empirical studies integrating Packaging Quality, Food Quality, and transportation facilities within a

single structural model while incorporating Distribution Performance as a mediating variable in the context of the Free Nutritious Meal Program remain relatively limited.

This research gap highlights the need for an empirical model capable of explaining how Packaging Quality, Food Quality, and MBG Delivery Vehicles influence Beneficiary Satisfaction both directly and indirectly through Distribution Performance. Understanding these relationships is essential for developing policies that improve the effectiveness of nutritious food distribution within the MBG Program.

The novelty of this study lies in the development of an integrative structural model linking Packaging Quality, Food Quality, and MBG Delivery Vehicles with Beneficiary Satisfaction through the mediating role of Distribution Performance in the Free Nutritious Meal Program. The proposed model offers a new perspective by emphasizing that successful food distribution depends not only on food quality itself but also on the integration of packaging systems, transportation facilities, and distribution performance within the logistics management process.

Accordingly, this study aims to examine the effects of Packaging Quality, Food Quality, and MBG Delivery Vehicles on Distribution Performance and Beneficiary Satisfaction in the Free Nutritious Meal Program. In addition, it investigates the mediating role of Distribution Performance in the relationships between these variables and Beneficiary Satisfaction. The findings are expected to contribute to the advancement of food logistics management literature while providing practical recommendations for the National Nutrition Agency and SPPG administrators to improve the effectiveness and sustainability of the Free Nutritious Meal Program.

METHODS

This study employed a quantitative research approach using a survey method to examine the causal relationships among the variables included in the proposed research model. A quantitative approach was selected because it enables the investigation of the direct and indirect effects of Packaging Quality, Food Quality, and MBG Delivery Vehicles on Beneficiary Satisfaction in the Free Nutritious Meal (MBG) Program, with Distribution Performance serving as the mediating variable. The research was conducted at the Nutrition Fulfillment Center (Sentra Pemenuhan Gizi—SPPG) of the Indonesian National Police, Semarang Police Resort, located in Keji Village, Semarang Regency, Central Java, Indonesia. The SPPG was selected as the research site because it is one of the operational units responsible for implementing the Free Nutritious Meal Program, including food production, packaging, and distribution to various beneficiary groups on a regular basis.

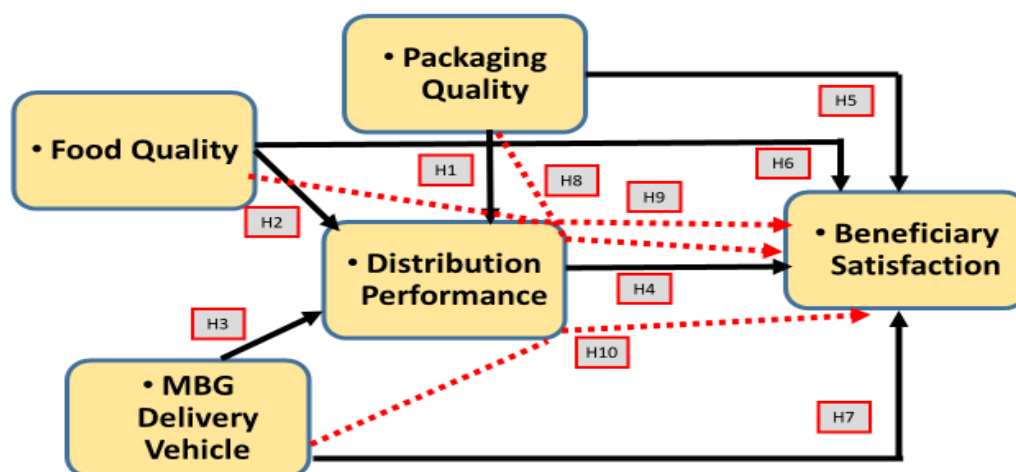
The study population consisted of all beneficiaries of the Free Nutritious Meal Program served by the SPPG of the Indonesian National Police, Semarang Police Resort. A purposive sampling technique was employed to ensure that respondents possessed sufficient experience and knowledge relevant to the objectives of the study. The selection criteria included beneficiaries who had received meals through the MBG Program, were at least 18 years of age, were capable of understanding the questionnaire, and voluntarily agreed to participate in the study. Based on these criteria, a total of 112 respondents were selected as the research sample. Five latent variables were investigated in this study: Packaging Quality (X_1), Food Quality (X_2), MBG Delivery Vehicle (X_3), Distribution Performance (Y) as the mediating variable, and Beneficiary Satisfaction (Z) as the endogenous variable. All constructs were measured using reflective indicators developed from relevant theoretical frameworks and previous empirical studies. Data were collected using a structured questionnaire based on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Prior to structural model analysis, descriptive statistics were performed to describe respondents' perceptions of each research variable. The measurement model (outer model) was subsequently evaluated through convergent validity using outer loading values and the Average

Variance Extracted (AVE), discriminant validity using the Fornell–Larcker Criterion and the Heterotrait–Monotrait Ratio (HTMT), and reliability assessment using Cronbach's Alpha and Composite Reliability. The results demonstrated that all indicator loadings exceeded the recommended threshold of 0.700, while all constructs satisfied the required validity and reliability criteria, indicating that the measurement model was appropriate for further structural analysis.

The structural model (inner model) was analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS 3 software. Model evaluation included the assessment of the coefficient of determination (Adjusted R^2), Predictive Relevance (Q^2), Effect Size (f^2), and hypothesis testing through the bootstrapping procedure. Following Hair et al. (2022), a hypothesis was considered statistically supported when the t-statistic exceeded 1.96 and the p-value was less than 0.05 at the 5% significance level.

The proposed structural model examined ten hypotheses consisting of seven direct effects and three indirect effects. The direct relationships included the effects of Packaging Quality, Food Quality, and MBG Delivery Vehicles on Distribution Performance and Beneficiary Satisfaction, as well as the effect of Distribution Performance on Beneficiary Satisfaction. The indirect relationships evaluated the mediating role of Distribution Performance in the relationships between Packaging Quality, Food Quality, MBG Delivery Vehicles, and Beneficiary Satisfaction. The proposed conceptual framework is presented in Figure 1.



Source : Developed From Previous Studies (2026)

Figure 1. Research Framework

RESULTS AND DISCUSSION

Respondent Characteristics

This study involved 112 beneficiaries of the Free Nutritious Meal (MBG) Program at the Nutrition Fulfillment Center (SPPG) of the Indonesian National Police, Semarang Police Resort. Based on demographic characteristics, female respondents accounted for the majority of the sample, comprising 81 individuals (72.32%), while male respondents totaled 31 individuals (27.68%). The largest age group was between 35 and 44 years (35.71%), and most respondents held a bachelor's degree (49.11%).

Regarding beneficiary categories, teachers represented the largest proportion of respondents (39.29%), followed by breastfeeding mothers (28.57%), educational staff (18.75%), pregnant women (9.82%), and members of the Family Welfare Empowerment Organization (PKK) (3.57%). Most respondents had participated in the MBG Program for four to six months and primarily received nutritious meals at schools. These characteristics indicate that the respondents possessed sufficient experience in evaluating the quality of MBG services and therefore constituted an appropriate source of information for this study.

Descriptive Analysis

Table 1. Descriptive Analysis

No.	Variable	Mean Score	Interpretation	Decision
1	Packaging Quality	3.22	Moderately Good	Eligible for Further Analysis
2	Food Quality	3.03	Moderately Good	Eligible for Further Analysis
3	MBG Delivery Vehicle	3.05	Moderately Good	Eligible for Further Analysis
4	Distribution Performance	2.98	Moderately Good	Eligible for Further Analysis
5	Beneficiary Satisfaction	3.22	Moderately Good	Eligible for Further Analysis

Source : Questionnaire (2026)

The descriptive analysis presented in Table 1 indicates that all research variables were classified as "moderately good." Packaging Quality obtained the highest mean score (3.22), followed by Beneficiary Satisfaction (3.22), MBG Delivery Vehicle (3.05), Food Quality (3.03), and Distribution Performance (2.98). These findings suggest that although the implementation of the Free Nutritious Meal Program has been relatively satisfactory, its overall performance has not yet reached the "good" category, indicating substantial opportunities for service improvement.

Measurement Model Evaluation (Outer Model)

The measurement model was evaluated by assessing construct validity and reliability. As presented in Table 2, all indicators demonstrated satisfactory psychometric properties.

Table 2. Convergent Validity and Reliability Results

Construct	Cronbach's Alpha	rho_A	Composite Reliability	AVE
Beneficiary Satisfaction	0.897	0.903	0.915	0.522
Distribution Performance	0.906	0.91	0.923	0.574
Food Quality	0.886	0.894	0.91	0.591
Packaging Quality	0.891	0.903	0.913	0.601
MBG Delivery Vehicle	0.901	0.926	0.92	0.624

Source : Questionnaire (2026)

The convergent validity assessment confirmed that all indicator loadings exceeded the recommended threshold of 0.700. Furthermore, all constructs achieved Average Variance Extracted (AVE) values greater than 0.500, indicating that each construct adequately explained the variance of its corresponding indicators.

Table 3. Discriminant Validity (Fornell–Larcker Criterion)

Construct	Beneficiary Satisfaction	Distribution Performance	Food Quality	Packaging Quality	MBG Delivery VehicleV
Beneficiary Satisfaction	0.723				
Distribution Performance	0.712	0.758			
Food Quality	0.705	0.598	0.769		
Packaging Quality	0.695	0.628	0.599	0.775	
MBG Delivery Vehicle	0.662	0.516	0.522	0.533	0.79

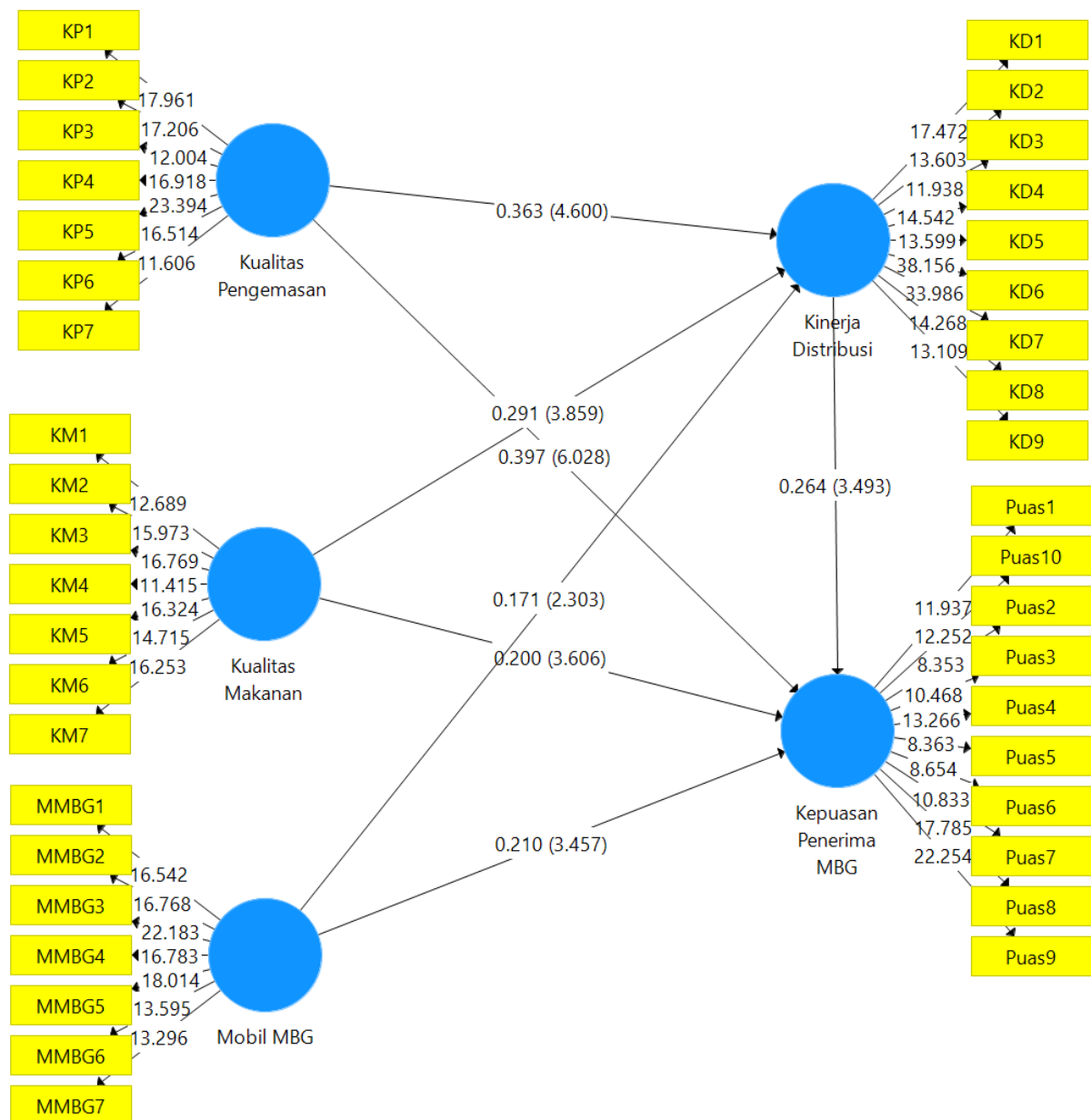
Source: Questionnaire Data (2026).

Discriminant validity was further assessed using the Fornell–Larcker Criterion and the Heterotrait–Monotrait Ratio (HTMT). The square root of the AVE for each construct exceeded

its correlations with other constructs, while all HTMT values were below the recommended threshold. These results confirm that each construct adequately represents a distinct theoretical concept. Reliability analysis also demonstrated excellent internal consistency. All constructs reported Cronbach's Alpha and Composite Reliability values above 0.700, confirming that the research instrument is both reliable and suitable for structural model analysis.

Structural Model Evaluation (Inner Model)

Figure 2 presents the results of the structural model estimated using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach.



Source: Questionnaire Data (2026)

Figure 2. Structural Model Results

The structural model evaluation demonstrates that all proposed hypotheses were statistically supported. Packaging Quality, Food Quality, and MBG Delivery Vehicle significantly influenced Distribution Performance. These three exogenous variables also exerted significant positive effects on Beneficiary Satisfaction. In addition, Distribution

Performance significantly affected Beneficiary Satisfaction and served as a mediating variable linking Packaging Quality, Food Quality, and MBG Delivery Vehicle with Beneficiary Satisfaction. The complete hypothesis testing results are presented in **Table 4**.

Table 4. Hypothesis Testing Results

Hypothesis	Path Coefficient	T-Statistic	p-value	Decision
Distribution Performance → Beneficiary Satisfaction	0.264	3.493	0.001	Supported
Food Quality → Beneficiary Satisfaction	0.2	3.606	0	Supported
Food Quality → Distribution Performance	0.291	3.859	0	Supported
Packaging Quality → Beneficiary Satisfaction	0.397	6.028	0	Supported
Packaging Quality → Distribution Performance	0.363	4.6	0	Supported
MBG Delivery Vehicle → Beneficiary Satisfaction	0.21	3.457	0.001	Supported
MBG Delivery Vehicle → Distribution Performance	0.171	2.303	0.022	Supported
Food Quality → Distribution Performance → Beneficiary Satisfaction	0.077	2.597	0.01	Supported
Packaging Quality → Distribution Performance → Beneficiary Satisfaction	0.096	2.41	0.016	Supported
MBG Delivery Vehicle → Distribution Performance → Beneficiary Satisfaction	0.045	1.996	0.046	Supported

Source: Questionnaire Data (2026).

Hypothesis testing was conducted using the bootstrapping procedure in SmartPLS. Following Hair et al. (2022), a hypothesis is accepted when the *t*-statistic exceeds 1.96 and the *p*-value is below 0.05. The results indicate that all ten hypotheses were supported.

Packaging Quality significantly improved Distribution Performance ($\beta = 0.363$; $T = 4.600$; $p < 0.001$), indicating that better food packaging enhances the effectiveness of meal distribution. Likewise, Food Quality ($\beta = 0.291$; $T = 3.859$; $p < 0.001$) and MBG Delivery Vehicle ($\beta = 0.171$; $T = 2.303$; $p = 0.022$) also had significant positive effects on Distribution Performance. Distribution Performance significantly influenced Beneficiary Satisfaction ($\beta = 0.264$; $T = 3.493$; $p = 0.001$). Furthermore, Packaging Quality exhibited the strongest direct effect on Beneficiary Satisfaction ($\beta = 0.397$; $T = 6.028$; $p < 0.001$), followed by MBG Delivery Vehicle ($\beta = 0.210$; $T = 3.457$; $p = 0.001$) and Food Quality ($\beta = 0.200$; $T = 3.606$; $p < 0.001$).

The mediation analysis confirmed that Distribution Performance significantly mediated the relationships between Packaging Quality, Food Quality, MBG Delivery Vehicle, and Beneficiary Satisfaction, thereby indicating that improvements in packaging, food quality, and transportation become more effective in enhancing beneficiary satisfaction when supported by an efficient distribution system.

Coefficient of Determination (R^2)

The coefficient of determination indicates that Packaging Quality, Food Quality, and MBG Delivery Vehicle jointly explain 47.6% of the variance in Distribution Performance (Adjusted $R^2 = 0.476$). Furthermore, the overall structural model explains 78.4% of the

variance in Beneficiary Satisfaction (Adjusted $R^2 = 0.784$), indicating substantial explanatory power.

The predictive relevance assessment produced Q^2 values of 0.270 for Distribution Performance and 0.382 for Beneficiary Satisfaction, both exceeding zero, thereby confirming satisfactory predictive capability. The effect size analysis (f^2) further revealed that Packaging Quality exerted the largest contribution to Beneficiary Satisfaction ($f^2 = 0.377$), whereas Distribution Performance demonstrated a moderate effect ($f^2 = 0.170$). Food Quality and MBG Delivery Vehicle contributed smaller yet statistically significant effects to the structural model.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

1. The first hypothesis (H1) was supported, indicating that Packaging Quality has a positive and significant effect on Distribution Performance, with a T-statistic of 4.600 (>1.96) and a p-value of 0.000 (<0.05). This finding demonstrates that improvements in food packaging quality significantly enhance the distribution performance of the Free Nutritious Meal (MBG) Program.
2. The second hypothesis (H2) was supported, showing that Food Quality has a positive and significant effect on Distribution Performance, with a T-statistic of 3.859 (>1.96) and a p-value of 0.000 (<0.05). This result indicates that higher food quality contributes to more effective and efficient food distribution.
3. The third hypothesis (H3) was supported, demonstrating that MBG Delivery Vehicles have a positive and significant effect on Distribution Performance, with a T-statistic of 2.303 (>1.96) and a p-value of 0.022 (<0.05). This finding confirms that appropriate transportation facilities improve the effectiveness of meal distribution.
4. The fourth hypothesis (H4) was supported, indicating that Distribution Performance positively and significantly influences Beneficiary Satisfaction, with a T-statistic of 3.493 (>1.96) and a p-value of 0.001 (<0.05). Timely, accurate, and reliable distribution therefore plays an essential role in improving beneficiary satisfaction.
5. The fifth hypothesis (H5) was supported, revealing that Packaging Quality has a positive and significant effect on Beneficiary Satisfaction, with a T-statistic of 6.028 (>1.96) and a p-value of 0.000 (<0.05). Among all direct relationships examined, Packaging Quality exhibited the strongest influence, making it the most dominant determinant of beneficiary satisfaction.
6. The sixth hypothesis (H6) was supported, showing that Food Quality positively and significantly affects Beneficiary Satisfaction, with a T-statistic of 3.606 (>1.96) and a p-value of 0.000 (<0.05). High-quality, safe, and nutritious meals significantly increase beneficiaries' satisfaction with the MBG Program.
7. The seventh hypothesis (H7) was supported, indicating that MBG Delivery Vehicles positively and significantly affect Beneficiary Satisfaction, with a T-statistic of 3.457 (>1.96) and a p-value of 0.001 (<0.05). Proper transportation facilities help preserve food quality during delivery, thereby enhancing beneficiary satisfaction.
8. The eighth hypothesis (H8) was supported, demonstrating that Distribution Performance mediates the relationship between Packaging Quality and Beneficiary Satisfaction, with an indirect T-statistic of 2.410 (>1.96) and a p-value of 0.016 (<0.05). This finding indicates that better packaging quality contributes more substantially to beneficiary satisfaction when supported by effective distribution performance.
9. The ninth hypothesis (H9) was supported, confirming that Distribution Performance mediates the relationship between Food Quality and Beneficiary Satisfaction, with a T-statistic of 2.597 (>1.96) and a p-value of 0.010 (<0.05). Thus, the positive impact of food quality on beneficiary satisfaction becomes stronger when distribution activities are effectively managed.

10. The tenth hypothesis (H10) was also supported, showing that Distribution Performance mediates the relationship between MBG Delivery Vehicles and Beneficiary Satisfaction, with a T-statistic of 1.996 (>1.96) and a p-value of 0.046 (<0.05). Although the indirect effect is relatively small, it confirms that improving transportation quality contributes to beneficiary satisfaction through enhanced distribution performance.

Limitations

This study has several limitations. First, the research was conducted only at one Free Nutritious Meal Service Unit (SPPG) of the Indonesian National Police in Semarang, limiting the generalizability of the findings to all MBG implementation sites across Indonesia. Second, the study involved only 112 beneficiaries, restricting the diversity of respondent characteristics.

Third, the research model included only Packaging Quality, Food Quality, MBG Delivery Vehicles, Distribution Performance, and Beneficiary Satisfaction. Other potential determinants, such as service quality, menu appropriateness, communication effectiveness, food safety management, and operational management, were not incorporated into the model.

Finally, the study employed a cross-sectional research design, which does not capture changes in beneficiary perceptions over time.

Recommendations

The National Nutrition Agency and SPPG managers are encouraged to improve packaging quality to better maintain food temperature, cleanliness, safety, and quality throughout the distribution process. Continuous quality control should also be implemented to ensure that meals consistently meet standards related to taste, nutritional value, hygiene, and food safety.

Program administrators should further improve the quality of MBG delivery vehicles by providing transportation that complies with food sanitation standards, has adequate carrying capacity, and operates under more effective delivery schedules. These improvements are expected to enhance distribution performance while increasing beneficiary satisfaction.

Future researchers are encouraged to expand the study to multiple SPPGs across different regions, increase the sample size, and incorporate additional variables such as service quality, beneficiary trust, food safety, distribution traceability technology, and cold chain logistics. Future studies may also employ longitudinal designs or alternative analytical approaches, including Covariance-Based Structural Equation Modeling (CB-SEM), Multi-Group Analysis (MGA), or Artificial Intelligence (AI)-based methods to provide a more comprehensive understanding of the determinants of the Free Nutritious Meal Program's success.

Author Contributions

Ayu Wanda Candrasa Haq contributed to the conceptualization of the study, questionnaire development, data collection, data analysis, interpretation of findings, and preparation of the initial manuscript. Erna Mulyati contributed to the development of the theoretical framework, validation of the research methodology, critical review of the findings, manuscript revision, and overall research supervision. Both authors have read, approved, and accepted full responsibility for the final version of the manuscript submitted for publication.

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