Aadhaar enabled Public Distribution System in Haryana

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Key Facts

- Authentication failure rates in the State declined to .5% of all Active cards in the month of November 2018.

- 98% of all successful fingerprint and iris-based authentication requests received response from UIDAI within 2 seconds.

- More than 70% of beneficiaries access the state AePDS in the last fifteen days of a month.

- More than half of all authentication failures were recoded in the last week of June 2018.

- High authentication attempt and greater ePOS active days were marred by frequent disconnection between ePOS devices and PDS server.

Study Methods and Data Sources

Data from the Aadhaar enabled Public Distribution System (AePDS) portal of Department of Food, Civil Supplies and Consumer Affairs, Government of Haryana was used for this analysis. AePDS is online portal containing data uploaded from ePOS devices used in fair price shops (FPS) for distribution of subsidized food grains. This website is updated daily. For further information about AePDS, including the data, visit the AePDS website at: http://epos.Haryana.gov.in.

All the data for the analysis was scraped from the website for the period of November 2017 to November 2018 and analysed using open source tools.

Summary

The Public Distribution System (PDS) in Haryana employs Aadhaar to authenticate the identity of its beneficiaries. The authentication takes place at the Fair Price Shops (FPS), wherein an individual eligible to receive subsidized food grains is required to furnish proof of possession of a ration card and must undergo Aadhaar-based authentication. The authentication workflow relies on biometric authentication.

This data brief characterizes the main attributes of Aadhaar-enabled Public Distribution System (AePDS) in Haryana and reports on the relative impact of essential components of the AePDS system on allocation of entitlements to the beneficiaries of the PDS system during the month of June 2018. A run-through of findings from authentications between November 2017 to November 2018 is also presented in this study.

The Aadhar authentication attempts for approximately 2M ration cards were made each month in Haryana's AePDS from November 2017 to November 2018. Faridabad district was observed to have more than twice the average failure rate in the state during this period. Half of all failures are captured in the last week of each month.

We found that the Unique Identification Authority of India (UIDAI)'s Aadhaar authentication services to be extremely responsive. More than 98% of all successful authentication requests received a response from UIDAI within two seconds of their generation at the ePOS machines and 78% out of these were received within one second. Only finger-print based biometric authentication was used for identification purposes.

Aadhaar enabled public distribution system (AePDS) has three major components. The ePOS machine at the PDS shop, the state PDS server, and the Aadhaar Authentication Services managed and provided by UIDAI. For efficient delivery of Aadhaar authentication enabled services to the beneficiaries these three components must function in tandem with high efficiency. The state PDS server contains the repository of the digitized ration cards of all the beneficiaries and logs each transaction generated by the ePOS device present in the PDS shop. Even temporary unavailability of the state PDS server greatly impacts the time taken to authenticate a beneficiary. We found that the PDS entitlement offtake in Haryana is characterized by abrupt surge in authentications attempts in the second half of each month. Any disruption of services by PDS server during this period aggravates the inconvenience caused to beneficiaries.

During the month of June 2018, the state PDS server of Haryana was found to be frequently inaccessible by the ePOS devices, especially on days with high number of authentication attempts and greater number of active ePOS devices.

These observations call for a detailed study of the efficacy of various components of AePDS to identify technical issues or bottlenecks in different parts of the authentication ecosystem and gain insights for improved strategic management of the authentication system.

Keywords: Aadhaar authentication; Public Distribution System: Haryana AePDS; State PDS

1. Background

Aadhaar authentication enables residents to prove their identity based on their demographic and/or biometric information captured during Aadhaar enrolment. Aadhaar authentication in public distribution system was introduced to make the process of identification of beneficiaries (a) *convenient*, by avoiding the need of multiple identity documents and (b) *accurate*, by using biometrics and/or OTP to accurately authenticate the identity of a beneficiary. Aadhaar authentication is also expected to bring in transparency and efficiency in the PDS by curbing corruption and leakages.
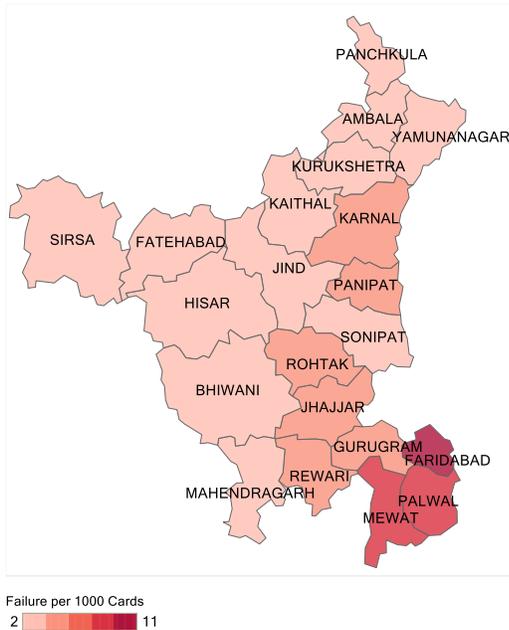
The Public Distribution System (PDS) in Haryana is Aadhaar-enabled. Haryana AePDS uses finger-print based biometric for authentication of beneficiaries. To receive food grains entitlement from the public distribution system the beneficiaries must correctly establish their identity by utilizing the 'Aadhaar authentication framework'. The authentication takes place at the network of Fair Price Shop (FPS) spread across the twenty-one districts in Haryana. Each FPS is equipped with an ePOS (Electronic Point of Sale) machine. These handheld devices act as an interface between beneficiary and the Aadhar authentication ecosystem.

Aadhaar authentication request for each beneficiary is generated using these ePOS devices. After retrieving the details of a beneficiary's ration card from the state PDS server a request for authentication is sent to UIDAI's Aadhaar authentication services which only responds with a Yes or No and no personal identity data (PID) is returned as part of the response.

The state PDS server contains the repository of the digitized ration cards of all eligible beneficiaries of the PDS system in the state. It also records details of every successful and fail authentication transaction generated by the ePOS devices. The PDS server has an important role in the Aadhaar enabled Public Distribution System (AePDS). For efficient delivery of authentication services to the beneficiaries, high efficiency of PDS server and UIDAI authentication services are extremely important and especially on days with high authentication attempts. Underperformance of either of these components can result in inconvenience to the residents.

We focus on understanding the key features of AePDS in Haryana. The objective is to examine the relative difference in usage and efficiency of the Authentication ecosystem under different authentication traffic over a period. We then identify different components of Haryana AePDS and examine their role in delivery of authentication services to the beneficiaries.

2. Key Observations in Haryana AePDS

Figure 1: Aadhaar authentication failures for every 1000 active ration cards in Haryana.

Failure per 1000 Cards
2 ▮▮▮▮▮▮ 11

2.1 Aadhaar authentication failure.

Aadhaar authentication attempts for approximately 2.1M ration cards were made in Haryana AePDS in the month of June 2018. In that, about 8,742 ration cards failed authentication during the same period.

Hisar(.17M) had the maximum number of active ration cards followed by Karnal(.16M). Panchkula district had the least (.03M) number of active ration cards. In absolute numbers Faridabad (1216) had the highest number of cards which failed Aadhaar authentication followed by Mewat (770) and Karnal (659).

For every 1000 active ration cards authenticated in Haryana, failure due to fingerprint-based authentication was found highest in Faridabad (11) and followed by Palwal (8) and Mewat (8) (Figure 1).

High failures rates were observed in Faridabad, Palwal and Mewat from November 2017 to November 2018. In Months of 2018, when failure rates were declining across the districts in the state (figure 2), the failure rate in Faridabad was more than twice the state average across these months.

Faridabad and Ambala districts have approximately the same number of active ration cards(.11M) but in the month of June 2018, It was observed that authentication failures in Faridabad was five times the failure in Ambala. Daily Average Authentication failures in Faridabad and Kaithal were found to be 45 and 10 respectively.

Further study is required to understand what factors were driving - up the failure rates in districts with approximately the same number of Active cards. Findings from this study can help improve the delivery of authentication services across the state.
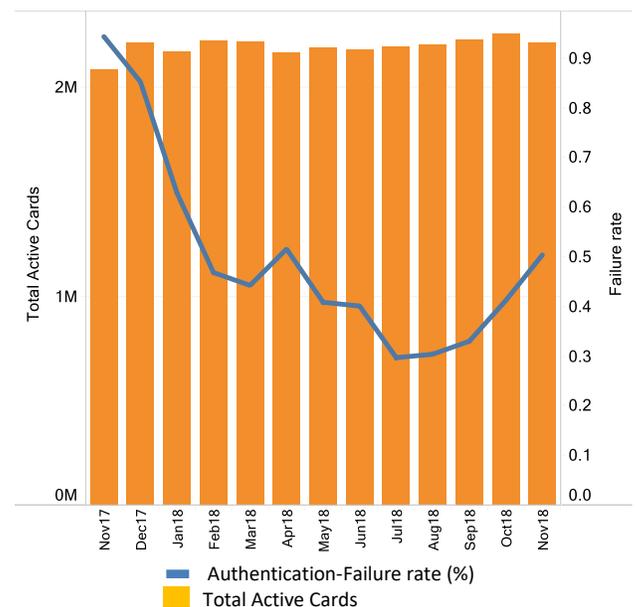
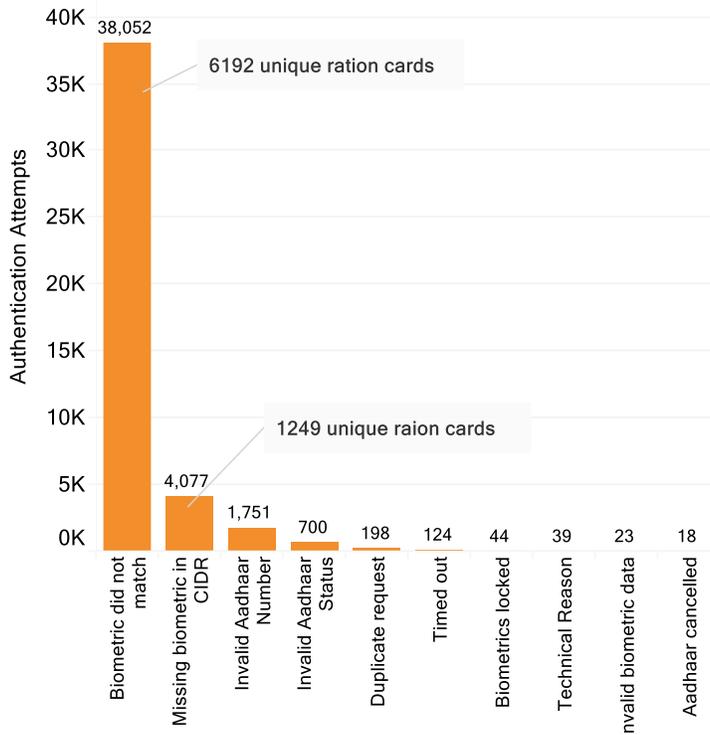

Figure 2: Aadhaar authentication failure rate in Haryana

Figure 3: Causes of biometric based Aadhaar authentication in June 2018

In the month of June 2018, several reasons were identified for the failure of Aadhaar authentication including biometric mismatch, invalid Aadhaar number, invalid biometric status and missing biometric data in CIDR.

Among these, about 71% beneficiaries failed Biometric authentication solely due to *biometric data mismatch* placing it as the leading cause of authentication failure in the state (Figure 3).

Biometric mismatch could happen due to several reasons. For example, the Aadhaar holder gives biometric information (fingerprint) on a scanner but the information is not identified by the Aadhaar database. This could be due to factors such as dry/oily finger, humidity, foreign material on scanner, or poor NIST Fingerprint Image Quality (NFIQ).

Since a large share of authentication failures are attributed to a single cause (i.e. biometric mismatch), a more detailed study of the factors that influence 'mismatch' of beneficiary biometrics is required.

It's interesting to note here that 70% of all AePDS beneficiaries authenticate in the last fifteen days of the month – a stark contrast to the neighboring state of Delhi where 85% of beneficiaries authenticated in the first fifteen days of each month.

More than half of the failures for June 2018 were recorded in the last week of the month. This leaves the beneficiaries who failed authentication less than five days to reattempt authentication.

Mahendragarh district witnessed heavy authentication request traffic in last week of June 2018 with 60% of all beneficiaries accessing the AePDS authentication at PDS shops during this time. Likewise, Panchkula and Yamunagar witnessed 50% of all beneficiaries accessing the system in the last week of June 2018.Similar trend was observed for the three districts over a period of 6 months prior to June 2018. It was also observed that ePOS resets were higher in these districts during the last week of each month.
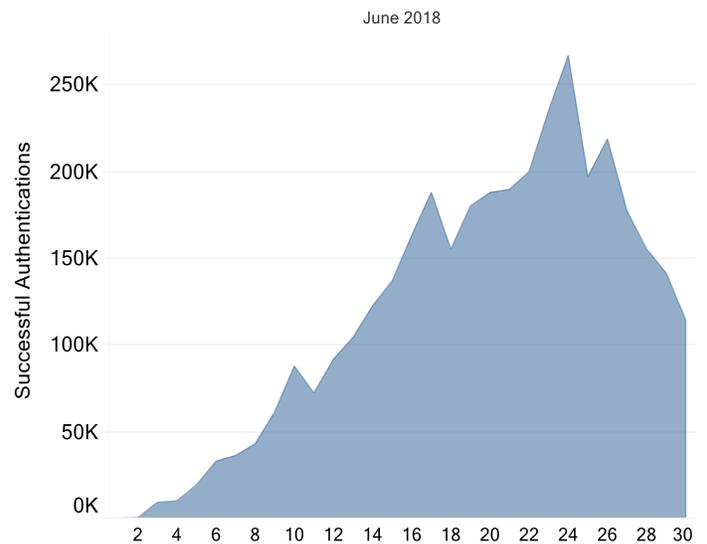

Figure 4: Daily Authentications in month of June 2018

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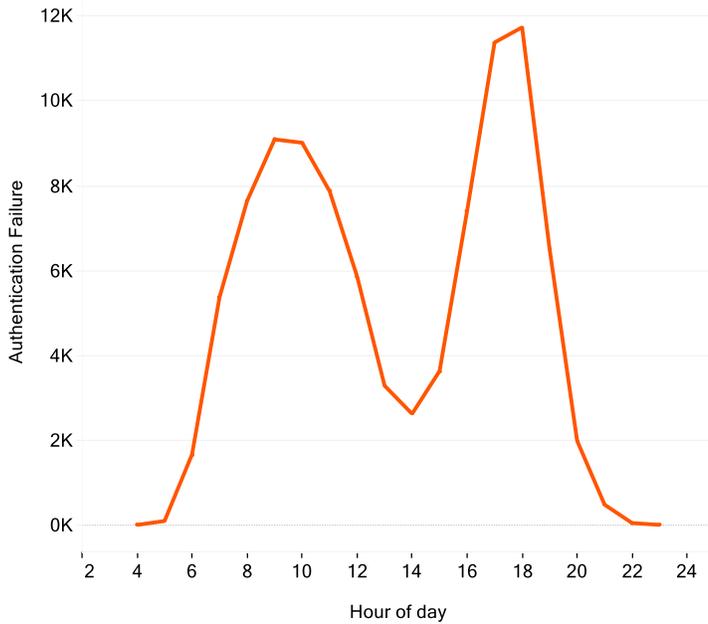## 2.2 Components of Haryana's AePDS and their role in service delivery.

Figure 5: Number of failed authentication attempts during hours of day in June 2018

It was observed that on daily basis in June 2018 the number of Aadhaar authentications were found to be highest during 8 am to 10 am in the morning and from 4 pm to 6 pm in the afternoon. 60% of all Authentication attempts of beneficiaries which failed were reported in these hours. (figure 5).

It was also observed that during these peak hours, the waiting time for authentication attempt of beneficiaries was higher than the rest of the day which suggests frequent ePOS resets may have a role in this and must be studied to understand its impact on authentication failures.

For efficient delivery of authentication services, it is critical that all components of the state AePDS framework provide uninterrupted authentication service especially during peak hours of authentication attempts by beneficiaries.

ePOS devices in AePDS can be operated only by designated PDS dealers who must establish their identity by using Aadhaar authentication at least once a day. These handheld ePOS devices connect the beneficiaries with Aadhaar authentication service provided by UIDAI with assistance of the state PDS server.

Using the beneficiary authentication attempt and active ePOS device's reset count data, we observed that in moth of June days with higher number of authentication attempts and relatively greater number of Active ePOS devices were marred by frequent disconnection of ePOS devices from the state PDS server (figure 6).

ePOS disconnections are manifested by frequent restarts of ePOS machines, delayed or no response from the state PDS server and decreased efficiency of the ration shops. The down time of these ePOS machines aggravates the inconvenience of the beneficiaries specially on days with higher authentication attempts.
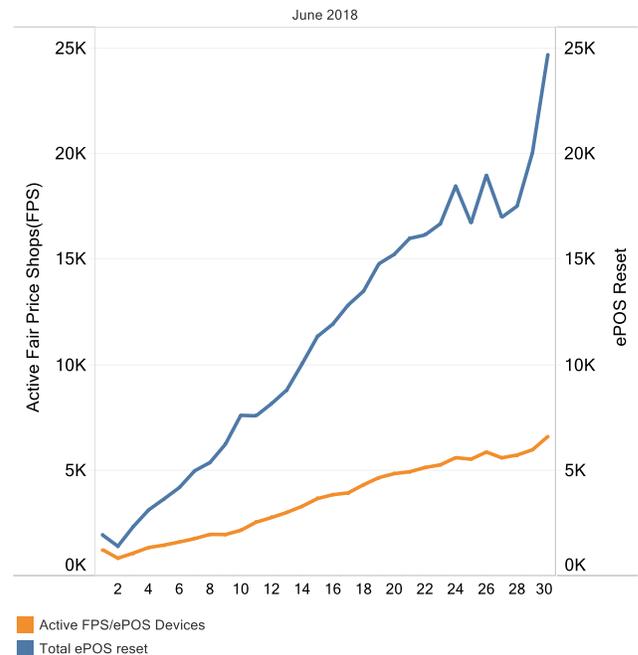

Figure 6: Daily ePOS disconnections and authentications per100 ration shops

3. Policy Implications

Haryana's Aadhaar enabled public distribution system (AePDS) provides one modality for Aadhaar authentication of beneficiaries. 98% of biometric-based authentications in Haryana AePDS were found to be authenticated by UIDAI within 2 seconds of their generation on the ePOS machines. This signifies the responsiveness of the Aadhaar authentication services provided by UIDAI.

70% of all AePDS beneficiaries authenticate in the last fifteen days of the month – a stark contrast to the neighboring state of Delhi where 85% of beneficiaries authenticated in the first fifteen days of each month. Approximately half of all the failed authentication attempts in Haryana were generated in the last week of each month. This leaves beneficiaries with less than a week to attempt again for authentication. If disbursal of ration is initiated early in the month then authentication traffic will be spread over a greater number of days and beneficiaries who failed authentication will have more days to authenticate again according to their convenience.

It was observed that the biometric authentication failure rate in state was reduced to half over a period of one year. Failure rates can be further brought down by using other modalities for authentication such as Iris and One-Time-Password (OTP). . OTP based authentication mechanism are generally considered as contingency when biometric based authentication is not possible due to network limitations or poor quality of biometric. OTP based authentications when efficiently utilized could lead to full inclusion of entitled beneficiaries.

Given the proven efficiency of iris-based authentication system, it can be introduced in Districts where failure rate is above the state average. If the Iris devices are already provided at the shops and not being used, then It could be due to unavailability of proper device at shops or lack of knowledge of using the iris device. Given the low False Rejection rate (FRR) and False Acceptance rate (FAR) of Iris based authentication, frequent use of this modality of authentication is required and it could even be used as a substitute of OTP based authentication provided the availability and frequent usage of iris scanners at PDS shops.

3.1 Further Research

This data brief seeks to establish a foundation for identifying issues surrounding the AePDS in Haryana and while doing so we were able to pose some questions for further research in following areas:

1. Using the entitlement allocation and authentication failure data, a coherent story of how people access the AePDS in Haryana could be created to get better insights of the beneficiary access to AePDS.
2. Identifying the underlying cause for variation in performance of different modalities of authentication across districts. This study could contribute in limiting exclusion of beneficiaries due to authentication failure.
3. Faridabad, Palwal and Mewat have relatively higher number of authentication failure. A thorough study of the factors leading to it could help improve authentication services in the district.
4. Introduction of Iris and OTP based authentication must be evaluated after scrutiny of the implementation mechanism of these modalities. Findings of which could contribute to improve the delivery of other social benefit programs using similar authentication framework.
5. A detailed study of the throughput of the PDS server under different load conditions and days to identify existence of any plausible underlaying technical issue or bottlenecks in the AePDS authentication ecosystem is required to minimize inconvenience to beneficiaries due to interruption of authentication services.

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