

# WHEN DIGITAL LITERACY MEETS NEGATIVE BIAS: UNDERSTANDING THE ADOPTION OF ONLINE INFORMATION AND SENTIMENT ON X

Rila Setyaningsih<sup>1\*</sup>, Didik Haryadi Santoso<sup>1</sup>, and Noor Afy Shovmayanti<sup>2</sup>

<sup>1</sup> Department of Communication, Universitas Mercu Buana Yogyakarta, Indonesia

<sup>2</sup> Department of Communication, Universitas Muhammadiyah Klaten, Indonesia

## ABSTRACT

**\*Corresponding author:**  
Rila Setyaningsih  
[rila.s@mercubuana-yogya.ac.id](mailto:rila.s@mercubuana-yogya.ac.id)

**Received:** 2 April 2026

**Revised:** 15 July 2026

**Accepted:** 30 July 2026

**Published:** 19 October 2026

**Citation:**  
Setyaningsih, R., Santoso,  
D. H., & Shovmayanti, N. A.  
(2026). When digital literacy  
meets negative bias:  
Understanding the adoption of  
online information and  
sentiment on X. *Humanities,  
Arts and Social Sciences  
Studies*, 26(3), 704–720.  
[https://doi.org/10.69598/  
hasss.26.3.284936](https://doi.org/10.69598/hasss.26.3.284936)

Digital platforms increasingly mediate how citizens engage with public policy, shaping not only access to information but also the formation of collective interpretations and sentiments. In the context of Indonesia's Free Nutritious Meal (*Makan Bergizi Gratis*: MBG) program, this study examines the relationship between individual digital literacy and online information adoption, while simultaneously mapping public sentiment and discourse dynamics on X. Employing a concurrent mixed-methods design, the study combines an online survey of 385 social media users drawing on the DigComp 2.2 framework and the Information Adoption Model with large-scale social media analysis of 87,589 MBG-related mentions on X collected between April and August 2025 using Drone Emprit. Regression analysis revealed that digital literacy significantly predicts information adoption regarding the MBG program ( $\beta = 0.581$ ,  $R^2 = 0.549$ ,  $p < 0.001$ ), indicating that digital literacy explains 54.9% of the variance in information adoption and substantially enhances individuals' capacity to evaluate and accept policy-related information. While digital literacy supports information adoption at the individual level, the overall online discourse surrounding MBG remained predominantly negative, suggesting a disconnect between individual informational competence and collective sentiment formation. Sentiment analysis further revealed that public discourse was predominantly negative (56%), compared with positive (43%) and neutral (1%) expressions, with significant surges observed in May and July 2025. Network analysis additionally revealed that negative sentiment is concentrated around accounts with high centrality and influence, thereby amplifying critical narratives through networked interactions. These findings highlight a structural tension between individual informational competence and collective sentiment formation in digital communication environments. This research contributes to the existing body of work on digital communication and public policy by illustrating that initiatives aimed at improving digital literacy should be complemented by network-aware communication strategies, such as influencer engagement and real-time discourse monitoring, to bolster public trust and legitimacy in extensive policy interventions.

**Keywords:** Digital literacy; policy communication; information adoption; sentiment analysis; networked public sphere

## 1. INTRODUCTION

The digital transformation of public information ecosystems has fundamentally reshaped the way health and nutrition policies are communicated and debated. Social media platforms have emerged as central arenas where policy narratives are produced, contested, and legitimized through public interaction. In the case of Indonesia's Free Nutritious Meal program (*Makan Bergizi Gratis*: MBG), social media discussions have reached a considerable scale, with tens of thousands of online mentions that can rapidly shape public perception and influence policy legitimacy. While such platforms enable the wide dissemination of information and participatory engagement, they also introduce significant risks of misinformation, emotional amplification, and polarized discourse.

MBG is one of Indonesia's flagship nutrition and social welfare initiatives designed to improve child nutrition, reduce stunting, and strengthen human capital development by providing nutritious meals for school-aged children. As a large-scale national program targeting millions of beneficiaries across diverse regions of Indonesia, MBG has attracted substantial public attention since its introduction. While the program is widely regarded as a strategic investment in public health and educational outcomes, it has also generated public debate concerning budget allocation, implementation capacity, governance, and long-term sustainability. Consequently, MBG has become a highly visible topic in digital media environments, where public opinion, competing narratives, and policy evaluations are actively disseminated and contested through social media platforms.

Social media has increasingly been recognized as a strategic tool in health promotion and policy communication, allowing institutions and professionals to disseminate educational content, engage communities, and foster trust. Platforms such as X (formerly Twitter) facilitate real-time interaction, advocacy, and collective sense-making, enabling public support for policy initiatives to be mobilized more quickly than through traditional media channels. These attributes underscore social media's capacity to enhance the communication of nutrition policies and foster public involvement. Nevertheless, this potential is often compromised by the rapid dissemination of inaccurate or deceptive information within online platforms. The proliferation of unverified influencers, automated accounts, and non-expert participants exacerbates distorted discussions and false equivalences, thereby hindering public comprehension and undermining evidence-based policy dialogue (Cram, 2022).

Despite these obstacles, social media remains a crucial arena for professional and institutional participation. Health organizations and specialists can directly engage with the public, respond to inquiries, and refute misinformation through a consistent digital presence and strategic communication. However, the efficacy of these initiatives hinges not only on the precision of the messages conveyed but also on users' ability to assess information critically. This vulnerability to misinformation underscores the importance of communication strategies that emphasize credibility, dialogue, and evidence-based engagement rather than one-way information dissemination (Balog-Way & McComas, 2025; Johnson, 2024).

Digital literacy has therefore become a central concept in understanding how individuals navigate online food and nutrition communication (Silva et al., 2023). Rather than a purely technical skill, digital literacy is increasingly conceptualized as a multidimensional capability encompassing functional, interactive, critical, and translational competencies. This perspective aligns with the Digital Competence Framework (DigComp 2.2) and the Information Adoption Model (IAM), both of which emphasize how literacy dimensions shape individuals' ability to assess information quality, evaluate source credibility, and perceive usefulness in complex digital environments. Functional literacy enables individuals to comprehend food-related information, while interactive literacy supports participation and information exchange within digital communities. Critical literacy is particularly crucial for identifying misinformation, as it equips users to scrutinize sources and the intent of messages.

Translational literacy facilitates the application of digital information to real-life dietary decisions. Existing studies in Humanities, Arts, and Social Sciences provide valuable insights into how digital practices intersect with learning, communication, and social behavior. Research on digital interactive storytelling demonstrates how tailored digital content can enhance comprehension and engagement among vulnerable groups, underscoring the role of adaptive communication strategies in facilitating information uptake (Hongngam et al., 2025). Similarly, studies on digital media guidelines for sustainable tourism reveal how effective digital communication can shape public understanding and long-term acceptance of policy initiatives rooted in cultural and community contexts (Boonprachoom et al., 2025). These findings suggest that digital competence and communication strategies are integral to how information is interpreted and adopted across policy domains.

At the same time, social media environments are characterized by affective dynamics that can intensify negative interactions and polarized sentiment. Research on social media use and cyberbullying among students

highlights how online spaces can amplify emotional responses and social conflict, necessitating the development of coping strategies beyond basic digital skills (Pushsapavardhana, 2025). Other studies emphasize that meaningful engagement with digital content is often fostered through structured learning models and community-based approaches that situate digital practices within broader social ecosystems (Suwan & Sithsungnoen, 2025; Yaboonthong et al., 2025). Reflections on online research-based learning during the COVID-19 pandemic further illustrate how digital platforms simultaneously enable access to information while reshaping interaction patterns and critical reflection processes (Jaroenpool et al., 2023). Collectively, this literature reinforces the view that digital environments function as complex social spaces where cognition, emotion, and interaction intersect.

In the context of the MBG program, the digital rollout has faced substantial challenges stemming from polarized online sentiment. Despite considerable digital literacy among specific demographic groups, negative discourse remains a dominant force in social media interactions, thereby impeding public endorsement of the program. This situation underscores the inadequacy of conceptualizing digital literacy exclusively as an individual technical skill. Enhanced literacy does not necessarily correlate with a positive collective sentiment, especially within contexts influenced by computational propaganda, the manipulation of hate speech, and the networked amplification of negative content. Furthermore, the COVID-19 pandemic has provided further evidence of how misleading health information can diminish trust and exacerbate skepticism about public health initiatives. Socio-digital inequalities further complicate this problem.

Disparities in access, device utilization, and literacy significantly affect individuals' ability to participate effectively in online policy dialogues. Those reliant solely on mobile devices, older populations, and marginalized groups may encounter obstacles that impede their involvement in digital communication efforts, thereby exacerbating existing structural inequities. These circumstances indicate that merely improving digital literacy is insufficient to ensure inclusive and productive public engagement with nutrition policies such as MBG.

To overcome these obstacles, policy communication strategies must move beyond fragmented approaches and embrace integrated frameworks that merge population-level digital literacy programs with network-aware communication strategies. Engaging credible influencers, implementing targeted counter-messaging, and establishing rapid misinformation response mechanisms can help mitigate negativity and enhance information adoption. However, such strategies must be designed carefully to avoid reinforcing misinformation or deepening polarization.

Despite the growing body of literature on digital literacy and information adoption, limited attention has been devoted to understanding why negative bias persists in online policy discussions, even among digitally literate users. Existing studies generally assume that higher digital literacy improves individuals' ability to evaluate information and to critically resist misinformation. However, digital communication environments are often shaped by emotional narratives, selective exposure, and network-driven amplification mechanisms that may sustain negative perceptions despite high levels of informational competence. This gap is particularly relevant in the context of large-scale public policy initiatives such as the MBG program.

Against this backdrop, the present study explores the intersection of digital literacy and social media sentiment within the food policy domain, using the MBG program as a focal case. Employing a concurrent mixed-methods approach, the study examines how digital literacy influences the adoption of MBG-related information while simultaneously analyzing public sentiment and social media discourse networks. By integrating DigComp 2.2 and the Information Adoption Model with large-scale sentiment analysis, this research contributes to digital communication and social science scholarship by illuminating the tension between individual-level informational capacity and collective sentiment formation in networked public spaces. Understanding this interaction is essential for designing communication strategies that foster trust, inclusivity, and legitimacy in large-scale nutrition policy interventions.

## 2. METHOD

This study employed a constructivist paradigm and adopted a mixed-methods approach with a concurrent triangulation design. The rationale for this design was to obtain a comprehensive understanding of the influence of digital literacy on information adoption regarding the Free Nutritious Meal (*Makan Bergizi Gratis*, MBG) program, while simultaneously mapping public sentiment on social media. Quantitative data (survey) were used to test hypotheses concerning digital literacy and information adoption, whereas social media analytics from X provided insights into public sentiment dynamics.

The study was conducted in Indonesia. Both survey distribution and X data extraction were undertaken between April 1, 2025 and August 31, 2025, a period chosen to capture the official implementation of the MBG program and fluctuations in online discourse surrounding it. The target population consisted of active social media users in Indonesia who had been exposed to MBG-related information. For the quantitative

strand, stratified random sampling was employed to ensure representation across age, gender, education, and frequency of social media use. Strata were defined by age groups (17–24; 25–34; 35–44;  $\geq 45$  years). The sampling frame was obtained through collaboration with the survey firm Populix. The required sample size was  $n = 385$ , calculated using Cochran's formula at a 95% confidence level and 5% margin of error ( $n_0 = 1.96^2 \times 0.5 \times 0.5 / 0.05^2 \approx 384.16$ , rounded to 385). A total of 385 valid responses were retained for analysis after screening for completeness and eligibility. Eligibility criteria were: (1) aged 17–60 years, (2) active social media use within the past 30 days, and (3) prior exposure to MBG-related information.

The survey instrument combined items from the DigComp 2.2 framework (five digital competence dimensions: information/data literacy, communication and collaboration, digital content creation, safety, problem solving) and the Information Adoption Model (IAM) (argument quality, source credibility, information usefulness). All items were measured on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Items were translated and back-translated where necessary. A panel of communication and public health experts confirmed content validity. A pilot test was conducted with  $n = 30$  respondents. Cronbach's  $\alpha$  values for all constructs exceeded 0.70, indicating acceptable reliability. For construct validity, Cronbach's  $\alpha$  and item-total correlations were computed to assess reliability and construct validity. All items exceeded the minimum validity threshold and demonstrated satisfactory internal consistency.

X data were collected using Drone Emprit (Astramaya), with predefined keyword queries: “*makan bergizi gratis*,” “*MBG*,” “*program makan sekolah*,” and “*makan siang gratis*.” The extraction covered April 1–August 31, 2025. Raw data included post content, metadata (timestamp, reposts, likes, replies), and public account attributes. Cleaning procedures removed duplicates, excluded non-Indonesian language posts, and eliminated suspected bot accounts. Drone Emprit's sentiment classification (lexicon-based with machine learning, optimized for Indonesian) was employed.

The study followed four phases: (1) Data collection: distribution of the online survey and extraction of X data. (2) Preprocessing: screening survey data (missing values and outliers) and cleaning X data (duplicates, bot accounts, and language filtering). (3) Analysis: Quantitative data were analyzed using descriptive statistics, reliability and validity testing, and simple linear regression to examine the relationship between digital literacy and information adoption. X data were analyzed through sentiment distribution (positive, neutral, and negative) and temporal trend analysis to identify patterns in public discourse regarding the MBG program. (4) Integration: Results from both strands were synthesized using triangulation to develop communication insights tailored to digital literacy profiles and prevailing sentiment patterns.

Survey data were analyzed using IBM SPSS Statistics 29. Reliability and validity assessments included Cronbach's  $\alpha$  and item-total correlation analyses. Descriptive statistics were computed to summarize respondent characteristics and key study variables. To examine the effect of digital literacy on information adoption regarding the MBG program, a simple linear regression model was employed using the following equation:  $\text{Information Adoption}_i = \beta_0 + \beta_1 (\text{Digital literacy}_i) + \varepsilon_i$ . Model fit was evaluated using the coefficient of determination ( $R^2$ ), while statistical significance was assessed through ANOVA (F-test) and regression coefficients. Assumption testing included normality, linearity, homoscedasticity, and outlier detection. Effect sizes ( $\beta$  and  $R^2$ ) and corresponding p-values were reported to evaluate the strength and significance of the relationship between variables.

Sentiment distributions were reported as proportions and weighted scores (engagement-weighted). Temporal dynamics were visualized weekly, with spikes linked to program-related events. In addition, sentiment distributions and temporal trends were analyzed to identify dominant patterns in MBG-related discussions on X.

### 3. RESULTS

#### 3.1 The effect of digital literacy on MBG information reception

Summary validity and internal consistency tests were conducted on the survey instrument before hypothesis testing. The variable validity, and reliability test results are shown in Tables 1 and 2.

**Table 1:** Variable validity test results

| Construct                | Item range (code) | Item-total correlation range (r) | r-table (N = 385, $\alpha = 0.01$ ) |
|--------------------------|-------------------|----------------------------------|-------------------------------------|
| Digital literacy (X)     | X1.1–X1.19        | 0.531–0.713                      | 0.130                               |
| Information adoption (Y) | Y1–Y13            | 0.422–0.747                      | 0.130                               |

Notes: All reported item-total correlations exceeded r-table (0.130), indicating that each item was adequately correlated with its respective construct total score.

**Table 2:** Reliability test results

| Construct                | No. of items | Cronbach's $\alpha$ |
|--------------------------|--------------|---------------------|
| Digital literacy (X)     | 19           | 0.921               |
| Information adoption (Y) | 13           | 0.864               |

Notes: Cronbach's  $\alpha > 0.70$  for both constructs, indicating acceptable to excellent internal consistency.

**Table 3:** Descriptive statistics

| Variable                 | N   | Minimum | Maximum | Mean  | SD   |
|--------------------------|-----|---------|---------|-------|------|
| Digital literacy (X)     | 385 | 39      | 95      | 80.98 | 9.61 |
| Information adoption (Y) | 385 | 26      | 65      | 52.03 | 7.53 |

The digital literacy variable (X) ranged from 39 to 95, with a mean of 80.98 and a standard deviation of 9.607 (see Table 3). The average score, close to the maximum, indicates that, in general, the respondent community's level of digital literacy is in the high category. The variable of information receipt of the Free Nutritious Meal Program (Y) has a minimum value of 26 and a maximum of 65, with an average score of 52.03 and a standard deviation of 7.527. A relatively high average score (close to the maximum of 65) indicates that acceptance of program-related information on social media is quite high.

**Table 4:** Model determination coefficient

| Model summary <sup>b</sup> |                   |          |                   |                            |
|----------------------------|-------------------|----------|-------------------|----------------------------|
| Model                      | R                 | R Square | Adjusted R square | Std. Error of the estimate |
| 1                          | .741 <sup>a</sup> | .549     | .548              | 5.059                      |

a. Predictors: (Constant), Literasi Digital (X)

b. Dependent Variable: Penerimaan Informasi Program MBG (Y)

Based on the results of the simple linear regression analysis presented in Table 4, the correlation coefficient (R) was 0.741, indicating a strong positive relationship between digital literacy and information adoption regarding the Free Nutritious Meal (MBG) program. The coefficient of determination ( $R^2$ ) was 0.549, indicating that digital literacy explained 54.9% of the variance in information adoption. This finding suggests that higher levels of digital literacy are associated with greater acceptance and adoption of MBG-related information on social media. Furthermore, the Adjusted  $R^2$  value of 0.548 indicates that the model remains stable after adjusting for sample size, while the standard error of the estimate (5.059) reflects an acceptable level of prediction accuracy.

**Table 5:** F-Test results (simultaneous)

| ANOVA <sup>a</sup> |            |                |     |             |         |                    |
|--------------------|------------|----------------|-----|-------------|---------|--------------------|
| Model              |            | Sum of squares | df  | Mean square | F       | Sig.               |
| 1                  | Regression | 11955.581      | 1   | 11955.581   | 467.096 | <.001 <sup>b</sup> |
|                    | Residual   | 9803.104       | 383 | 25.596      |         |                    |
|                    | Total      | 21758.686      | 384 |             |         |                    |

a. Dependent Variable: Penerimaan Informasi Program MBG (Y)

b. Predictors: (Constant), Literasi Digital (X)

The hypotheses tested in this study are formulated as follows:

$H_0$ : Digital Literacy (X) has no significant effect on the Receipt of Information on the Free Nutritious Meal Program (Y).

$H_1$ : Digital Literacy (X) has a significant effect on the Receipt of Information for the Free Nutritious Meal Program (Y).

Based on the ANOVA results (Table 5), the regression model was statistically significant ( $F = 467.096$ ,  $p < 0.001$ ). The calculated F-value exceeded the critical F-value (3.86) at  $\alpha = 0.05$ , with degrees of freedom ( $df_1 = 1$ ,  $df_2 = 383$ ), indicating that the regression model provides a significant explanation of the relationship between digital literacy and information adoption for the MBG program. Therefore, digital literacy significantly predicts information adoption, supporting the proposed research hypothesis.

### 3.2 X Sentiment Analysis Results (April–August 2025)

Sentiment data showed a total of 87,589 mentions, divided into three categories: negative (48,787 mentions, 56%), positive (37,688 mentions, 43%), and neutral (1,114 mentions, 1%). Negative sentiments dominate the public conversation, while neutral sentiments are relatively insignificant.

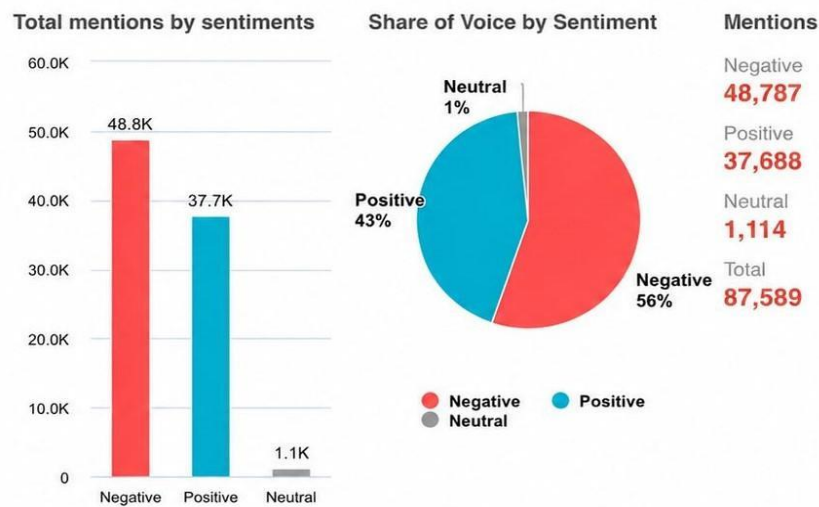


**Figure 1:** Sentiment towards the MBG program on social media X

Figure 1 clearly demonstrates the predominance of negative sentiment, accounting for 56% of all detected mentions, compared with 43% positive and only 1% neutral. This distribution highlights a substantial negative bias in public discussions about the MBG program on X.

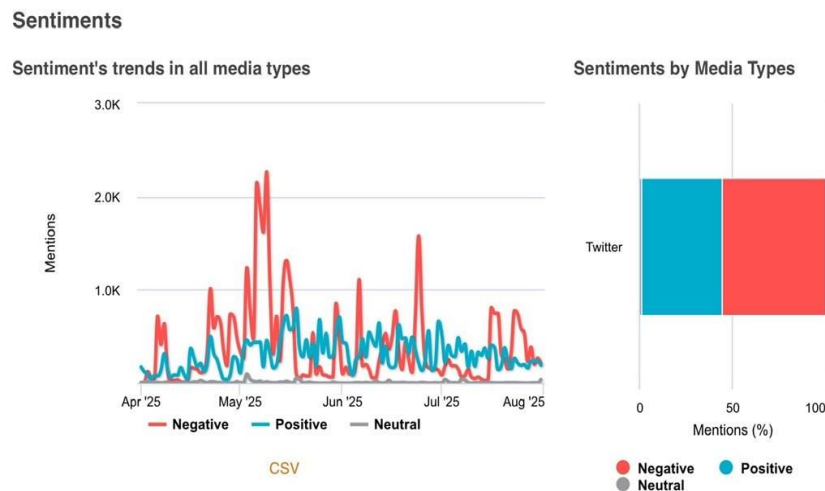


**Figure 2:** Sentiment trends for the MBG program on social media for the April–August 2025 period

Negative opinions dominated the public conversation throughout the period from April to August 2025. The sentiment trend graph (Figure 2) shows that the number of negative *mentions* is consistently higher than the numbers for positive and neutral sentiment. A significant spike occurred in May 2025, when negative mentions exceeded 2,000, far exceeding the positive and neutral sentiment, which tends to remain in the hundreds. This pattern repeats in July, although it is not as large as the peak in May.

|   |                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                     |        |           |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|
| 4 | <b>致 @minseonblues:</b><br>RT Kisruh Proyek Makan Bergizi Gratis, ICW: Lebih Baik MBG Dihentikan<br><a href="https://t.co/PnJ71ZxoQA">https://t.co/PnJ71ZxoQA</a> [REtempodotco]<br>22/Apr/2025 07:05                                                                                          | <a href="https://www.tempo.co/video/arsip/kisruh-proyek-makan-bergizi-gratis-icw-lebih-ba-ik-mbg-dihentikan-1233377">https://www.tempo.co/video/arsip/kisruh-proyek-makan-bergizi-gratis-icw-lebih-ba-ik-mbg-dihentikan-1233377</a> | 35,930 | 3,767     |
| 5 | <b>tempo.co @tempodotco:</b><br>BPOM Catat 17 Kejadian Luar Biasa Kasus Keracunan MBG sejak Januari<br><a href="https://t.co/72AXgYCIUQ">https://t.co/72AXgYCIUQ</a><br>15/May/2025 19:10                                                                                                      | <a href="https://www.tempo.co/politik/bpom-catat-17-kejadian-luar-biasa-kasus-keracunan-mbg-sejak-januari-1444155">https://www.tempo.co/politik/bpom-catat-17-kejadian-luar-biasa-kasus-keracunan-mbg-sejak-januari-1444155</a>     | 32,754 | 2,400,604 |
| 6 | <b>clarissa diva @clarissadiva5:</b><br>RT Meleng dikit, MBG bermasalah Meleng dikit, pagar laut Meleng dikit, gas 3 kg langka Meleng dikit, Danantara Meleng dikit, korupsi Pertamina Meleng dikit, CPNS ditunda Meleng dikit, UU TNI Negara apa ini? [RE ardisatriawan]<br>28/Apr/2025 12:34 | <a href="https://x.com/clarissadiva5/status/191672776385831192">https://x.com/clarissadiva5/status/191672776385831192</a>                                                                                                           | 30,344 | 108       |

**Figure 3:** Network structure of MBG-related discussions on X

Figure 3 illustrates the network structure of MBG-related discussions on X. The visualization reveals several interconnected clusters that shaped the flow of information regarding the MBG program. The concentration of interactions within specific clusters suggests that highly connected actors and communities influenced public discourse. This pattern indicates that negative narratives may have been amplified through network-level interactions, helping to explain the persistence of negative sentiment despite relatively high levels of digital literacy among respondents.

#### 4. DISCUSSION

The study highlights a strong correlation between digital literacy and the adoption of the MBG program, demonstrating that higher levels of digital literacy are associated with greater information uptake ( $\beta = 0.581$ ,  $R^2 = 0.549$ ,  $p < 0.001$ ,  $N = 385$ ). This finding emphasizes the critical role of digital literacy in enabling communities to understand, evaluate, and respond positively to public health initiatives. It shows that improving digital competence can directly support MBG's goals of promoting better child nutrition outcomes in Indonesia.

Digital literacy itself is a fundamental capability that enhances individuals' ability to access, analyze, and effectively utilize information. In the context of MBG, this competency ensures that citizens can understand program objectives, evaluate their benefits, and adopt practices aligned with the initiative (Buchori, 2018). Without adequate literacy, communities risk misinterpreting program messages, which could weaken overall public support.

Several studies reinforce this link between literacy and community development. Evidence shows that increased digital literacy correlates with higher levels of participation in development initiatives, enabling citizens to contribute more meaningfully to collective goals (Atobishi & Mansur, 2025; Dillahun et al., 2025). This aligns with the objectives of MBG, where broad-based public involvement is necessary for effective implementation and long-term sustainability.

Despite these positive associations, the study also reveals a contrasting picture in the digital public sphere. Analysis of 87,589 X mentions between April and August 2025 indicates that 56% of discourse about MBG was negative. This result suggests that digital literacy, while fostering information adoption at the individual level, does not automatically translate into positive sentiment at the collective level. Instead, online narratives can become dominated by skepticism or critique.

The prevalence of negative sentiment on X points to a disconnect between literacy-driven information adoption and public perception. Factors such as misinformation or ineffective engagement strategies may explain why public discourse does not mirror the individual-level benefits of digital literacy (Evenstein Sigalov & Tsybulsky, 2026). In the case of MBG, these dynamics illustrate how polarized conversations in digital spaces can challenge the program's legitimacy.

Moreover, social media has the capacity to amplify negativity, giving disproportionate visibility to critical or misleading narratives. Such amplification can undermine the effectiveness of official communication efforts and weaken public confidence in programs like MBG (Hari et al., 2026). This highlights the need for government and health organizations to develop more proactive and network-aware communication approaches.

Ultimately, while digital literacy is essential for enabling citizens to adopt information effectively, the negative sentiment surrounding MBG indicates that literacy alone is insufficient. Addressing misinformation and shaping public perceptions must accompany literacy initiatives to ensure program success. A dual focus, enhancing individual digital skills while actively managing online discourse, is therefore critical for strengthening MBG's impact and sustaining public trust in large-scale nutrition interventions.

The positive association between digital literacy and information adoption is increasingly supported by contemporary research, which demonstrates that competencies such as information evaluation, source appraisal, and critical thinking significantly enhance users' uptake of health-related messages. Within the context of the MBG program, these skills are vital for ensuring that citizens accurately understand the program's objectives and integrate them into their daily practices. This link highlights the importance of digital health literacy as a foundational skill set for engaging with nutrition-related policies in the digital age.

Digital literacy and health literacy are closely interconnected. A recent study found that higher levels of digital literacy are positively associated with health literacy scores, suggesting that individuals with stronger digital skills are better equipped to comprehend health information (Yıldırım, 2024). For the MBG program, this indicates that communities with higher digital literacy may be more likely to understand the program's goals, evaluate its credibility, and adopt the recommended practices for child nutrition.

Moreover, digital health literacy has been linked to improved health outcomes more broadly. Evidence shows that individuals with higher levels of digital literacy engage more effectively with available health resources (Yuen et al., 2024). This finding aligns with the aims of MBG, which relies on public engagement to achieve sustainable improvements in nutrition and reduce child malnutrition rates across Indonesia.

A critical factor in this relationship is the role of critical thinking, which enables individuals to assess the reliability of health information found online. Studies have shown that those lacking critical thinking skills are more likely to depend on unreliable sources, which can negatively affect their health-related decisions (Dissen, 2023; Younis, 2025). Within the MBG context, weak critical thinking could leave some communities vulnerable to misinformation about the program, potentially reducing trust and undermining uptake.

Training initiatives designed to improve digital literacy can therefore play a crucial role in empowering citizens to engage with MBG more effectively. By equipping users to critically assess information, such programs foster better health management behaviors and strengthen the credibility of nutrition policies (Bertschi & Levin-Zamir, 2020). This suggests that embedding digital literacy interventions alongside MBG communication strategies could amplify the program's impact.

Nonetheless, while the overall benefits of digital literacy for health information adoption are evident, some studies report mixed results regarding its effectiveness across different demographic groups. For example, variations in age, education, and socioeconomic background influence the extent to which individuals benefit from digital literacy (Yuen et al., 2024). For MBG, these disparities highlight the need for targeted interventions that ensure inclusivity, particularly for vulnerable populations with limited digital access.

Taken together, the evidence reinforces the importance of digital literacy as both a determinant of health literacy and a driver of program adoption. In the case of MBG, improving digital health literacy across diverse communities not only supports more informed decision-making but also strengthens the program's legitimacy amid online criticism and misinformation. Tailored strategies that account for demographic disparities will be essential to ensure that MBG's benefits reach all population segments equitably.

The dominance of negative sentiment on X regarding the MBG program cannot be explained solely by individual literacy levels. The sentiment analysis revealed that out of 87,589 mentions recorded between April and August 2025, 56% were negative, 43% positive, and only 1% neutral. These results show how negativity became the dominant tone in online discourse, creating a perception of widespread dissatisfaction with the program. This imbalance cannot be attributed to literacy alone; rather, it reflects network-level mechanisms that shape and amplify sentiment in digital spaces.

Echo chambers are among the primary drivers of this phenomenon. They are insulated online spaces where users predominantly engage with like-minded perspectives, reinforcing their existing beliefs while excluding opposing views (Lukáč et al., 2025; Perera et al., 2026). In the MBG context, echo chambers allowed critical voices to dominate certain online communities, creating cycles of skepticism that were continuously validated and amplified within closed networks. This explains why negative perceptions persisted despite supportive narratives.

Socio-cognitive biases strongly influence the formation of these echo chambers. Such biases limit the diversity of viewpoints that individuals are willing to consider, reducing their exposure to alternative perspectives (Duan et al., 2020). For MBG, this means that even when credible program information was available, those embedded in echo chambers were less likely to encounter or accept it. Instead, they reinforced polarized attitudes toward the program, further entrenching distrust in official communication.

Algorithmic amplification also contributed significantly to the skewed distribution of sentiment. Social media algorithms prioritize emotionally charged content, particularly posts that express anger and animosity (Ayolov, 2026). In the MBG debate, algorithmic systems elevated hostile narratives, ensuring that critical content reached wider audiences more quickly. This dynamic created an online environment in which negative sentiment appeared dominant, overshadowing positive or neutral discussions.

The amplification of negative posts that gained significant traction further produced a collective negativity bias. Posts critical of MBG spread more rapidly and widely, creating an echo effect where skepticism appeared to outweigh support. As a result, online discourse surrounding MBG was disproportionately negative, contributing to the perception that the program lacked public approval even though survey data indicated high adoption among digitally literate individuals.

Beyond network-level mechanisms, psychological factors may also help explain why digital literacy does not necessarily eliminate negative bias. Research on negativity bias suggests that individuals tend to pay greater attention to negative information than to positive information because negative messages are often perceived as more salient, emotionally engaging, and socially relevant (Robertson et al., 2023; Soroka et al., 2019). Consequently, even highly digitally literate users who possess the skills to evaluate information critically may still be more likely to notice, remember, and share negative content. In addition, confirmation bias may reinforce this tendency, as individuals often seek and interpret information in ways that align with their pre-existing beliefs and attitudes (Pennycook & Rand, 2021). Within the context of the MBG program, users who are already skeptical of government initiatives may therefore be more receptive to critical narratives, regardless of their level of digital competence.

Political and institutional factors may further contribute to the persistence of negative sentiment. Public trust in government plays a crucial role in shaping how policy-related information is interpreted and evaluated. When trust is low, citizens may be more inclined to question official narratives and give greater credibility to critical or oppositional viewpoints (van der Meer & Hakhverdian, 2017). In highly visible public programs such as MBG, online discussions may therefore reflect broader concerns about governance, transparency, budget allocation, and policy implementation rather than the program's nutritional objectives. These dynamics help explain why negative sentiment can remain dominant even when individuals demonstrate relatively high levels of digital literacy and information adoption (Jennings et al., 2021).

Influencer centrality further shaped this dynamic. Influencers embedded in these networks were able to steer conversations by promoting negative perspectives on MBG, which were more likely to be reposted and widely disseminated (Ullah et al., 2024). When such influencers framed MBG critically, their reach amplified distrust and skepticism, entrenching negativity in public discussions. This explains why negative sentiment outweighed positive sentiment, despite evidence that many individuals adopted MBG information when assessed outside of social media contexts.

Despite this dominance of negativity, opportunities remain for positive discourse to emerge. Strategic interventions aimed at diversifying content exposure and mitigating the effects of echo chambers could help rebalance online narratives. For MBG, this means that individual digital literacy competencies, while important, must be supported by structural communication strategies that address network-level dynamics. The findings thus highlight the complexity of public sentiment on social media, where user competencies are often overshadowed by echo chambers, algorithmic amplification, and influencer activity that collectively shape the tone of online engagement.

Integrating the DigComp 2.2 framework with the Information Adoption Model (IAM) provides a nuanced lens for analyzing how digital literacy influences information adoption in the *Makan Bergizi Gratis* (MBG) program. At the micro-level, digital literacy enhances individual capacities to evaluate information, while at the meso-level, network structures determine the visibility and spread of messages. This dual perspective reveals that although digitally literate citizens may be able to discern credible information about MBG, the broader online ecosystem can still amplify negative or misleading narratives.

At the micro-level, digital literacy plays a pivotal role in shaping how individuals evaluate the credibility of online messages. Users with higher digital literacy are more adept at identifying misinformation by focusing on metadata cues such as authorship, timestamps, or source credibility (Steinfeld, 2023). In the MBG context, these skills are crucial for distinguishing official program information from unverified claims circulating on platforms like X.

The extended Information Adoption Model (EIAM) further underscores the importance of source credibility and argument quality in shaping information adoption. Research suggests that digital literacy enhances individuals' ability to assess these factors, thereby influencing whether they adopt or reject messages encountered online (Sun et al., 2019). Applied to MBG, this means that those with stronger literacy competencies are more likely to adopt accurate nutrition information and support the program. In contrast, those with weaker skills may be vulnerable to misinformation.

Civic online reasoning, considered a core dimension of digital literacy, is also critical. It encompasses the ability to distinguish credible from false information, and is shaped by factors such as education and prior exposure to credible news sources (Guath & Nygren, 2022). For MBG, civic online reasoning enables citizens to critically engage in debates about the program, recognize misinformation and biased narratives, and reinforce the legitimacy of government communication.

At the meso-level, however, network structures strongly influence which arguments gain visibility and traction. Online discussions are shaped by the interactions among participants within these networks, where the placement of messages and their relational ties determine whether they are amplified or overlooked (Boschi et al., 2021). In the MBG debate, this means that even credible messages may remain peripheral if they are not strategically positioned within influential parts of the network.

The structure of online debate trees also influences how messages are distributed and sampled. Research shows that justified arguments may not always dominate; instead, network configurations determine which messages are amplified (Boschi et al., 2021). In the MBG case, misinformation or critical narratives may gain disproportionate visibility simply because of how discussions are organized and shared, regardless of the actual quality of the arguments.

Finally, political contexts illustrate how network-level competence shapes the dissemination of messages. Digital campaign competence, for example, affects how messages are perceived and engaged with, reflecting the broader role of network structures in public communication (Minihold et al., 2025). For MBG, this implies that beyond strengthening digital literacy at the micro-level, strategic interventions at the meso-level are required to ensure that credible, evidence-based information about the program gains visibility and influence. Without attention to these structural dynamics, even high levels of individual literacy may not suffice to counteract the dominance of negative or misleading narratives.

The exploration of alternative accounts in sentiment analysis highlights the complexities of interpreting online discourse surrounding the MBG program. Factors such as sample selection bias, measurement limitations, and unobserved confounders can significantly shape the outcomes of sentiment studies (Table 6). These methodological challenges emphasize the need for careful interpretation of findings, especially given the polarized debates about MBG on platforms such as X. Robustness analyses, including subgroup regressions and validation tests, therefore play an important role in clarifying the boundaries of inference.

Sample selection bias remains a critical issue in analyzing MBG-related sentiment. Social media datasets often overrepresent specific demographics, such as younger, urban, and digitally active populations, while underrepresenting rural or older citizens. This imbalance can skew conclusions, creating the impression that negative sentiment dominates across all groups when, in reality, public opinion may be more heterogeneous. As seen in other political contexts, such biases can lead to misleading generalizations about program legitimacy and uptake.

Measurement limitations also complicate sentiment classification in the MBG discourse. Automated tools often struggle to detect sarcasm and contextual irony, which are common in social media debates (Ortega Bueno, 2025). For MBG, posts employing satire or coded language may be misclassified, distorting the overall sentiment distribution. The informal and dynamic nature of online communication further compounds this problem, highlighting the need for more sophisticated methodologies to achieve accurate sentiment analysis (van der Velden et al., 2025).

Unobserved confounders pose additional challenges to interpreting MBG sentiment. Factors such as political trust, partisanship, and message framing can influence public reactions without being explicitly measured (Poria et al., 2023). For instance, citizens skeptical of government initiatives in general may express negativity toward MBG regardless of its actual merits. These unmeasured variables risk obscuring the true relationship between sentiment and support for the program, complicating efforts to draw causal inferences from sentiment data.

While robustness analyses, such as subgroup regressions or sentiment validation, can strengthen findings about MBG-related discourse, they cannot fully eliminate these complexities. Instead, ongoing methodological advancements and critical evaluations of sentiment tools are required to improve reliability. For the MBG program, this means that sentiment analysis should be interpreted not as a definitive measure of public opinion but as a component within a broader framework for digital engagement analysis, complementing surveys, qualitative insights, and policy evaluations.

**Table 6:** Potential biases in sentiment analysis of MBG and mitigation strategies

| Potential-bias          | Impact on MBG sentiment analysis                                                                                                               | Mitigation strategy                                                                        |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Sample selection bias   | Overrepresentation of urban, young, and digitally active users may exaggerate negative sentiment.                                              | Use mixed data sources, complement sentiment analysis with surveys and demographic checks. |
| Measurement limitations | Misclassification of sarcasm, irony, or informal language distorts sentiment distribution (Farias & Rosso, 2017; van der Velden et al., 2025). | Employ advanced NLP tools trained on contextual language and domain-specific corpora.      |
| Unobserved confounders  | Political trust, framing, or partisanship may influence sentiment without direct measurement (Poria et al., 2023).                             | Conduct robustness tests, subgroup analyses, and integrate qualitative data insights.      |

This study contributes to the theoretical understanding of digital competence frameworks by linking them to information adoption in the food-policy domain, with a specific focus on the *Makan Bergizi Gratis* (MBG) program. By examining how digital competencies influence public engagement with MBG, the research demonstrates that digital literacy is not only a technical skill but also a determinant of how individuals navigate food-related decision-making and policy communication in digital environments. This theoretical connection reinforces the importance of embedding digital competence into the design and implementation of nutrition programs.

A key theoretical contribution of this study lies in linking digital competence to food policy. The findings suggest that individuals with higher digital skills are more likely to engage with information about MBG, leading to greater acceptance and support for the program (Hamadeh, 2024). This implies that digital literacy can serve as a bridge between government initiatives and public participation, ensuring that nutrition policies resonate more effectively with their intended beneficiaries.

The research also builds on existing frameworks by incorporating perspectives from multiple disciplines, including marketing and the social sciences, to develop a more comprehensive model of food-policy dynamics in the digital age (García-León & Teichert, 2024). In the context of MBG, this integrative approach highlights how digital competencies interact with message quality, source credibility, and online sentiment, providing a richer theoretical foundation for analyzing public responses to food policy interventions.

Methodologically, the study employs a concurrent mixed-methods design that combines quantitative surveys with qualitative social media analytics. This approach enables a richer dataset and deeper insights into consumer behavior, providing evidence of how digital literacy influences both individual-level information adoption and collective sentiment toward MBG (Baragwanath, 2021). By capturing both structured survey responses and organic social media discourse, the study demonstrates the value of integrating diverse methods for evaluating public engagement with nutrition policies.

Finally, the study highlights the role of large-scale social media analytics in understanding real-time consumer preferences and behaviors (Almashjari & Ismail, 2024). For MBG, this method reveals how online sentiment polarization can shape the program's legitimacy, while also offering actionable insights to improve communication strategies. However, the findings also point to persistent challenges, such as the digital divide, which may limit vulnerable populations' access to credible information. Addressing these structural inequalities will be essential to ensure that the benefits of MBG and the broader application of digital competencies in food policy are equitably distributed.

To effectively counteract the amplification of negativity surrounding the MBG program and enhance its public uptake, policymakers need to integrate literacy-raising interventions with network-aware strategies. This multifaceted approach combines proactive and reactive measures, addressing not only the spread of misinformation but also the conditions that make communities vulnerable to it. By doing so, the MBG program can strengthen public trust and increase its legitimacy in the digital sphere.

One key component of this strategy is enhancing media literacy. Increasing public understanding of media empowers individuals to evaluate sources of information and reduce susceptibility to misinformation critically (Roozenbeek et al., 2023). Within the MBG context, improved media literacy would enable citizens to distinguish credible government nutrition communication from misleading claims circulating online, thereby reinforcing accurate perceptions of the program.

In addition, inoculation strategies provide a proactive way to equip individuals with knowledge of common misinformation tactics before they encounter them. By strengthening cognitive resilience, such strategies bolster defenses against false claims (Derstroff et al., 2023; Kozyreva et al., 2022). Applied to MBG, inoculation could help communities resist narratives that attempt to discredit the program, ensuring that misinformation does not erode support.

Network-aware tactics are equally vital in shaping discourse about MBG (Table 7). Strategic influencer engagement has proven effective in amplifying accurate messaging and countering misinformation (Kozyreva et al., 2022; Roozenbeek et al., 2023). For MBG, collaborating with trusted local figures or community leaders on digital platforms could enhance message reach and credibility. Similarly, message pre-bunking, which delivers accurate information before exposure to misinformation, has been shown to reduce its impact (Bayiz & Topcu, 2023; Tay et al., 2024). This preventive communication strategy could be embedded in MBG campaigns to build anticipatory awareness among target audiences.

Finally, rapid-response monitoring systems are essential for detecting and countering misinformation in real time. Implementing mechanisms that quickly identify misleading narratives and respond with corrective information can prevent misinformation from spreading widely (Derstroff et al., 2023). For MBG, such systems would enable policymakers to intervene swiftly when false claims gain traction online, thereby preserving the program's credibility and effectiveness. While these strategies are promising, consistent implementation and sustained public engagement remain challenges, highlighting the need for ongoing research and adaptive policy frameworks that support MBG's long-term success.

**Table 7:** Literacy-raising interventions and network-aware tactics for MBG

| Strategy type           | Specific intervention           | Application to MBG                                                                         | Expected outcome                                            |
|-------------------------|---------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| <b>Literacy-raising</b> | Media literacy                  | Public campaigns to teach communities how to evaluate nutrition-related information online | Reduced susceptibility to misinformation                    |
|                         | Inoculation strategies          | Pre-exposure education on common misinformation tactics targeting MBG                      | Stronger public resistance to false claims                  |
| <b>Network-aware</b>    | Strategic influencer engagement | Collaboration with trusted community figures to share MBG messages                         | Greater credibility and wider reach of accurate information |
|                         | Message pre-bunking             | Disseminating accurate MBG information before misinformation spreads                       | Reduced impact of false narratives                          |
|                         | Rapid-response monitoring       | Real-time detection and correction of misinformation related to MBG                        | Limited spread and influence of misleading content          |

Future research on the MBG program should adopt longitudinal and experimental designs to advance causal inference regarding digital literacy, information adoption, and public sentiment. Cross-sectional analyses, while informative, are insufficient to capture the dynamic and evolving nature of digital engagement. Longitudinal approaches would enable scholars to track how public attitudes toward MBG shift over time in response to changes in communication strategies and online discourse, while experimental designs could isolate the causal mechanisms underlying these dynamics. Such methodological innovations would enhance the rigor of digital communication research in food-policy contexts and offer lessons for global nutrition initiatives.

Equally important is the exploration of mediation and moderation mechanisms to unpack the complexity of digital engagement. For instance, future studies could examine whether exposure to influencers moderates the relationship between digital literacy and information adoption, thereby shaping the legitimacy of food programs like MBG. Insights into such mechanisms would not only refine theoretical models, such as the Information Adoption Model, but also generate actionable knowledge for policymakers and practitioners worldwide. Understanding how trusted voices amplify or diminish the effects of literacy provides a transferable framework for designing evidence-based interventions across diverse cultural and policy contexts.

Finally, expanding sentiment and discourse analyses beyond X is crucial for enhancing the generalizability of findings. While X captures real-time debates, platforms such as Facebook, Instagram, and TikTok host broader, demographically diverse user bases and often serve as primary sources of health and nutrition information for communities. Comparative, cross-platform analyses of MBG-related discourse would illuminate platform-specific dynamics and reveal whether the mechanisms observed in one digital environment hold elsewhere. Such insights would enrich the global literature on digital health communication, supporting the design of inclusive, context-sensitive strategies to combat misinformation and strengthen public trust in food-policy initiatives.

This study draws strength from its use of validated survey instruments and an extensive corpus of X data, which together enhance both reliability and external validity. At the same time, it is important to acknowledge the boundary conditions of these design choices. The exclusive reliance on X provides valuable insights into real-time discourse, yet it inevitably excludes perspectives from users more active on platforms such as Facebook, Instagram, or TikTok. Rather than undermining the contributions of this study, this limitation highlights the need for future cross-platform investigations to capture a fuller spectrum of digital engagement with food-policy initiatives such as the *Makan Bergizi Gratis* (MBG) program.

A second consideration concerns the potential for classification noise in automated sentiment analysis. While computational tools enable large-scale analysis efficiently, they face challenges in accurately detecting sarcasm, irony, and context-specific expressions that often characterize online debates. This issue does not diminish the robustness of the current findings but signals opportunities for refinement through the integration of advanced natural language processing techniques and hybrid validation approaches. Such methodological innovations could sharpen future assessments of how sentiment toward MBG and related nutrition programs is expressed in digital environments.

So, the cross-sectional survey design places inherent constraints on causal inference. While the present analysis provides strong evidence of associations between digital literacy and information adoption, it cannot fully account for temporal dynamics or causal mechanisms. This limitation should be viewed as a catalyst for methodological innovation, encouraging longitudinal and experimental designs that can deepen causal understanding. Taken together, these considerations position the current study as a valuable empirical foundation while charting clear directions for future research to advance global debates on digital literacy, misinformation, and food-policy communication.

The findings of this study demonstrate that strengthening individual digital literacy is an essential step toward enabling citizens to critically evaluate, adopt, and act upon accurate information. Higher levels of digital competence enhance the ability to discern credible sources and interpret the quality of arguments, thereby supporting more informed engagement with initiatives such as the MBG program. Yet the persistence of polarized sentiment online reveals that literacy alone cannot fully insulate public discourse from misinformation or the amplification of negative narratives.

The evidence underscores the importance of complementing individual-level literacy interventions with structural approaches that address the dynamics of digital networks. Coordinated strategies that combine literacy training, influencer engagement, algorithm-aware communication, and rapid-response systems can ensure that accurate, evidence-based information achieves visibility in contested digital spaces. By bridging individual competencies with meso-level infrastructures, policymakers can more effectively counter misinformation and cultivate narratives that reinforce the legitimacy of public nutrition programs.

Taken together, these insights highlight a broader imperative for health and policy communication in the digital age. Effective food communication is not only a matter of enhancing citizens' critical skills but also of designing network-aware strategies that shape the flow of information in equitable and trustworthy ways. By aligning individual empowerment with structural innovation, programs like MBG can serve as a model for global efforts to safeguard public health communication, advance nutrition equity, and strengthen resilience against the systemic risks of misinformation.

## 5. CONCLUSION

This investigation explored the correlation between digital literacy and the uptake of online information within the context of the Indonesia MBG initiative, simultaneously mapping public sentiment as expressed on X during the program's initial implementation phase (April–August 2025). The results indicate that, at the individual level, elevated digital literacy correlates significantly with greater information adoption, suggesting that digital proficiency augments users' ability to assess and engage with policy-related material. Simultaneously, the analysis of extensive social media data indicates that the collective online discourse surrounding MBG is predominantly negative, suggesting that public narratives are influenced not only by individual cognitive abilities but also by broader network dynamics and affective processes inherent to digital platforms.

These findings, when considered collectively, suggest a structural tension between individuals' informational competence and the formation of collective sentiment in networked public spaces. Although individuals with digital literacy may possess superior abilities to evaluate and adopt information, the visibility and dissemination of policy narratives are significantly affected by elements such as influencer centrality, emotional amplification, and negativity bias. This observation emphasizes the limitations of strategies that focus solely on enhancing individual digital skills and highlights the need to examine how digital communication networks influence public meaning-making and the legitimacy of policy. This research contributes to the fields of digital communication and social sciences by integrating the Digital Competence Framework (DigComp 2.2) and the Information Adoption Model with large-scale sentiment and network analysis. The concurrent mixed-methods approach used here demonstrates the value of combining survey data on individual skills with analyses of collective discussions. This provides a clearer understanding of the complex ways in which people engage with digital public policy. Future research could build on these findings by using longitudinal or experimental designs, thereby expanding the analysis to include different platforms. This would allow for a more in-depth examination of the causes and contextual differences in digital policy communication.

In practical terms, the findings suggest that efforts to enhance digital literacy in nutrition policy contexts should be complemented by communication strategies that are sensitive to network structures and emotional dynamics. Strengthening individual capacity remains important, but it is unlikely to translate into broader public acceptance without parallel efforts to engage influential actors, monitor emerging narratives, and address misinformation in real time. For policymakers, embedding digital literacy within nutrition programs while supporting adaptive, network-aware communication infrastructures may help foster more balanced public discourse and sustain trust in large-scale social interventions, such as MBG.

For policymakers, these findings point to the importance of integrating literacy-centered communication strategies with real-time digital engagement mechanisms. Agencies responsible for implementing the MBG program should invest in continuous social media monitoring, collaborate with trusted health professionals, educators, and community influencers, and develop rapid-response communication protocols to address misinformation before it gains widespread visibility. In addition, targeted digital literacy campaigns should be tailored to different demographic groups to ensure that accurate nutrition-related information reaches diverse segments of society. By combining individual capacity-building with network-aware communication interventions, policymakers can foster a more balanced public discourse and strengthen long-term trust in large-scale nutrition initiatives.

Overall, this study highlights that the effectiveness of digital policy communication depends not only on what individuals know or can do online but also on how information circulates, gains visibility, and acquires meaning within digitally mediated public spheres. Recognizing and addressing this interaction between literacy and emotion is essential for advancing inclusive, credible, and socially responsive approaches to nutrition policy communication.

## DECLARATIONS

### 1. Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this study.

### 2. Generative AI and AI-assisted technologies in the writing process

The authors used ChatGPT (OpenAI, GPT-6) solely to assist with language refinement and to improve the clarity and readability of the manuscript. The tool was not used to generate research data, conduct statistical analyses, interpret the findings, or make substantive scientific decisions. All AI-assisted outputs were critically reviewed and revised by the authors, who take full responsibility for the content and integrity of the final manuscript.

### 3. Data availability statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The survey data are not publicly available to protect participant confidentiality. Social media data analyzed in this study were obtained from publicly available posts on X through the Drone Emprit platform and were analyzed in aggregated form.

### 4. Ethics statement

This study involved an online survey of social media users and the analysis of publicly available social media data. Participation in the survey was voluntary, and informed consent was obtained from all participants prior to data collection. Respondents were informed about the purpose of the study, the voluntary nature of their participation, and the confidentiality of their responses. No personally identifiable information was reported. The analysis of X data was conducted using publicly available information and reported only in aggregated form to protect user privacy.

### 5. Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

### 6. Contributor Role Taxonomy (CRediT)

Rila Setyaningsih: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Project administration.

Didik Haryadi Santoso: Methodology, Formal analysis, Validation, Writing – review & editing, Visualization.

Noor Afy Shovmayanti: Investigation, Data curation, Validation, Writing – review & editing, Visualization.

## ORCID

Rila Setyaningsih: <https://orcid.org/0000-0002-7768-2885>  
 Didik Haryadi Santoso: <https://orcid.org/0009-0004-4396-5782>  
 Noor Afy Shovmayanti: <https://orcid.org/0009-0005-8991-6166>

## REFERENCES

- Almashjari, S., & Ismail, H. (2024). Intelligent food recommendation framework based on social media behavioral data. In *Proceedings of the Cognitive Models and Artificial Intelligence Conference, Turkey* (pp. 124–129). Association for Computing Machinery. <https://doi.org/10.1145/3660853.3660883>
- Atobishi, T., & Mansur, H. (2025). Bridging digital divides: Validating government ICT investments accelerating sustainable development goals. *Sustainability*, 17(5), Article 2191. <https://doi.org/10.3390/su17052191>
- Ayolov, P. (2026). *Moral outrage networks: The sociology of digital anger*. SSRN. <https://doi.org/10.2139/ssrn.5998714>
- Balog-Way, D., & McComas, K. (2025). Unpacking the risk of misinformation: A communication-based critique. *Risk Analysis*, 45(12), 4097–4109. <https://doi.org/10.1111/risa.70093>
- Baragwanath, T. (2021, January 14). *Digital opportunities for demand-side policies to improve consumer health and the sustainability of food systems* (OECD Food, Agriculture and Fisheries Papers No. 148). OECD Publishing. <http://dx.doi.org/10.1787/bec87135-en>
- Bayiz, Y. E., & Topcu, U. (2023). *Prebunking design as a defense mechanism against misinformation propagation on social networks*. arXiv. <https://doi.org/10.48550/arXiv.2311.14200>
- Bertschi, I., & Levin-Zamir, D. (2020). Der Umgang mit Gesundheitsbotschaften aus traditionellen und digitalen Medien – Media Health Literacy und digitale Gesundheitskompetenz [Dealing with health messages from traditional and digital media: Media health literacy and digital health literacy]. In T. M. Bollweg, J. Bröder, & P. Pinheiro (Eds.), *Health Literacy im Kindes- und Jugendalter: Ein- und Ausblicke* (pp. 225–238). Springer VS. [https://doi.org/10.1007/978-3-658-29816-6\\_13](https://doi.org/10.1007/978-3-658-29816-6_13) [in German]
- Boonprachoom, S., Sirirat, P., & Manorom, A. (2025). Digital media guidelines for sustainable tourism: A case study of historical tourism in Baan Khamkerm-Nong Saeng, Nakhon Phanom province, Thailand. *Humanities, Arts and Social Sciences Studies*, 25(3), 684–698. <https://doi.org/10.69598/hasss.25.3.279083>
- Boschi, G., Young, A. P., Joglekar, S., Cammarota, C., & Sastry, N. (2021). Who has the last word? Understanding how to sample online discussions. *ACM Transactions on the Web*, 15(3), Article 12. <https://doi.org/10.1145/3452936>
- Buchori, A. (2018). Pentingnya literasi digital untuk meningkatkan partisipasi masyarakat dalam sosialisasi pembangunan melalui media social [The importance of digital literacy in increasing public participation in disseminating development information through social media]. *OMNICOM: Jurnal Ilmu Komunikasi*, 4(1), 11–16. [in Indonesian]
- Cram, I. (2022). *Liberal democracy, law and the citizen speaker: Regulating online speech*. Bloomsbury Publishing.
- Derstroff, M., Härtling, V. E., Hölttä, W., Traub, M. H., van der Linden, L. A. P. J., & Thomas, J. C. (2023). Stemming the tide of disinformation in public health. *South Eastern European Journal of Public Health*, 1, 132–146. <https://doi.org/10.56801/seejph.vi.374>
- Dillahunt, T. R., Shedden, K., Filipof, M. E., Lee, S., Naseem, M., Toyama, K., & Hui, J. (2025). The development of a new measure of collective digital literacy. *Proceedings of the ACM on Human-Computer Interaction*, 9(2), Article CSCW186. <https://doi.org/10.1145/3711084>
- Dissen, A. (2023). A critical issue: Assessing the critical thinking skills and dispositions of undergraduate health science students. *Discover Education*, 2(1), Article 21. <https://doi.org/10.1007/s44217-023-00044-z>
- Duan, X., Ho, C.-J., & Yin, M. (2020). Does exposure to diverse perspectives mitigate biases in crowdwork? An explorative study. *Proceedings of the Eighth AAAI Conference on Human Computation and Crowdsourcing*, 8(1), 155–158. <https://doi.org/10.1609/hcomp.v8i1.7474>
- Evenstein Sigalov, S., & Tsybulsky, D. (2026). Critical ignoring reimaged: Insights from STEM digital curation on Wikimedia platforms. *Smart Learning Environments*, 13(1), Article 4. <https://doi.org/10.1186/s40561-026-00432-6>
- Farias, D. I. H., & Rosso, P. (2017). Irony, sarcasm, and sentiment analysis. In F. A. Pozzi, E. Fersini, E. Messina, & B. Liu (Eds.), *Sentiment analysis in social networks* (pp. 113–128). Morgan Kaufmann. <http://dx.doi.org/10.1016/B978-0-12-804412-4.00007-3>

- García-León, R. A., & Teichert, T. (2024). Food and social media: A research stream analysis. *Management Review Quarterly*, 74(2), 1145–1183. <https://doi.org/10.1007/s11301-023-00330-y>
- Guath, M., & Nygren, T. (2022). Civic online reasoning among adults: An empirical evaluation of a prescriptive theory and its correlates. *Frontiers in Education*, 7, Article 721731. <https://doi.org/10.3389/feduc.2022.721731>
- Hamadeh, S. (2024). Smart food and sports policies in the digital age: Re-defining nutrition economic, education designs, and governance. In A. Salman & A. Tharwat (Eds.), *Informatics for digital education* (pp. 49–61). Springer. [https://doi.org/10.1007/978-3-031-49393-5\\_7](https://doi.org/10.1007/978-3-031-49393-5_7)
- Hari, Y., Yanggah, M. E., & Budiman, A. (2026). Model integration of information technology in optimizing the food supply chain of the Free Nutritious Meal (MBG) program to reduce food waste. *Journal of Applied Data Sciences*, 7(1), 438–457. <https://doi.org/10.47738/jads.v7i1.1039>
- Hongngam, K., Jitsupa, J., Skunhom, V., Yanuchit, C., & Meeusah, N. (2025). Digital Interactive Storytelling to promote Thai language vocabulary learning for children with dyslexia. *Humanities, Arts and Social Sciences Studies*, 25(3), 620–630. <https://doi.org/10.69598/hasss.25.3.274432>
- Jaroenpool, J., Suwanbamrung, C., Sukkaew, N., & Dadras, M. (2023). Students' reflections on an integrated research subject using a research-based learning online model during the COVID-19 pandemic: A qualitative study in Thailand. *Humanities, Arts and Social Sciences Studies*, 23(3), 695–707. <https://doi.org/10.14456/hasss.2023.59>
- Jennings, W., Stoker, G., Bunting, H., Valgarðsson, V. O., Gaskell, J., Devine, D., McKay, L., & Mills, M. C. (2021). Lack of trust, conspiracy beliefs, and social media use predict COVID-19 vaccine hesitancy. *Vaccines*, 9(6), Article 593. <https://doi.org/10.3390/vaccines9060593>
- Johnson, D. R. (2024). *Health communications matter: A comparative case study of best practices to combat misinformation and disinformation during the COVID-19 pandemic* [Doctoral dissertation, The University of North Carolina at Chapel Hill]. ProQuest Dissertations & Theses Global. <https://www.proquest.com/docview/3056981572>
- Kozyreva, A., Lorenz-Spreen, P., Herzog, S. M., Ecker, U. K., Lewandowsky, S., Hertwig, R., Ali, A., Bak-Coleman, J., Barzilai, S., Basol, M., Berinsky, A. J., Betsch, C., Cook, J., Fazio, L. K., Geers, M., Guess, A. M., Huang, H., Larreguy, H., Maertens, R., . . . Wineburg, S. (2022). *Toolbox of interventions against online misinformation*. PsyArXiv. <https://doi.org/10.31234/osf.io/x8ejt>
- Lukáč, J., Kudlová, Z., Kopčáková, J., & Gallo, P. (2025). Impact of socio-economic factors on digital literacy and security. *TEM Journal*, 14(1), 925–932. <https://doi.org/10.18421/TEM141-81>
- Minihold, S., Lecheler, S., Gibson, R., de Vreese, C., & Kruikemeier, S. (2025). Understanding digital campaign competence: Conceptualizing data-driven political advertising literacy. *Mass Communication and Society*, 28(5), 852–878. <https://doi.org/10.1080/15205436.2024.2312202>
- Ortega Bueno, R. (2025). *New avenues in computational irony detection in social media* [Doctoral dissertation, Universitat Politècnica de València]. Repositorio Riunet.
- Pennycook, G., & Rand, D. G. (2021). The psychology of fake news. *Trends in Cognitive Sciences*, 25(5), 388–402. <https://doi.org/10.1016/j.tics.2021.02.007>
- Perera, P., Selvanathan, S., Selvanathan, S., Su, J.-J., & Jayasinghe, M. (2026). From digital inequality to income inequality: Exploring the multifaceted impact of digital literacy on income. *Digital Policy, Regulation and Governance*, 28(2), 173–189. <https://doi.org/10.1108/DPRG-11-2024-0278>
- Poria, S., Hazarika, D., Majumder, N., & Mihalcea, R. (2023). Beneath the tip of the iceberg: Current challenges and new directions in sentiment analysis research. *IEEE Transactions on Affective Computing*, 14(1), 108–132. <https://doi.org/10.1109/TAFFC.2020.3038167>
- Pushsapavardhana, N. (2025). Social media usage and cyberbullying: Experiences and coping strategies among secondary school students in Surat Thani, Thailand. *Humanities, Arts and Social Sciences Studies*, 25(3), 550–566. <https://doi.org/10.69598/hasss.25.3.278093>
- Robertson, C. E., Pröllochs, N., Schwarzenegger, K., Pärnamets, P., Van Bavel, J. J., & Feuerriegel, S. (2023). Negativity drives online news consumption. *Nature Human Behaviour*, 7, 812–822. <https://doi.org/10.1038/s41562-023-01538-4>
- Roozenbeek, J., Culloty, E., & Suiter, J. (2023). Countering misinformation. *European Psychologist*, 28(3), 189–205. <https://doi.org/10.1027/1016-9040/a000492>
- Silva, P., Araújo, R., Lopes, F., & Ray, S. (2023). Nutrition and food literacy: Framing the challenges to health communication. *Nutrients*, 15(22), Article 4708. <https://doi.org/10.3390/nu15224708>
- Soroka, S., Fournier, P., & Nir, L. (2019). Cross-national evidence of a negativity bias in psychophysiological reactions to news. *Proceedings of the National Academy of Sciences of the United States of America*, 116(38), 18888–18892. <https://doi.org/10.1073/pnas.1908369116>

- Steinfeld, N. (2023). How do users examine online messages to determine if they are credible? An eye-tracking study of digital literacy, visual attention to metadata, and success in misinformation identification. *Social Media + Society*, 9(3). <https://doi.org/10.1177/20563051231196871>
- Sun, Y., Wang, N., Shen, X.-L., & Zhang, X. (2019). Bias effects, synergistic effects, and information contingency effects: Developing and testing an extended information adoption model in social Q&A. *Journal of the Association for Information Science and Technology*, 70(12), 1368–1382. <https://doi.org/10.1002/asi.24228>
- Suwan, S., & Sithsungnoen, C. (2025). The effects of a learning management model using design thinking and community-based learning to enhance local visual art design in line with the creative economy concept among high school students. *Humanities, Arts and Social Sciences Studies*, 25(2), 485–497. <https://doi.org/10.69598/hasss.25.2.273333>
- Tay, L. Q., Hurlstone, M., Kurz, T., & Ecker, U. K. H. (2024). *Do prebunking and debunking protect against novel misinformation?* PsyArXiv. <https://doi.org/10.31234/osf.io/w7gja>
- Ullah, A., Din, S. U., Khan, N., Mawuli, C. B., & Shao, J. (2024). Towards investigating influencers in complex social networks using electric potential concept from a centrality perspective. *Information Fusion*, 109, Article 102439. <https://doi.org/10.1016/j.inffus.2024.102439>
- van der Meer, T., & Hakhverdian, A. (2017). Political trust as the evaluation of process and performance: A cross-national study of 42 European countries. *Political Studies*, 65(1), 81–102. <https://doi.org/10.1177/0032321715607514>
- van der Velden, M. A. C. G., Casapa, N. U., & Pipal, C. (2025). Sentiment analysis. In A. Nai, M. Grömping, & D. Wirz (Eds.), *Elgar encyclopedia of political communication* (Vol. 3, pp. 477–480). Edward Elgar Publishing. <https://doi.org/10.4337/9781035301447.vol3.00116>
- Yaboonthong, Y., Damrongpanit, S., Rupavijetra, P., & Phothi, S. (2025). An integrated active learning model focused on learning outcomes for schools in Thailand. *Humanities, Arts and Social Sciences Studies*, 25(3), 567–580. <https://doi.org/10.69598/hasss.25.3.277595>
- Yıldırım, M. S. (2024). The relationship between digital literacy and health literacy in individuals aged 18–65. *Balıkesir Sağlık Bilimleri Dergisi*, 13(3), 721–727. <https://doi.org/10.53424/balikesirsbd.1544000>
- Younis, B. K. (2025). From digital literacy to action: The impact of digital mental health literacy and critical thinking on mental health behaviors in university populations. *Current Psychology*, 44(11), 10851–10864. <https://doi.org/10.1007/s12144-025-07930-9>
- Yuen, E., Winter, N., Savira, F., Huggins, C. E., Nguyen, L., Cooper, P., Peeters, A., Anderson, K., Bhoyroo, R., Crowe, S., & Ugalde, A. (2024). Digital health literacy and its association with sociodemographic characteristics, health resource use, and health outcomes: Rapid review. *Interactive Journal of Medical Research*, 13, Article e46888. <https://doi.org/10.2196/46888>