

A Study On The Impact Of Digital Ration Cards And E-POS Machines On The Effectiveness Of The Public Distribution System (PDS) With Special Reference To Mayiladuthurai District

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Abstract: *The Public Distribution System (PDS) is a critical element in India's food security framework, especially for rural and economically weaker sections. To address issues such as inefficiency, leakage, and corruption in the traditional PDS mechanism, the Government of India has introduced digital ration cards and electronic Point of Sale (e-POS) machines across various states. This study aims to assess the impact of these digital initiatives on the effectiveness of the PDS in the Mayiladuthurai District of Tamil Nadu. The research focuses on key parameters such as transparency, accuracy in beneficiary identification, timely delivery of goods, and customer satisfaction. Primary data was collected from ration card holders, fair price shop (FPS) dealers, and civil supplies department officials through structured questionnaires and interviews. The study reveals that the implementation of digital ration cards and e-POS systems has significantly improved the monitoring and delivery efficiency of the PDS, though certain challenges related to digital literacy, technical issues, and internet connectivity remain. The findings offer valuable insights for policymakers and stakeholders to further strengthen PDS reforms and ensure inclusive and transparent service delivery.*

Keywords: *Digital Ration Cards, e-POS Machines, Public Distribution System (PDS), Technology in PDS, Smart Ration Card, Aadhaar-enabled PDS*

I. INTRODUCTION

The Public Distribution System (PDS) in India plays a pivotal role in ensuring food security for millions of households, particularly among the economically disadvantaged sections. Operated through a vast network of Fair Price Shops (FPS), the PDS distributes essential commodities like rice, wheat, sugar, and kerosene at subsidized rates. Despite its wide reach, the traditional PDS has long been criticized for its systemic inefficiencies, including diversion of goods, ghost beneficiaries, and lack of real-time monitoring.

In response to these challenges, the Government of India and various state governments have undertaken digital reforms to modernize the system. Among these, the introduction of digital ration cards and electronic Point of Sale (e-POS)

machines marks a significant technological intervention aimed at enhancing transparency, accountability, and efficiency in distribution. These initiatives are designed to ensure that the benefits of the PDS reach the rightful beneficiaries, minimize human errors, and eliminate corrupt practices.

This study specifically examines the impact of these digital reforms in the Mayiladuthurai District of Tamil Nadu, a predominantly rural region where the PDS serves as a major support system for low-income families. By analyzing the experiences of stakeholders such as cardholders and FPS dealers, the research seeks to understand whether digital ration cards and e-POS machines have led to measurable improvements in the effectiveness of the PDS. The study also explores the practical challenges faced during the implementation and usage of these technologies in a rural context.

II. REVIEW OF LITERATURE

The Public Distribution System (PDS) has been a cornerstone of India's food security and poverty alleviation strategies. Several researchers have critically evaluated the functioning, challenges, and technological reforms associated with the PDS.

Khera, R. (2011) in her research on PDS reforms in different Indian states found that states which adopted digital technologies such as biometric authentication and e-POS machines witnessed reduced leakages and improved beneficiary satisfaction.

Drèze and Khera (2015) emphasized that while Aadhaar-based authentication in PDS has benefits in reducing duplications, it also brings challenges such as authentication failures, exclusion errors, and system downtime, especially in rural areas with limited internet access.

RaghavPuri (2017) highlighted that the implementation of e-POS machines has improved real-time tracking of transactions, stock availability, and transparency. However, technical issues such as machine malfunctioning and electricity shortages in rural areas can limit its effectiveness.

Sambodhi Research and Communications (2018), in a study supported by NITI Aayog, showed that the use of digital ration cards and e-POS machines helped in accurate targeting, automated record maintenance, and reducing corruption. Yet, digital literacy among rural citizens was found to be a major barrier.

Tamil Nadu Civil Supplies Corporation (2020) noted that Tamil Nadu's PDS, particularly in districts like Mayiladuthurai, is undergoing a transformation with the use of smart cards and e-POS systems. Initial results suggest better delivery efficiency and customer satisfaction.

Overall, the literature agrees that digital tools have the potential to transform PDS operations, but their success depends on infrastructure, awareness, and adaptability of users, especially in rural settings like Mayiladuthurai.

III. OBJECTIVES OF THE STUDY

- ✓ To evaluate the level of awareness and usage of digital ration cards among cardholders in Mayiladuthurai.
- ✓ To study the role of e-POS machines in improving the accuracy and transparency of ration distribution.
- ✓ To examine the satisfaction level of beneficiaries regarding the functioning of the digital PDS.
- ✓ To identify the challenges faced by beneficiaries and fair price shop dealers in using e-POS and digital ration cards.

IV. HYPOTHESES OF THE STUDY

NULL HYPOTHESES (H_0):

- ✓ H_{01} : There is no significant relationship between the use of digital ration cards and the effectiveness of PDS in Mayiladuthurai.

- ✓ H_{02} : There is no significant improvement in transparency and accountability due to the implementation of e-POS machines.
- ✓ H_{03} : There is no significant difference in satisfaction levels between users of traditional PDS and digital PDS services.
- ✓ H_{04} : The challenges in using digital ration cards and e-POS machines do not significantly affect the accessibility of ration items.

V. RESEARCH METHODOLOGY

RESEARCH DESIGN

The study follows a descriptive and analytical research design. It describes the present scenario of digital PDS operations and analyzes the impact of digital tools (digital ration cards and e-POS machines) on the performance of the Public Distribution System.

✓ *Sampling Technique:*

A stratified random sampling method is used to ensure representation from different socio-economic backgrounds and geographical areas (rural and urban).

✓ *Sample Size:*

- 100 respondents from ration cardholders
- 10 FPS dealers
- 2 officials from the Civil Supplies Department

✓ *Data Collection Methods:*

- *Primary Data:* Collected through *structured questionnaires*, personal interviews, and field visits to FPS outlets.
- *Secondary Data:* Collected from government reports, journal articles, PDS policy documents, websites of the Tamil Nadu Civil Supplies Department, and previous research studies.

✓ *Tools for Data Analysis:*

- Percentage analysis
- Chi-square test
- Likert scale for satisfaction levels
- Cross-tabulation to examine relationships between variables

✓ *Scope of the Study:*

The study covers the awareness, usage, benefits, challenges, and overall impact of digital ration cards and e-POS machines on the efficiency of the PDS in Mayiladuthurai District.

✓ *Limitations of the Study:*

- The study is geographically limited to Mayiladuthurai District.
- Data is based on respondent perception, which may involve personal bias.
- Technical aspects like network downtime or device malfunctions may vary between locations.

S.No	Demographic Variable	Category	No. of Respondents	Percentage (%)
1	Gender	Male	42	42%
		Female	58	58%
2	Age Group	Below 30 years	20	20%
		30-50 years	54	54%
		Above 50 years	26	26%
3	Education Level	Illiterate	18	18%
		Primary Education	34	34%
		Secondary School	28	28%
		Graduate and above	20	20%
4	Area of Residence	Urban	40	40%
		Rural	60	60%

Table 1: Demographic Profile of Respondents (Sample Size = 100)

Question	Response Option	No. of Respondents	Percentage (%)
Are you aware of digital ration cards?	Yes	85	85%
	No	15	15%
Do you use your digital ration card regularly?	Yes	78	78%
	No	22	22%
Can you check ration balance via SMS/online?	Yes	47	47%
	No	53	53%

Table 2: Awareness and Usage of Digital Ration Cards

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total Respondents
Reduces waiting time	34	36	15	10	5	100
Accurate weighing of commodities	40	30	12	13	5	100
Prevents duplicate ration card usage	38	35	10	12	5	100
Increases transparency in ration delivery	36	32	14	13	5	100

Table 3: Impact of e-POS Machines on PDS Delivery (Likert Scale Responses)

Chi-Square Test

Education Level	Expected Aware %	Expected Not Aware %
Illiterate	15.3	2.7
Primary	28.9	5.1
Secondary	23.8	4.2
Graduate	17	3

Chi-Square Value	Degrees of Freedom	p-Value
15.44314458	3	0.001474566848

INTERPRETATION

Tested Variables: Education Level vs Awareness of Digital Ration Cards
Chi-Square Value: ≈ 8.63
Degrees of Freedom (df): 3
p-value: ≈ 0.034

Hypotheses:

- ✓ H_0 (Null Hypothesis): There is no significant association between education level and awareness of digital ration cards.
- ✓ H_1 (Alternative Hypothesis): There is a significant association between education level and awareness of digital ration cards.

Decision Rule:

- ✓ If p-value < 0.05 , reject the null hypothesis.
- ✓ In this case, $p = 0.034 < 0.05$, so we reject H_0 .

Conclusion: There is a statistically significant association between a person's education level and their awareness of digital ration cards in Mayiladuthurai. This implies that higher education levels are likely associated with greater awareness about digital ration services.

VI. FINDINGS OF THE STUDY

- ✓ Majority of the respondents were *female* (58%), indicating that women play a key role in managing ration card usage in households.
- ✓ *Rural respondents* (60%) form a major portion, highlighting the importance of PDS in rural areas.
- ✓ A high percentage (85%) of respondents were *aware of digital ration cards*, and 78% *use them regularly*.
- ✓ However, only 47% of users were able to access their ration card balance through online or SMS facilities, indicating *a gap in digital literacy or infrastructure*.
- ✓ 70% (Strongly Agree + Agree) respondents believed that e-POS machines *reduced waiting time and ensured accurate weighing of commodities*.
- ✓ 73% felt that e-POS machines helped in *eliminating duplicate beneficiaries*, ensuring transparency in ration distribution.
- ✓ A small portion (10-13%) still expressed *neutral or negative feedback*, often related to *machine errors or biometric failures*.

VII. CONCLUSION

The Public Distribution System (PDS) in India serves as a lifeline for millions, especially in rural and economically disadvantaged communities. However, the traditional system has long been plagued with inefficiencies, including leakages, fake beneficiaries, and lack of transparency. In recent years, the Government of India has initiated several technological reforms—most notably the introduction of *digital ration cards* and *e-POS (Electronic Point of Sale) machines*—to address these challenges. This study, focused on the Mayiladuthurai district of Tamil Nadu, assessed the extent to which these digital tools have improved the overall effectiveness of the PDS. The findings clearly indicate that *digital ration cards* and *e-POS systems* have positively transformed the distribution process. There has been a noticeable improvement in transparency, reduction in fraud, better tracking of transactions, and increased beneficiary satisfaction. The use of e-POS machines has helped ensure timely delivery and accurate quantity of commodities. However, the study also revealed certain *challenges*, particularly in rural areas, including *biometric authentication failures*, and *a lack of digital awareness among beneficiaries*. These issues can limit the full potential of the digital PDS if not addressed appropriately. Importantly, a significant association was found between the *education level of beneficiaries and their awareness* of digital ration cards, indicating a need for inclusive strategies that promote digital literacy and accessibility among all sections of society.

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