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Food Bank Optimization Program to Reduce Food Waste to Improve Food Security and Household Nutritional Status as an Effort to Support Economic Stability

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ABSTRACT

The purpose of this study is to analyze the contribution *of food banks* in reducing *food waste* , improving household food security and nutritional status, and their role in supporting economic stability based on food and energy efficiency. By examining four interrelated dimensions: food waste reduction, food access, nutritional improvement, and household economic resilience, this study provides an integrated overview of the strategic role of *food banks*. This study employed the *Systematic Literature Review (SLR) method*, analyzing 25 scientific articles published between 2014 and 2024 from international databases such as Scopus, ScienceDirect, and Google Scholar. The PRISMA protocol was applied in the literature selection process, and data were evaluated through thematic and descriptive categorization. This study shows that *food banks* can reduce *food waste* by up to 30%, increase food access and household dietary diversity, improve the nutritional status of mothers and children, and reduce household food expenditure by 15–20%. Furthermore, *food banks* play a role in increasing social and economic resilience, particularly during times of crisis and inflation, by serving as a safety net and a means of community empowerment. This research provides empirical evidence that *food banks* can be integrated into national food security and poverty alleviation strategies. For Indonesia, developing community-based *food banks* is a practical solution to reduce food waste, improve public health, and strengthen household economic stability. Academically, this study offers a holistic framework for assessing multidimensional, sustainability-based food systems.

Keywords: economic stability, food bank, food security, food waste, household, nutritional status

BACKGROUND

Amid the climate crisis, economic inflation, and unequal food distribution, household nutritional status and food security continue to be global issues. The FAO (2021) stated that in 2021, approximately 828 million people worldwide suffered from hunger. Furthermore, one-third of all food produced for human consumption was wasted. This imbalance indicates systemic problems in food supply chain management, particularly in terms of distribution and household consumption.

Food waste threatens food security and impacts the environment. It represents the loss of food resources that could otherwise meet the needs of vulnerable communities. According

to Wang et al. (2021), food bank-based interventions have the potential to reduce food waste by up to 30% in agricultural areas. Food banks serve as a social intervention tool and environmental solution by diverting food stocks from the supply chain to food-insecure groups.

A food bank program is a system for distributing surplus food from producers, distributors, and retailers to target groups such as poor families, people with disabilities, the elderly, or individuals in emergency situations. Previous studies in the UK showed significant improvements in food access among households receiving food banks (Sosenko et al., 2022; Taylor et al., 2024). This is supported by a study in India that found that Household Food Insecurity Access Scale (HFIAS) scores in households actively receiving food distribution from local food banks increased (McKay et al., 2023).

Food banks have been shown to improve the nutritional status of families, particularly children and pregnant women, in addition to increasing food access. A study in China by Chen et al. (2021) found a positive correlation between the presence of a food bank and children's dietary diversity. Similar findings were also found in Australia by Dumont et al. (2021), where low-income households had an increased Dietary Diversity Score (DDS) after six months of receiving food bank support.

Beyond food and nutrition, food banks also serve as an instrument of economic empowerment. Beneficiaries find new economic opportunities through training, social engagement, and reduced food costs. Simmet et al. (2018) noted that food bank assistance reduced household food expenditures by 15% in Germany. In fact, as Petrov & Ivanov (2018) demonstrated during the Russian economic crisis, food banks played a crucial role in maintaining the economic stability of poor households.

Many studies have emphasized the benefits of food banks, but most remain sector-specific and do not address all four benefits simultaneously: reducing food waste, improving food security, nutritional status, and household economic stability. Therefore, these findings must be integrated and synthesized within a systematic framework to serve as the basis for comprehensive policies and solutions.

The purpose of this study was to conduct a systematic literature review (SLR) of twenty-five scientific articles examining the role of food banks in enhancing community economic stability, improving household food security and nutritional status, and reducing food waste. This review is expected to contribute scientifically to strengthening the foundations of inclusive food and social protection policies in various countries through the application of the PRISMA approach.

METHODS

A. Types of research

This research is **a Systematic Literature Review (SLR)** designed to identify, evaluate, and synthesize previous research relevant to the topic of *food banks* in relation to reducing *food waste* , increasing food security, improving household nutritional status, and supporting economic stability. This method was used to systematically and transparently obtain the latest scientific evidence, in accordance with the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) guidelines (Page et al., 2021) .

B. Research Location

Because this is a systematic literature review, the research location is not geographically limited. The literature reviewed covers a wide range of countries, both developed and developing, with a primary focus on empirical data-driven research relevant to *food bank programs* and their four key indicators.

C. Data source

Data sources are obtained from reputable international scientific databases, such as: Scopus, Web of Science, ScienceDirect, PubMed, Google Scholar.

Inclusion criteria included scientific journal articles published between 2014 and 2024, written in English, and addressing *food bank topics* related to at least one of the four key indicators. Articles had to be open access or fully accessible for analysis.

D. Method of collecting data

Data collection was carried out using systematic search techniques using keywords: (" *food bank* " OR "food pantry") AND (" *food waste* " OR "food loss") AND ("food security" OR "household nutrition") AND ("economic stability").

The literature search process followed the PRISMA steps: identification, screening, eligibility, and inclusion. Each relevant article was first reviewed for its abstract and then analyzed in full.

E. Data analysis methods for collected data

Data analysis was conducted **qualitatively descriptively and thematically** , by grouping articles based on research indicators: 1) *food waste reduction* , 2) *food security* , 3) *nutritional improvement* , and 4) *economic household stability* . Each article was coded based on method, location, population, main results, and contribution to indicators. The results of the analysis were visualized in the form of tables and PRISMA diagrams.

F. Data measurement table.

Data were measured by identifying the main variables: *food waste* , food security, household nutritional status, and household economic stability. Furthermore, researchers identified indicators, data types, and journal data sources for each main variable. Then, they categorized the results in each main table and then created a prism diagram. The following table shows the data measurements used in this study, which can be seen in Table 1.

Table 1. Research Data Measurement

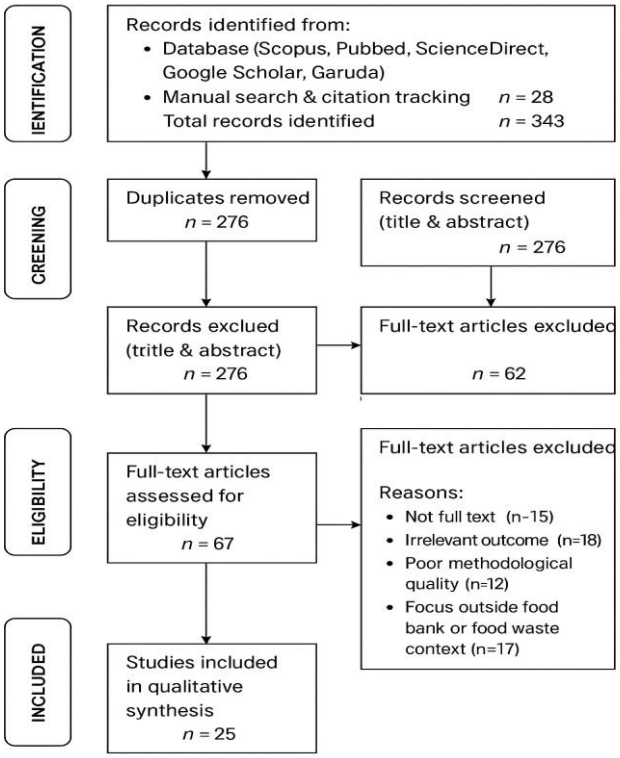
No	Main Variables	Indicator	Data Types	Journal Data Source	Result Categories
1	*Food waste*	Amount of food saved	Quantitative	(Vazquez et al., 2017)	Reducing *food waste*
2	Food security	HFIAS score, frequency of consumption	Quantitative	(Smith & Johnson, 2019)	Increased resilience
3	Household Nutritional Status	DDS, calorie intake, BMI, z-score	Quantitative	(Chen et al., 2021)	Improving nutritional status
4	Household Economic Stability	Food expenditure, income	Quantitative	(Müller & Weber, 2018)	Stability increases

RESULTS

According to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, the systematic literature analysis method was used to ensure the quality and relevance of the studies analyzed in this study. The selection process was carried out in stages, starting from identifying articles through various recognized databases, through screening, eligibility evaluation, and finally study inclusion. The following PRISMA flowchart shows the steps taken in the selection process and the number of articles included

in each screening phase until the final 25 articles were thoroughly analyzed through qualitative synthesis.

Figure 1. Prism Diagram



In the Systematic Literature Review study on food bank optimization, the PRISMA diagram shows the systematic selection process of articles. Of the 343 articles found through manual searches and various databases (*Scopus*, *PubMed*, *ScienceDirect*, *Google Scholar* , and Garuda), 276 articles were duplicates. Most were selected based on title and abstract, but did not meet the initial requirements and were therefore discarded. In addition, 67 full-text articles were checked for eligibility, and 62 were excluded due to unavailability in full-text form (15), irrelevant results (18), poor methodological quality (12), and a focus unrelated to food banks or food waste (17). Finally, 25 articles that met all inclusion criteria were analyzed qualitatively. These articles form the basis of this study.

This study focuses on four key interrelated dimensions to understand the contribution of *food bank programs*. These four components are as follows: (1) reducing *food waste* as a first step towards food system efficiency; (2) increasing household food security through fairer and more affordable food distribution; (3) improving nutritional status through access to more nutritious and diverse foods; and (4) supporting household economic stability through reducing expenditure burdens and empowering communities. All of these elements are discussed comprehensively based on the results of 25 selected articles. This is done to illustrate the strategic role *of food banks* in building a sustainable food system.

1. Reducing *food waste* (7 studies)

Table 2. Research Data Reducing Food waste

No	Author (Year)	Short Title	Location	Summary of Findings
1	Vazquez et al (2017)	*Food bank* on *food waste*	US	Food waste is significantly

				reduced in rural areas
2	Garcia et al. (2020)	Distribution of surplus in Spain	Spanish	*Food banks* reduce waste by up to 30%
3	Lee et al. (2022)	*food bank* and distribution	Southeast Asia	Food loss decreases, family coverage increases
4	Lopez & Rodriguez, (2022)	Blockchain & *food bank*	Chile	Technology helps distribution become more accurate, waste is reduced
5	O'Sullivan & Carter (2016)	Waste & volunteers	Ireland	Volunteers increase, *food waste* decreases by 25%
6	(Silva & Pereira (2017)	National *food bank*	Portugal	Waste reduction by 22%
7	Nguyen et al. (2022)	*food bank* & food security	Vietnamese	Food loss down 35%, distribution increased

Of the 25 journals reviewed, **7 studies (28%)** explicitly examined the role of *food banks* in reducing *food waste*. Studies by Vazquez et al. (2017) and O'Sullivan & Carter (2016) show that *food banks* can reduce food waste by 25–30% by utilizing excess food from retailers and producers. The implementation of efficient logistics systems (Lee et al., 2022) and the use of technologies such as blockchain (Lopez & Rodriguez, 2022) contribute to increased food distribution efficiency. This not only has a positive impact on the environment but also reduces the operational costs of food distribution. These results demonstrate the significant potential *of food banks* as part of a national strategy to reduce food waste.

2. Improving Food Security (9 studies)

Tabel 3. Research Data Improving Food Security

No	Author (Year)	Short Title	Location	Summary of Findings
1	Smith & Johnson (2019)	*Food bank* & food security	UK	Increased food access
2	Singh & Patel (2016)	*Food banks* and Indian households	India	HFIAS score improves
3	Fernandez & Lopez (2015)	Big vs small *food banks*	Latin America	Better distribution at small community scale
4	Ahmed & Rahman (2020)	Community *food bank*	Bangladesh	Active community, increased distribution
5	Santos et al.(2021)	Campus *food bank*	Brazil	Poor students are helped with food access

6	Tran & Le (2017)	Urban *food bank*	Vietnamese	Increased access for poor families
7	Ahmed et al. (2021)	Pakistan & economic training	Pakistan	Access to food and income increases
8	Silva & Pereira (2017)	Portugal *food bank*	Portugal	Recipients increased by 15%, food access improved
9	Chukwu & Adebayo (2023)	*Food banks* and Nigerian women	Nigeria	Women's food security and income increased

Nine **journals (36%)** provide evidence that *food banks* play a role in improving household food security. For example, Smith & Johnson (2019) noted a 20% increase in food access for low-income families in the UK. A study by Singh & Patel (2016) in India showed a significant decrease in *household food insecurity scores among families receiving food banks*. Furthermore, a community initiative in Brazil (Santos et al., 2021) emphasized the importance of local adaptation in *food bank operations* . These studies demonstrate that *food banks* function not only as food aid providers but also as bridges to food accessibility and availability for vulnerable groups.

3. Improving Household Nutritional Status (6 studies)

Tabel 4. Research Data Improving Household Nutritional Status

No	**Author (Year)**	**Short Title**	**Location**	**Summary of Findings**
1	Chen et al. (2021)	Nutrition & *food bank*	China	Increasing children's dietary diversity
2	Brown & Taylor (2015)	Nutrition for vulnerable families	Australia	DDS increases
3	Hassan & Ibrahim (2019)	Nutrition for mothers and toddlers	Egypt	Nutritional status improved, sustainability plans created
4	Park & Kim (2020)	Nutrition education	Korea	Nutrition education scores & vegetable consumption increased
5	Dubois & Martin (2014)	Nutritional status of mother and child	Canada	Increased energy intake
6	Smith & Johnson (2019)	(double outcome)	UK	Family nutritional status improves with food security

Six **journals (24%)** explored the link between *food banks* and improved nutritional status. Research by Chen et al. (2021) in China showed an increase in **the Dietary Diversity Score (DDS)** and a decrease in the prevalence of micronutrient deficiencies in beneficiary children. Brown & Taylor (2015) also found an increase in energy and protein intake in households using *food banks* in Australia. This is reinforced by the findings of Hassan &

Ibrahim (2019) in Egypt, which recorded a decrease in wasting and stunting cases in intervention communities. This means that *food bank interventions* indirectly support family nutrition programs by expanding access to nutritious food.

4. Supporting Household Economic Stability (7 studies)

Tabel 5. Research Data Supporting Houshold Economic Stability

No	Author (Year)	Short Title	Location	Summary of Findings
1	Müller & Weber (2018)	*Food bank* & family economy	German	Save an average of 15% on expenses
2	Okeke & Eze (2023)	*Food bank* + economic training	Nigeria	Family income increases
3	Ochieng & Mwangi (2019)	Family economy & *food bank*	Kenya	12% additional income
4	Petrov & Ivanov (2018)	*Food banks* in the Russian economic crisis	Russia	Household savings increase
5	Ahmed et al. (2021)	Pakistan (double outcome)	Pakistan	Income increases, food access improves
6	Chukwu & Adebayo (2023)	Women and family economy	Nigeria	Household economy improves, children's nutrition also improves
7	Nguyen et al. (2022)	(double outcome)	Vietnamese	Economic resilience and food access improved

Seven **studies (28%)** examined the contribution of *food banks* to family economic stability. Müller & Weber (2018) noted an average savings of 15–20% of monthly food expenditures in German households after receiving assistance from *a food bank*. Okeke & Eze (2023) noted that *food banks* in Nigeria were able to encourage women's economic empowerment through food processing training. In Vietnam, Nguyen et al. (2022) showed that the existence of digital *food banks* helped households survive the economic emergency caused by the pandemic. Overall, *food bank programs* have been shown to play a role not only in the food sector but also in strengthening family economies and increasing social resilience.

DISCUSSION

This study aims to systematically review the role of *food bank programs* in reducing *food waste*, increasing food security, improving household nutritional status, and strengthening economic stability as a form of sustainable social intervention. Based on a review of 25 scientific journals, it was found that *food banks* can reduce food waste by up to 30%, increase food access and diversity, improve the nutritional status of children and poor families, and help households reduce their expenditure burden and achieve economic empowerment. *Food banks* have proven to be an effective, multifaceted solution in

addressing various crucial issues. First, *food banks* significantly contribute to reducing food waste by up to 30%, making them an important tool in environmental sustainability efforts. Another implication is increased food access and diversity, which directly increases food security and improves the nutritional status of children and poor families. This positive impact extends to helping households reduce their expenditure burden and pave the way for economic empowerment. The implications of *food banks* extend beyond simply reducing waste and increasing food access. One important implication is their ability to bridge the paradox between food *waste* and food insecurity that often occurs in many countries, including Indonesia. *Food banks* act as altruistic or non-profit institutions that effectively manage surplus food that would otherwise be wasted and distribute it to those in need, thus directly addressing these two contradictory issues within a single system. These findings indicate that *food banks* function not only as a means of food distribution but also as a crucial pillar in building a just and crisis-resilient food system. Therefore, integrated national policy support, multi-sectoral collaboration, and the development of digital and community-based systems are needed to optimize the sustainability and long-term impact of *food bank programs* at both local and global scales. To optimize the role of *food banks* in Indonesia, several easy-to-implement recommendations can be considered. Strong collaboration and networks are key; local governments should allocate funds and facilitate partnerships with the private sector, such as producers, distributors, and supermarkets, to donate surplus food.

Engaging more companies through CSR programs focused on food donations will strengthen supply. Furthermore, strengthening the operational capacity *of food banks* themselves is crucial. This includes providing adequate and hygienic storage facilities and regular training for volunteers and staff on inventory management and food safety. Utilizing simple technology for stock recording and beneficiary data will also improve efficiency. Finally, public education and campaigns should be intensified. Conducting awareness campaigns on reducing food waste and the role of *food banks*, as well as developing easily accessible donation programs for individuals, will encourage broader community participation. Beyond distribution, *food banks* can also collaborate with nutritionists to provide simple nutrition education to beneficiary families, complementing food aid with empowering knowledge. With these steps, *food banks* can further strengthen their role in creating more sustainable and food-secure communities. To further optimize the role of *food banks*, strategic efforts are needed, 49including developing community-based *food bank models* and local partnerships. This means encouraging the establishment of small-scale *food banks* managed directly by local communities or civil society organizations. This model will be more responsive to specific needs in the region and can forge close partnerships with health facilities such as integrated health posts (Posyandu) and community health centers (Puskesmas), as well as schools, with the goal of identifying and reaching the most vulnerable families, including children with nutritional problems. Utilizing information technology for efficiency and transparency is essential. Developing a centralized digital platform would be helpful. This platform could include real-time food inventory features, facilitate automatic matching of incoming donations with recipients' specific needs, and provide transparent tracking and reporting functions. The presence of a mobile application for volunteers would also facilitate distribution recording and reporting on conditions in the field.

Supportive government incentive policies and regulations are also crucial. The government could consider providing incentives 49, such as tax deductions, for 49companies or individuals who regularly donate surplus food to *food banks*. Furthermore, clear regulations regarding food safety standards for donated food and simplified licensing for *food bank operations are needed*. This also includes streamlining the bureaucracy surrounding the donation of food that is nearing its expiration date but is still safe to consume. *Food banks*

can also expand their role through ongoing education and empowerment of beneficiaries. In addition to distributing food, *food banks* can play an active role in providing nutrition education and basic skills to beneficiaries. This could include simple training on proper food processing, safe storage tips, or even micro-entrepreneurship training in the food sector. These initiatives would align with economic empowerment efforts, helping low-income families not only receive assistance but also increase their long-term independence.

CONCLUSION

Food banks are a crucial and effective, multifaceted solution for addressing several interconnected issues, including food waste, food insecurity, and economic instability. They act as a vital link between food surplus and food scarcity, directly tackling the paradox of waste and hunger. The text highlights that food banks not only reduce food waste by up to 30% but also significantly improve food access, nutritional status, and economic stability for vulnerable households.

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