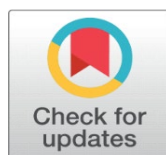


# A QUANTITATIVE ANALYSIS OF VARIOUS FOOD DISTRIBUTION STRATEGIES AND THEIR PERFORMANCE IN TAMIL NADU, INDIA

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## ABSTRACT

The Right to Food is a universal human right recognized by various human rights organizations and policies, such as Article 25 of the Universal Declaration of Human Rights (UDHR) and Article 11 of the International Covenant on Economic, Social and Cultural Rights (ICESCR). The Indian Constitution also recognizes it and imposes it on the public through various welfare schemes and public assistance. In Tamil Nadu, these schemes, programs, and assistance can be seen through multiple food distribution strategies, including Amma canteens, midday meals, the Public Distribution System (PDS), and NGO-based initiatives. These initiatives and strategies play a vital role in providing safe, sufficient, and nutritious food to the marginalized populations. This paper analyzes these food distribution strategies by evaluating their reach, efficiency, availability, and performance across various districts in Tamil Nadu. This paper studies these strategies using structured questionnaires and field surveys. The study includes the total number of active food distributors, consumer demographics, logistic operations, and the overall efficiency and effectiveness of these strategies. The data is collected from consumers, administrative staff, and non-governmental actors involved in the strategy. Various statistical tools are utilized to evaluate the correlation between strategy type, coverage area, and service satisfaction levels. The findings of this paper can help us improve existing strategies by highlighting the strengths and weaknesses collected from the data within the framework of the Right to Food. This paper aims to contribute to the solidification of food security systems in Tamil Nadu through evidence-based policy reforms.

**Keywords:** Right-To-Food, Food Security, Food Distribution Strategies, Midday-Meals, Amma Canteens

## 1. INTRODUCTION

The 'Right to Food' is a crucial legal issue both nationally and internationally, aimed at achieving SDG 2. The Right to Food Act was enacted in 2013 as part of the National Food Security Act (NFSA). In the Indian Constitution, the right to food is part of the right to life. The right to food is a fundamental human right, as established in international law, to promote human dignity, equality, and justice. The right to food ensures that every individual has access to adequate, safe, and nutritious food at all times, enabling them to lead a healthy and active life. Article 11 of the ICESCR includes the right to food and is reinforced by global frameworks, such as the SDGs, specifically Goal 2: Zero Hunger, and the Universal Declaration of Human Rights. Many countries enforce multiple food security systems to ensure the right to food and prevent malnutrition and hunger. If food security is implemented, all people will have access to safe, sufficient, and nutritious food. This depends on availability, access, utilization, and stability. To reduce vulnerability and improve access

to adequate food for its large population, the government provides schemes such as agricultural subsidies, emergency food reserves, public distribution systems, and national food programs.

Even with these processes in place, more people still suffer from hunger, food insecurity, and undernutrition due to poverty, inequality, conflict, and environmental conditions. Therefore, implementing the right to food through reliable food security policies and accountable governance mechanisms is prioritized to ensure equitable and sustainable development. Its main goal is to address malnutrition, hunger, and inequality, and to provide access to nutritious and sufficient food. To address these needs, the Government of India has launched various schemes, including the Mid-Day Meal Scheme, the Public Distribution System (PDS), the Antyodaya Anna Yojana, and the Integrated Child Development Services, among others. These schemes are designed to ensure that all citizens, particularly those from vulnerable groups, have access to sufficient food. In some regions, these schemes may vary due to local government strategies, policies, and community participation. The success rate of implementing the SDG goal related to the right to food also differs across regions. Several earlier research works have been conducted to address the uneven implementation of food programs or schemes across urban and rural areas. And highlights the role of decentralized government in establishing nutritional food programs (Agarwal et al., 2024; N. C. Saxena, 2018). Smapson et al. (2021) have highlighted the demand and gaps in implementing various food security programs and right-to-food schemes, such as ICDS and PDS. During the COVID-19 pandemic, it becomes even more essential to analyze the adequacy of food distribution, the security framework, and which schemes are in higher demand for delivering food, making it even more crucial to do so. To ensure the current quality and effectiveness of PDS, ICDS, and other food security schemes across regions, various methods are employed. Therefore, this paper presents a case study to systematically analyze the number of schemes and the beneficiaries they cover.

This paper presents a quantitative analysis by collecting much information related to RTF strategies currently active in Tamil Nadu, India. A questionnaire is issued to 100 respondents and gathers their personal and experiential data regarding the government strategies employed under the “right-to-food” and “food security” initiatives concerning SDG 2, No Hunger. To understand the problem statement, a detailed survey is given below.

## 2. LITERATURE SURVEY

Shareen Hertel (2015) has analyzed the strengths and weaknesses of the Indian economy in relation to the Right to Food (RTF) Campaign. This campaign employs a hybrid approach that combines both radical legal demands and efforts to reform current food programs. It mainly reflects two logics of human rights: economic rights and the right to life. Finally, the campaign has increased recognition of the RTF Act. However, it has a weakness in the formulation of its reform policy. The RTF Act is one of the fundamental human rights. Susan Randolph and Shareen Hertel (2012) have examined the impacts of RTF, traced the development of RTF globally, and finally assessed how well global institutions take action to fulfill the right. Finally, the authors also identify long-lasting issues, including rising meat consumption, climate change, and the increase in biofuel production. Ghulam Mustafa Dogar and Shazia Yaqoob (2023) have presented an advanced strategy to enhance the Food Security Act in Punjab and Pakistan, considering various aspects such as advanced technology, international cooperation, stakeholder involvement, and a regulatory framework. The article highlights the numerous factors that impact food safety, ranging from farming and distribution to food consumption. Finally, the author evaluates the overall effectiveness of the process by inspecting the food authorities in Punjab. Seyed Mohammad Hosseini et al. (2024) have proposed an advanced food security model based on recent reports and expert interviews, highlighting issues such as unequal distribution and food scarcity. Other methods implemented by countries include sustainable agriculture, virtual water importation, and waste reduction. The success of these efforts mainly depends on global conditions and national capabilities. Ultimately, the author asserts that effective management can enhance public health, improve food security, and mitigate environmental damage.

Tiwari et al. (2023) examine India's food security law and strategies, as well as the challenges associated with achieving zero hunger. The aim of “From Hunger to Hope” in India's Food Security is to evaluate current issues and find solutions. The main challenges include insufficient infrastructure, climate change affecting agricultural productivity, limited access to food, and high levels of poverty and inequality in food distribution. Finally, the author suggests that ensuring food security in India depends on increasing storage capacity, investing more funds in agricultural research and development, promoting sustainable farming practices, and improving the food supply chain. The author also evaluates social welfare schemes, such as the midday meals scheme and the Integrated Child Development Program, which help enhance the nutritional status of children and pregnant women. Shukla et al. (2015) have explored

technologies to improve agricultural practices. The main issue is that the growing population leads to economic growth, so the primary concern is providing food for every individual. The Government of India passed a Bill in 2013 that guarantees each person's right to quality food. Most of the traditional public distribution system (PDS) structures are in place. In the conventional model, there are some weaknesses in food safety controls, and improvements are needed in policies and the regulatory system. The author examines various technologies that aim to enhance the right to food, including those that facilitate harvesting, production, distribution, and storage. Therefore, the author uses modern technology to improve food safety controls. Islam, S. (2025) has studied agriculture, food security, and sustainability. Food security and sustainability mainly depend on agriculture, so the author explores sustainable agriculture practices to increase food productivity. Traditional farming methods contribute to water scarcity, soil erosion, and emissions, ultimately affecting the long-term food supply chain. Therefore, AI-based technology, precision farming, and agroecology provide solutions for traditional farming challenges. The author concludes that achieving food security requires global action, proper food distribution, and climate-resilient methods to meet sustainability goals.

Barman et al. (2021) focused on the socioeconomic challenges faced by society during the pandemic period, with the agriculture sector, supply chain, and food chain being severely impacted. In the agricultural industry, there is a labor shortage for sowing and harvesting. Migrating workers face challenges in the agricultural sector and food processing units, which impact planting, harvesting, and post-harvest activities. In the food supply chain, distribution was hindered due to the improper functioning of warehouses and delays in transporting perishable food items, such as fruits, vegetables, and milk, caused by transportation issues, shorter shelf lives, and a lack of cold storage. Environmental factors also contribute to food waste through methane emissions from rotting food, which can lead to cross-contamination. This issue could be addressed by ensuring worker safety, adapting workplaces, improving public distribution systems, and implementing better planning with enhanced infrastructure in both the government and private sectors, which could ultimately enhance food security in the future.

Food fortification has both limitations and motivations, where micronutrients play a major role. Olson et al. (2021) have proposed that vitamins and minerals have a major impact on fortified foods. They are a major requirement in health, development, and growth. Many low- and middle-income countries suffer from various deficiencies, including anaemia caused by iron deficiency, blindness due to vitamin A deficiency, and infections caused by a lack of zinc. This has caused many people, including children and pregnant women, to develop long-term health issues. The consumption of fortified foods is affordable, widespread in rural settings, and has proven to be effective in preventing diseases. Fortified food comes in various forms, including large-scale food fortification, home fortification, and biofortification. These support national and global programs in providing research training and partnering with both the government and private food companies. They may have some effects in overconsumption of the fortified foods, but the enhancement of micronutrients improves public health and ensures sustainable national development. Sampson et al. (2021) proposed this article on the impact of food security and nutrition through a review system, which examines rights-based approaches to food security and nutrition. The rights-based approaches emphasize accountability, non-discrimination, and empowerment. The right to food is an essential requirement of every person in society, and food sovereignty is the right of people to define their food systems, which supports local food production. Analyses of global literature, including reports, policy briefs, and NGO publications, are organized by geographic region and outcomes related to food security and nutrition. Rights-based approaches rely on the food system to address underlying inequalities, secure sustainable political support, and foster active engagement in legal frameworks.

Whereas several studies have focused solely on the number of original beneficiaries served. This gap underscores the need for case studies that not only examine the scope of food security but also identify context-specific approaches that have emerged at the grassroots level. This study aims to identify these challenges.

### 3. RESEARCH METHODOLOGY

This study presents a quantitative analysis using a question-and-answer (Q&A) method with participants from various regions. The primary objective of this investigation is to evaluate the effectiveness and reach of the food distribution system across multiple regions in India. Based on factors such as poverty rates, population, and food security initiatives, the research examines rural and urban districts in India, particularly in the state of Tamil Nadu, including Tiruchirappalli, Chennai, and Madurai. The QA data is gathered from three groups of respondents: students, working men, and housewives. Results are presented from 100 respondents across different regions in Tiruchirappalli. The questionnaire contains various structured questions, such as personal information, awareness of the right to food

schemes, types of food provided, satisfaction levels, food security status, and challenges faced during food delivery. All the responses are collected through direct field review. The following section discusses the ratio of the obtained results on various questions answered by the respondent.

**Table 1** Respondents Vs Gender

Number of Respondents	Gender classification	
	Male	Female
100	32	68

**Table 2** Respondents Vs Age

Number of Respondents	Age classification		
	≤30	30>50	>50
100	33	46	21

Table-1 and 2 show the classification results of respondents based on gender and age, respectively. The gender classification in table-1 shows that out of 100 respondents, 68% are female and 32% are male. This is because women are more actively involved with household food management systems compared to men. The age-wise classification in Table 2 indicates that, among the three groups (≤30, 30-50, and >50), 46% belong to the 30-50 age group, 33% are in the ≤30 group, and the remaining 21% are in the > 50 age group. This is because people in the middle age of 30-50 are economically active and aware of the current schemes' efficacy and functionality regarding the right to food.

**Table 3** Respondents Vs Role

Number of Respondents	Respondents Role		
	Student	Working Men's	House Wives
100	44	19	37

**Table 4** Respondents Vs Right To Food

Number of Respondents	Aware Of Any Schemes Or Programs Related To The "Right To Food"	
	Yes	No
100	73	27

Table 3 presents the total number of respondents and their roles in daily life. The results show that out of 100 respondents, 44 are students, 37 are housewives, and 19 are working men. Students and housewives constitute the majority of respondents. This is because, compared to working men, housewives and students have direct access to food schemes and are closely connected to food distribution points such as ration shops and schools. Similarly, Table 4 displays the distribution of respondents who are aware of the right to food programs and schemes. The results indicate that among 100 respondents, 73% are aware of the right-to-food schemes. This awareness is created through digital marketing systems, direct announcements, or by engaging housewives involved in household food management systems.

**Table 5** Various Food Programs

Number of Respondents	Which of the following food programs are active in your area?							
	PDS	MDMS	ICDS	NFSA	CK	AAA	NGO	Others
100	39	18	12			2	4	-

**Table 6** Respondent Vs the number of food being distributed

Number of Respondents	Number of people being fed			
	<100	100-500	501-1000	>1000
100	35	40	15	10

Table 5 presents the results of a survey conducted to determine the awareness of the "Right to Food" and related acts among the population. This survey was conducted with 100 randomly selected individuals, comprising both males

and females. It found that 73% of the people were aware of these acts, while 23% still do not know about them. Table 6 presents the results of a survey conducted to determine which security programs are currently available in the area. These include various food security programs such as the Mid-Day Meals Scheme (MDMS), Integrated Child Development Services (ICDS), Public Distribution System, Community Kitchen (CK), NGO-run feeding programs, Antyodaya Anna Yojana (AAA), and others. This survey also involved 100 randomly selected individuals, including males and females. The results indicate that 39% of the people say PDS is currently available in their area, which is the highest. The second most common is MDMS, reported by 18% of the respondents. Only 2% said that AAA is currently available in their area, making it the least available program.

**Table 7** Number of People Undergoes Right to Food Schemes

Number of Respondents	Which groups are mostly covered under these schemes?							
	(0-6yrs)	School students	Pregnant women	BPL families	Elderly	Migrant worker	Homeless individuals	Others
100	14	20	12	18	10	9	7	10

**Table 8** Type of Food Provisions

Number of Respondents	Types of Food Provisions					
	Cooked meals	Dry ration	THR	DBT	CK	Others
100	28	22	15	10	15	10

Table 7 presents the results of a survey conducted to determine the number of people in the area who are fed by one of these food security programs. This survey also included approximately 100 people who had previously attended surveys. The survey was divided into four categories: fewer than 100 members, 100-500 members, 501-1000 members, and more than 1,000 members. The results showed that 40% of respondents stated that 100-500 people are regularly fed, which is the highest percentage. 35% said fewer than 100 people are regularly fed. 15% said that 100-500 people are regularly fed. Finally, only 10% reported that the food security program regularly feeds more than 1,000 people. Table 8 presents the results of a survey conducted to identify which group of people benefits most from these food security programs. The groups were categorized into eight types: children aged 0-6 years old, pregnant women, school students, elderly individuals, BPL families, homeless individuals, migrant workers, and others. The survey indicated that about 20% of respondents stated that school students are the most covered by the food program, which is the highest percentage. 18% said BPL families are the most covered. Finally, 7% reported that homeless individuals are the least covered by these food programs.

**Table 9** Frequency of Food Distributed

Number of Respondents	What is the frequency of food distribution?				
	Daily	Weekly	Fortnightly	Monthly	Others
100	25	30	15	20	10

**Table 10** Challenges to implementing the right to food

Number of Respondents	What are the main challenges in implementing food rights programmes in your area?					
	Irregular supply	Corruption/leakages	Lack of awareness	Transportation issues	Identification of beneficiaries	Others
100	20	22	18	15	13	12

**Table 11** Respondent vs. food distribution satisfaction

Number of Respondents	Do you think current food security programs are sufficient to meet local needs?		
	Yes	No	Partially
100	33	46	21

Table 9 illustrates the frequency of food distribution based on the scheme or policy and the responses gathered from 100 individuals. According to the responses, 30% of people receive food weekly, 25% receive food daily, 15% receive it fortnightly, 20% receive it monthly, and 25% receive food at various other frequencies. Table 10 shows the challenges



in implementing the right to food, based on responses from 100 individuals. The challenges identified include irregular supply at 20%, corruption or leakages at 22%, lack of awareness at 18%, transportation issues at 15%, identification of beneficiaries at 13%, and other challenges accounting for 12%. These challenges must be addressed in upcoming policies to implement the Right to Food Act effectively. Table 11 illustrates the satisfaction level regarding food distribution, based on responses from 100 individuals. The responses indicate that 33% of people are satisfied, 21% are partially satisfied, and the remaining 46% are dissatisfied with the current food security programs' ability to meet local needs. More effective food security initiatives are still necessary to adequately meet local demands.

#### 4. CONCLUSION

This paper presents an analysis of various food distribution strategies operating in Tamil Nadu, India, within the framework of the Right to Food. The assessment was conducted using structured questionnaires and field surveys among operational food distributors, including Amma Canteens, midday meals, the Public Distribution System (PDS), and NGO-driven initiatives. The surveys evaluated the reach, efficiency, availability, and performance of these food distributors at the local level. The analysis shows a positive contribution to food security. However, differences still exist in coverage consistency, food quality, and service accessibility. These disparities are mainly found in rural and marginalized communities. Additionally, government initiatives have a greater reach compared to NGO programs, but NGOs demonstrate higher flexibility and responsiveness. The performance metrics indicate that multi-channel integration, community involvement, and real-time grievance mechanisms improve the efficiency and fairness of food delivery systems.

#### 5. FUTURE WORK

This paper offers valuable insights into various food distribution strategies and their effectiveness. Future research can explore multiple directions to enhance these strategies. A longitudinal study could be introduced to evaluate these programs over time, monitoring changes and assessing their sustainability and adaptability. Such research can be particularly beneficial during crises, such as pandemics and epidemics. Including methods like focus group discussions can help uncover socio-economic and cultural insights about local communities, providing access to food that aligns with their cultural norms and needs. Additionally, integrating geospatial technology can enable real-time data analysis for precise monitoring. Future studies could also compare Tamil Nadu's strategies with those of North India or international models, leading to improved food delivery practices and a more resilient food security framework.

#### CONFLICT OF INTERESTS

None.

#### ACKNOWLEDGMENTS

None.

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## APPENDIX

### Questionnaire For Conducting a Quantitative Approach To Examine the Strategies of “Right-To-Food” Quantitative

<b>Respondents Personal Details</b>	
Name	
Age	
Gender	<input type="checkbox"/> Male / <input type="checkbox"/> Female
Designation	
Location [ Within Tiruchirappalli District]	
<b>Beneficiary Coverage</b>	
Are you aware of any schemes or programs related to the “right to food” in your area?	<input type="checkbox"/> Yes / <input type="checkbox"/> No
If yes, which of the following food programs are active in your area?	<input type="checkbox"/> Public Distribution System (PDS) <input type="checkbox"/> Mid-Day Meal Scheme <input type="checkbox"/> Integrated Child Development Services (ICDS) <input type="checkbox"/> Antyodaya Anna Yojana <input type="checkbox"/> National Food Security Act (NFSA) <input type="checkbox"/> Community Kitchens <input type="checkbox"/> NGO-run feeding programs <input type="checkbox"/> Others (Please specify):----- -----
Approximately how many people are being provided for under these schemes in your area?	<input type="checkbox"/> Less than 100 <input type="checkbox"/> 100–500 <input type="checkbox"/> 501–1000 <input type="checkbox"/> More than 1000
Which groups are mostly covered under these schemes?	<input type="checkbox"/> Children (0–6 years) <input type="checkbox"/> School-going children <input type="checkbox"/> Pregnant/lactating women <input type="checkbox"/> Below Poverty Line (BPL) families <input type="checkbox"/> Elderly <input type="checkbox"/> Migrant workers

	<input type="checkbox"/> Homeless individuals <input type="checkbox"/> Others: _____
--	-----------------------------------------------------------------------------------------

<b>Strategies and Implementation</b>	
How many strategies are food distribution models being used in your area?	<input type="checkbox"/> One <input type="checkbox"/> Two <input type="checkbox"/> Three or more
Please describe the main strategies used to provide food.	
How is the food provided	<input type="checkbox"/> Cooked meals <input type="checkbox"/> Dry rations <input type="checkbox"/> Take-home rations (THR) <input type="checkbox"/> Food coupons or Direct Benefit Transfer (DBT) <input type="checkbox"/> Community kitchens <input type="checkbox"/> Others: _____
What is the frequency of food distribution?	<input type="checkbox"/> Daily <input type="checkbox"/> Weekly <input type="checkbox"/> Fortnightly <input type="checkbox"/> Monthly <input type="checkbox"/> Others: _____
Are any digital or technical-based methods used in identifying beneficiaries or distributing food?	
<b>Challenges Are Suggestions</b>	
What are the main challenges in implementing food rights programmes in your area?	<input type="checkbox"/> Irregular supply <input type="checkbox"/> Corruption/leakages <input type="checkbox"/> Lack of awareness <input type="checkbox"/> Transportation issues <input type="checkbox"/> Identification of beneficiaries <input type="checkbox"/> Others: _____
Do you think current food security programs are sufficient to meet local needs?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Partially
Suggestions to improve food access and delivery in your areas	