International Development

ISSN 1470-2320

Working Paper Series 2019

No.19-198

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Published: October 2019

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Can Digital Platforms Help Decentralise Social Assistance Programmes? Learning from the Aadhaar-enabled Fertiliser Distribution System

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ABSTRACT

National biometric identity systems are a recent e-governance reform initiative for implementing social assistance[1] programmes in developing countries. However, beyond providing a unique identity to those previously excluded from these programmes and reducing leakages in the system, little is known about whether these systems can improve the effectiveness of social assistance programmes for low-income sections of the population. Aadhaar is India's major initiative aimed at improving subsidy dispersal to disadvantaged communities and in this paper, we investigate its role in reshaping the distribution of subsidised fertiliser to low-income farmers in Andhra Pradesh through the Aadhaar-enabled Fertiliser Distribution System (AeFDS). Aside from the functional benefits to government of streamlining subsidy disbursement to farmers, we find that the relevance of the biometric platform for farmers and retails depends crucially on the enactment of processes at the sub-national level. This result holds important policy implications for the role of digital identity platforms in decentralising the governance of social assistance programmes.

Keywords: Digital platforms; Decentralisation; Aadhaar; Social Assistance; India

INTRODUCTION

In recent years, many low and middle-income countries have implemented national digital identity platforms with the aim of providing critical government and economic services to citizens. While the right to identity has long been an element in the human rights agenda, only relatively recently since the adoption of the SDGs in 2015 has it been recognised as a core development priority (World Bank, 2017). For many developing countries, these platforms provide an opportunity to include communities previously cut off from welfare benefits due to their lack of identification and to prevent fraudulent activity by those making claims for services through multiple identities (Barrientos & Pellissery, 2015; Sud & VanSandt, 2015). For example, biometric enrolling of civil servants has been found to eliminate ghost workers saving millions of dollars of government funds in many developing countries such as Nigeria, India and Liberia (World Bank, 2016).

The most ambitious of national identity platforms is India's Aadhaar[2] which was introduced in 2009 and received legislative backing in 2016. Aadhaar aims to provide a reliable unified system of identifying individuals that can be used for dispersing social assistance payments by different government agencies. As Nandan Nilekani, first Chairman of the Unique Identification Authority of India (UIDAI) - the organisation set up to implement the Aadhaar scheme noted, the overall idea of implementing the scheme was 'inclusion' of the poor in social protection schemes, *'I think it (Aadhaar) is a very powerful and inclusive idea. It will help the poor have better access to public services and will be a greater enabler for their financial inclusion. Moreover, the flagship assistance schemes of the government can be made more efficient'* (Nilekani, 2009). To achieve its objective, Aadhaar provides a clear proof of identity to its 1.2 billion residents by issuing a 12-digit

[1] Social assistance consists of government transfers of income and services to address poverty
[2] Literally means 'foundation' or 'support' in Hindi

randomly generated number after collecting demographic and biometric details of individuals. While UIDAI outsourced the procurement of human resources required for enrolment of its residents to public-private partnerships, data analytics allowed officials to monitor and evaluate the enrolment process (Singh, 2019).

One of the most contentious points that has emerged in the literature on Aadhaar refers to exclusions errors which have prevented eligible beneficiaries from accessing entitlements. These have arisen due to connectivity problems and sometimes due to difficulties in capturing biometrics, for example in the case of elderly persons with faded fingerprints resulting in the UIDAI introducing offline verification for local authentication without the need to connect to a centralised database (Mahapatra, 2018). Concern has also been expressed about the threat of surveillance abuses as a result of government's control of biometric and demographic information related to its population. Specifically, the linking of the centralised biometric identity platform to various artefacts such as bank account and mobile number has raised alarm amongst civil rights organisations about potential profiling and misuse of personal data by government, the financial/services sector and by tech companies in the wake of unclear legislative and regulatory frameworks to protect citizens (Sarkar, 2014; Arora, 2016). A significant body of recent work interrogates the extent to which the system has achieved its policy objectives of inclusion and reducing corruption. In their study of the PDS in Jharkhand, Dreze *et al.* (2017) find that the system has neither served to reduce quantity fraud nor has it helped to address other critical shortcomings of targeting eligible individuals for assistance. Similarly, Masiero (2016) found that while Aadhaar was focusing on eliminating leakages at the level of ration dealers in Kerala's public distribution system, in fact the real problem of leakages was further up the value chain which the Aadhaar system was not capturing. With respect to Aadhaar's objective of 'inclusion', Bhatia & Bhabha (2017) identify several interpretations of the concept which go beyond producing an efficient database for authentication and subsidy transfer and involve social mediation to address deeper structural biases of marginality and poverty.

This paper contributes to the existing critical discourse on Aadhaar by focusing on the extent to which the platform provides leverage for decentralising the governance of social assistance programming. Our motivation stems from a remark made by Nilekani to us at the start of our research,

> *'Aadhaar is only a platform on which others can build applications. Governments are beginning to see the value of using Aadhaar for key sectors such as health, education, land records. Now it is up to governments and district authorities to create applications where they collate government data to the Aadhaar system. As and when such applications are developed by different stakeholders, analytics will take a more sophisticated approach' (Nilekani, 19 July 2016)*

We are particularly interested to revisit the role of sub-national agencies in implementing social assistance programmes. Our main hypothesis is that while Aadhaar is seen as a centralizing power controlled by UIDAI, its developmental value depends crucially on whether the biometric identity platform proves leverage for decentralized governance of social assistance programmes. At a broader level, our study contributes to the emergent discourse on the developmental value of digital platforms (Koskinen *et al.*, 2018).

In the next section, we develop a conceptual framework to improve understanding of digitisation of social assistance programmes in developing countries comparing earlier digitisation initiatives with the architecture of digital platforms. Following a description of our study methodology, we then

present the findings of our study of the Aadhaar-enabled Fertilizer Distribution System (AeFDS) first piloted in Krishna district of Andhra Pradesh in 2016. In the final section, we draw on our conceptual framework to interpret our findings and reflect on implications of our study for theory and policy.

DIGITISATION OF SOCIAL ASSISTANCE PROGRAMMING: THE CHALLENGE OF REDISTRIBUTING CONTROL

In this section we develop a conceptual framework to guide our study of digital identity platforms for decentralising the governance of social assistance programming in low and middle-income countries. We commence by reviewing the motivations and outcome of early digitisation initiatives for social assistance programming. Next, we consider the rationale behind recent implementations of national digital identity platforms focusing on opportunities and challenges for redistributing control of planning and implementation of social assistance programming.

(i) Early digitisation initiatives for social assistance programming

The digitisation of social assistance programmes is not a new phenomenon. From the mid-1980s large investments were made by international development agencies and country governments to introduce microcomputers for promoting decentralised planning and administration of social assistance programmes (Cartwright, 1987). A central goal of these initiatives was to improve service delivery and accountability based on the assumption that decentralisation would enable the collection of more informed, better-reasoned decision-making. While a variety of difficulties emerged to hinder this goal such as lack of funds, technical support and training for the collection, processing and analysis of data, there were also significant challenges involved relating to design (Singh, 1990). In India, Madon (2009) found that systems that were intended to decentralise planning and administration were designed in a top-down fashion by central government without addressing local needs and priorities and were subsequently not used at district level. In her study of the impact of computerisation in District Rural Development Agencies in Gujarat, Madon found that some district officers took the initiative to develop local computer applications and introduced new work processes to help them in their operations and were encouraged to do so by the state government. However, this activity was not systematised in a way that could be useful in terms of providing local intelligence to support longer term planning and monitoring of rural development programmes.

A new wave of digitisation initiatives for social assistance programming took hold in international development agencies and country governments from the early 2000s. Driven by the World Bank, this policy drew inspiration from neoliberal service-oriented objectives of using technology to reduce transaction costs of delivering social assistance by disintermediating local intermediaries. In India the National E-Governance Action Plan (NeGP) 2003-7 was launched with an ambitious outlay of approximately US$2.6 bn. to support the introduction of single-window systems for a number of ‘mission mode’ projects executed by various government departments at central and state level. Direct efficiency gains were observed through digitisation in terms of reducing costs and time for both citizens and administration as numerous transactions for different schemes could be carried out from one information technology-enabled service point (Bhatnagar & Singh, 2010). However, several studies also noted that these applications tended to crowd out local government agencies who were often essential for last-mile delivery of government services to disadvantaged members of the community. For example, in a study of the Sustainable Access in Rural India (SARI) e-services project in Tamil Nadu, Kumar & Best (2006) found that the facility of providing

income and caste certificates was not useful as most of the low-income population needed additional documentation that still needed to be verified by sub-district functionaries. Similarly, while the Bhoomi land records e-services project implemented in Karnataka was designed to increase transparency in land registration and mutations, it did so by eliminating the village accountant who served as a crucial local intermediary in helping smallholder farmers and landless labourers to access social assistance programs and bank loans (Prakash & De, 2007).

(ii) Digital identity platforms for social assistance programming

In recent years, the emergence of platformed governance models has marked a new way of thinking about information technology-based government projects. While earlier, vertically integrated solutions were designed by central government to be carried out within individual departments, the digital platform provides an architecture in which government only controls a core component of the service opening up space for public and private sector players to innovate in tailoring applications and services to address citizen needs (Janssen & Estevez, 2013). A core aspect of contemporary public sector platforms around the world is the digital identification scheme which enables government to securely manage, label and categorise individuals for service delivery, increasingly seen as important for providing critical economic and government services to vulnerable communities in low and middle-income countries. The current 'identity for development' policy thrust by international agencies and country governments has provided an impetus for governments to focus on the creation of a core biometric database that can provide secure authentication of eligible beneficiaries, for deduplicating records and for helping to facilitate integration between identity-related transactions (Barrientos, 2013; World Economic Forum, 2018). As most social assistance programmes have an income transfer component which can either be fixed or variable, the digital identity platform can provide a link to the beneficiary bank account further reducing leakages, improving user experience and reducing payment delays (Abraham *et al.*, 2017). A significant amount of research on digital identity platforms for social assistance programmes has focused on connecting the technical attributes of biometric authentication to the provision of large-scale disbursement of social assistance benefits to eligible beneficiaries. For example, Pakistan's National Database and Registration Authority (NADRA) has reported significant savings in transfer programmes by using its unique identity database to weed out multiple registrations (World Bank, 2018). Of interest to other scholars are issues related to the design and management of the interfaces that link the core database to complementary services within the platform ecosystem (Mukhopadhyay *et al*, 2019). With respect to the Aadhaar system, the design of open standards is seen as crucial as it enables the centralized UIDAI to limit its role to identity creation enabling other ecosystem partners to provide complementary solutions such as social assistance payments to be made directly to the bank account of beneficiaries.

From a policy perspective, the reorganizing of governance infrastructure as a platform can provide leverage for decentralising the governance of social assistance programming. A digital platform architecture implies that the government only controls a critical part of the programming (the core) and opens up space for innovation and it is this architecture that has motivated some scholars to consider whether platforms provide leverage to decentre social assistance programmes (Brown *et al.*, 2017; Janowski *et al.*, 2018). Interfaces are designed to horizontally integrate a range of complementary services on the platform to be provided by state and private sector players. However, at the same time, a digital platform does not exist in a vacuum, rather it remains embedded within a traditional centralised bureaucracy (Singh, 2019). Indeed, the emergence of digital platforms has led to an increasing tendency to centralise the design and implementation of programmes. For example, through their study of India's National Rural Employment Guarantee Act, Masiero & Maiorano (2017) noted how the centralised management information system which was linked to Aadhaar and smartcard biometric recognition controlled the supply chain from the

procurement of jobs to assignment of works to villagers. This system served to concentrate power in the hands of a limited set of actors at central government level rather than decentralising power to wage-seekers or to local government agencies who provide a vital support structure to low-income labourers.

Ultimately, what remains of interest is how the benefits that can be derived from a digital identity platform can co-exist with local systems and processes. For example, Rao & Greenleaf (2013) found in their study of the homeless population in Delhi that while an identity-based system served to objectively include or exclude individuals from particular activities or benefits, this unique identity ultimately becomes enmeshed with formal and informal local institutions and older forms of social identity which together determine the effectiveness of inclusive growth policies. Building on the assumption that local knowledge is an asset for social assistance programming and that its assimilation can make the state more 'supple' in the long term, the open architecture of digital platforms may provide an opportunity for reflection on where to locate the 'intelligence': in the centralised biometric platform or in local processes and knowledge base. At the same time, an important insight is that usually only part of a task or service can be automated using technology while the remaining part requires human skills such as discretion that cannot be done by machines. There is widespread evidence that local government agencies are vital intermediaries in implementing social assistance programmes. Beyond India, a desk review of implementing social assistance programmes in seven countries across Asia and the Pacific showed how local government had a dominant role to play in enacting a range of adaptations to existing programmes including sensitizing and awareness raising, targeting of vulnerable groups, delivery of benefits, monitoring and reporting, managing grievance and redressal systems, and coordination of services across sectors (UNDP/UNCDF, 2013). In a similar vein, in the context of Brazil Schoburgh & Chakrabarti (2016) emphasise how the leadership of local government resulted in various institutional arrangements that led to economic restructuring in Sao Paolo's industrial region. Of importance in this discourse is recognition that decentralization can enact a process of 'social learning' referred to by Faguet *et al.*, (2015) as 'the collective acquisition of knowledge, norms and practices that occur between citizens and local organisations'. According to these scholars, this kind of learning by doing relies on repeated actions undertaken by citizens with local government and other civic organisations over time. Particularly for goods and services that cannot readily be standardised, Evans & Heller (2015) point to the need for tapping local knowledge and resources for continuous monitoring and feedback in order to support effective service delivery.

Aadhaar is often perceived as a centralising power as its biometric database constitutes the core of the platform. However, its challenge lies in encouraging the cultivation of skills amongst local agencies to source accurate information, analyse it and establish continuous monitoring to improve service delivery and more accurate measurement of developmental progress (Wild *et al.,* 2012; Arora, 2016). In the rest of the paper, build on this conceptualisation of digital identity platforms, we study the complex sequence of adaptations that were enacted for the AeFDS in Krishna District of Andhra Pradesh in order to improve fertilizer subsidy disbursement to low-income farmers.

METHODS

We adopted a qualitative case study approach given that research on the decentralising effects of government identity platforms is at an exploratory stage both in OECD and developing countries. Our case is the implementation of AeFDS in Krishna district, Andhra Pradesh which was one of the initial 16 pilot districts selected by central government in 2016 for piloting AeFDS[3]. Agriculture remains the most important sector of the Indian economy with almost 50% of India's total population consisting of smallholder farmers and their families. Fertiliser subsidy can bring

[3] This was increased to 19 districts in January 2017

economic benefits to these low-income farmers but can also be a major cause of negative environmental externalities when fertiliser is used excessively. While the amount of fertiliser subsidy in India has increased substantially over the past 25 years, it is estimated that approximately 65% of it is not reaching its intended beneficiaries (GOI, 2016). For this reason, fertiliser subsidy distribution was one of the key application areas for social assistance programming when Aadhaar was being piloted in the country.

Secondary data sources included newspaper briefs on the status of Aadhaar, literature on low-income farmers in Andhra Pradesh and a recent MicroSave evaluation study of AeFDS pilot projects. Primary data was used to obtain a first-hand understanding of the project's vision and a more localised understanding of how Aadhaar was both perceived and used at the level of retail outlets to improve the system of fertiliser distribution to low-income farmers. Interviews were conducted with Nandan Nilekani, founder of UIDAI in Bangalore, and with district, block and retail outlet level with a random selection of informants who were engaged with the AeFDS. We also conducted interviews with two senior key informants who had initiated the AeFDS project in Krishna district. Data was collected during two field visits to Krishna district by one of the authors in July 2016 and September 2017 as detailed in Table 1 below.

Table 1: Listing of interviews

Interviewee	Affiliation/Agency	Date
Nilekani	Founder of Aadhaar	19/7/2016
District Collector	District Administration, Krishna district	25/7/2016
District Development Officer, Agriculture	District Administration, Krishna district	24/7/2016 to 25/7/2016
Mandal Agricultural Officer (Inputs)	Vijayawada Urban mandal	4/9/2017
Mandal Revenue Officer	Kankipadu mandal	4/9/2017
Mandal Multi-Purpose Extension Officer	Kankipadu Mandal Agricultural Marketing Society	4/9/2017
Private Retailer	Venkatesh Fertiliser Retail Outlet	4/9/2017
Farmers Focus Group	Kankipadu mandal	4/9/2017
Joint Director, Agriculture	Agriculture Department, Krishna	5/9/2017
Technicians	Soil Testing Laboratory, Krishna	5/9/2017
Retailer	District Marketing Board, Golapuri village, Vijayawada Rural mandal	5/9/2017
Retailer	Jaggayyapeta mandal	5/9/2017

CASE STUDY RESULTS

Krishna district is one of nine coastal districts of Andhra Pradesh. Agriculture is the main source of livelihood with paddy as the main crop together with cotton, sugar cane, chillies and pulse. Approximately 60-70% of farmers in Krishna district are non-landowning or tenant farmers who are mainly low skilled and below the poverty line. These farmers lease land from landowners for cultivation based on an oral contract. Krishna district is one of many farming districts in the state where regular farmer suicides take place due to debt. Between June 2014 and late 2018, 1,513 farmers committed suicide (The Hindu, 2019).

(a) The AeFDS pilot: Objectives and design

We commenced our empirical research with an initial encounter with the erstwhile District Collector in Krishna in 2016 which illustrated the importance of Aadhaar for efficient targeting eligible beneficiaries for social assistance programmes:

> *'there are two extremes – at one end are the real poor who are excluded, at the other extreme there are those who are close to power who make a mockery of the system. Identification of who is deserving has always been an issue in Indian administration and most of the time we spend on that only'.*

The AeFDS was first piloted in Krishna district in March 2016. The objective of the pilot was to effectively monitor the distribution of fertiliser across the value chain from manufacturers to farmers based on biometric authentication of retailers and farmers. In the earlier system, fertilizer companies would receive payment from the government once fertilizer stock was received and verified at district warehouses. From there, the fertilisers were transported to retail shops where farmers bought them at government subsidized price. However, under this system, almost half of government subsidy was diverted to industries that used similar chemicals in their manufacturing processes or was illegally exported to neighboring countries causing delayed payments to fertilizer companies and overuse of cheap fertilizer which undermined farm productivity. The reform of the fertilizer supply chain started in 2007 with an online tracking system that was used to track the availability of fertilizer in a district. In 2012, a mobile phone-based add-on extended the tracking to retailers who were required to send updates by text to confirm receipt of fertilizer from wholesalers before fertiliser companies received their payments from government. In 2013, it was recommended that fertilizer sales from retailers to farmers also be tracked using the AeFDS and that companies would get subsidy only after the fertilizer is sold to the farmer via the PoS.

Aside from reducing fraudulent activity, a key objective of the AeFDS was to help bring about positive change in farmers' behaviour encouraging them to use only optimal quantity and type of fertilisers for their fields resulting in better yield, improved soil health and reduced input cost to farmers (MicroSave, 2017). From the commencement of the pilot in 2016 there was an incremental increase in the number of fertiliser retail shops in the district and by the time of our second visit to Krishna district 1065 outlets existed each with point of sale (PoS) devices. Initial technical problems relating to poor internet connectivity and authentication difficulties were resolved in the first few months of implementation with local companies engaged to provide ongoing maintenance of equipment.

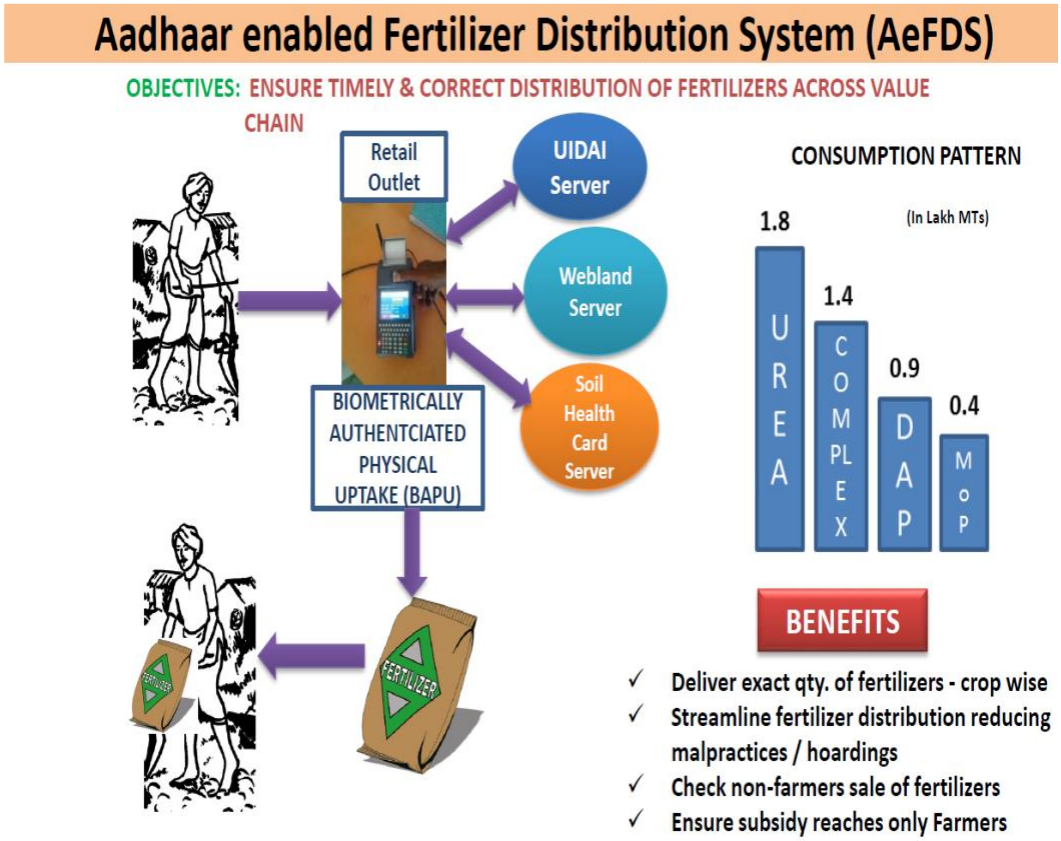
After successful login by the retailer using his Aadhaar number and fingerprint, the system performs two key interrelated functions. The first function relates to the retailer's accurate reporting that he has received fertiliser stock at his outlet. The product details are logged onto the AeFDS server and updated when new stock arrives at the retail outlet with a receipt of acknowledgement issued by the retailer recording the quantity of the received product. The second function involves the selling of fertiliser to the farmer once he has been successfully authenticated through his Aadhaar number and fingerprint. The selling of fertiliser depends on the status of two

sub-national level databases: Webland and the Soil Health Database. The procedure for doing this was narrated to us by the Mandal[4] Agricultural Officer in Vijayawada Urban mandal,

> '*When the farmer arrives at the retail outlet and authenticates himself on the PoS device using his Aadhaar number and fingerprint, the system automatically generates details such as his name, his father's name and his cultivated land holding by linking Aadhaar data to a land holdings database'*.

Whereas prior to the implementation of the AeFDS, a common perception amongst farmers was that more fertiliser usage was better for producing higher yield and generating more income, the PoS device recommends the farmer to use an optimal type and quantity of fertiliser based on an algorithm that calculates the type of irrigation, the soil health of the cultivated land and the crop being cultivated as illustrated in Figure 1 below.

Figure 1: Krishna district's Fertiliser Distribution System



Source: Internal Document of Department of Agriculture, Krishna District, Andhra Pradesh

The process of arriving at a recommendation is a complex one as we came to understand through our discussions with a retailer at the District Marketing Board, Golapuri village, Vijayawada Rural mandal,

> *'The retailer can sell more than 75 different types of fertiliser products making AeFDS a more complicated system than other subsidy dispersal programs. The recommendation*

[4] Mandal is the name given to a sub-district administrative unit in Andhra Pradesh

made for optimal type and quantity of fertiliser for the farmer is based on linking Aadhaar with two local databases, Webland and the Soil health database'

The Webland database consists of a digital record of all land holdings that was first developed in 2011 by the state of Andhra Pradesh and the mandal revenue officer of Kankipadu mandal described the various local process that are needed for updating records,

'In Krishna district in 2017, 90% of land holdings have been digitised. When land holdings are transferred to another person (mutation), a survey is done at that time and records are updated. The new landowner applies for a khata number by visiting his local MySewa centre in the village. The process of updating the database takes about 30 days'.

The Webland database is a dynamic repository. It has to be updated regularly at local level by mandal extension officers who input data on the quality of farmland in the district which is assessed across five soil health testing laboratories in the district. We visited one of the laboratories and interviewed a technician who explained the process of testing soil,

'The exercise is conducted by a team of agricultural officers and extension staff and involves taking a representative sample of 25 acres of soil from each of the three geographic grids in the district. Testing for the level of nutrients found in the soil in the samples is carried out every year between February to May in Krishna district after which the results are fed into the soil health database and the records updated with comments added by the team of agronomists to indicate whether the results are too high or too low as a sensor for extension officers to offer advice to the farmer'.

Each farmer is issued with a soil health card providing information on the quality of soil on his land and this information is updated every 3 years. During 2016-17, 94,000 samples had been analysed in Krishna district.

Once a decision is taken about the type and quantity of fertiliser to be purchased, the retailer generates a transaction receipt for the sale and the farmer receives the fertiliser at subsidised prices. For the District Agricultural Department, the AeFDS facilitates real-time monitoring of fertiliser sales across different retail outlets as the Joint Director, Agricultural Department, Krishna district noted,

'The PoS device enables the retailer to generate a variety of reports including a fertiliser stock report on the current quantity of each fertiliser held at a particular point in time and a weekly sales report summarising the quantity of products sold during the week. This data is used for district level management of fertiliser sales across different retail outlets'.

(b) *Local adaptations to the AeFDS implemented in Krishna district between 2016 and 2017*

Over the past few years, several adaptations have been made to the AeFDS by local agencies in order to make the system relevant for retailers and farmers in Krishna district. The first adaptation involved responding to retailers, many of whom found that their routines had been disrupted as a result of the intervention. Retailers had been used to the practice of not necessarily being present at their outlet to hand over fertiliser to farmers at the time of sale and it was common for them to delegate this task to another person while being occupied with other activities. However, when the AeFDS was introduced, the system had been designed in such a way that it became mandatory for the retailer himself to be present in order to authenticate himself before any transaction could occur and this led to resistance by retailers as narrated to us by one retailer at Jaggayyapeta mandal,

'When AeFDS was introduced, resistance was from retailers as beforehand they didn't necessarily have to be present to hand over fertiliser. Another person could hand over the fertiliser if they were busy with some other activity. Many retailers closed down'

Retailer resistance prompted the district staff to address the problem. In version 2.1 of the system, the design was modified to include an 'add' option whereby retailers could nominate two additional persons of their choice to distribute fertiliser to farmers using their Aadhaar number.

A second adaptation occurred early on in the implementation of the pilot when it was found that the system which was originally designed to provide subsidised fertiliser to landowner farmers could not accommodate the high number of tenant farmers prevalent in Krishna district. The District Development Officer in the district explained how this was addressed locally,

'During the course of the year, updates were made to the system to make it possible for the landowner to nominate another person to receive the subsidised fertiliser on his behalf. When the buyer was a farmer and held land himself, the tab 'self' (shown in Figure 1, 5.1) would be used to authenticate himself but in the case where someone other than the farmer such as a tenant farmer working on his land, auto driver or relative came to collect fertiliser on behalf of the landowner the tab 'other' would be used'.

A third adaptation made at district level aimed to address the regular occurrence of farmers forgetting their Aadhaar authentication or a situation where the system failed to authenticate the farmer due to network/server issues or unclear fingerprints. When the system was first implemented, these situations resulted in the farmer being unable to purchase fertiliser as no official mechanism existed to manage exceptions. This led to severe consequences for low income farmers. However, as narrated to us by an Agricultural Extension Officer at Kankipadu Mandal Agricultural Marketing Society,

'Several practices have emerged over the course of the year in order to provide fertiliser to farmers. In some cases, we were told that the farmer may be given the required fertiliser and asked to come back in a few hours or days to complete authentication on the PoS device. Alternatively, the Aadhaar number of a family member or acquaintance of the farmer may be obtained in order to complete the transaction, or else the number of bags of fertiliser purchased by the farmer could be added to the sale of the next farmer in the queue at the retail outlet with a note made at the retail outlet that this had occurred and that adjustments would be made accordingly later on. Some retailers adopted the practice of maintaining a manual register of local farmer Aadhaar numbers so that the transaction could be completed even if the farmer did not bring his Aadhaar card. We also observed how many retail outlets displayed notices encouraging farmers to save their Aadhaar number on their phone in case they forgot their card'.

Fourth, while most retailers were able to successfully log on to the ePos device in one or two attempts, we found that most of them were concerned about the average transaction time per customer taking approximately five minutes compared to the few seconds it took to complete manual transactions. During the off-season where an average 10-20 customers could be expected each day this was not a major problem, but retailers were concerned about managing impatient crowds of farmers during the peak agricultural period in June/July when 300-500 customers a day could be expected. However, by the time of our second visit this was no longer seen as a problem by retailers as by then all the outlets in Krishna district had been provided with Wifi dongles which could handle larger volumes of transactions.

Finally, while the AeFDS was designed to recommend optimal type and quantity of fertiliser to the farmer, we observed that these recommendations were not always enforced with Krishna district striving to achieve a positive reaction from the public for the newly-introduced system. For example, we observed that the recommendations made to the farmer about the optimal fertiliser to purchase through the PoS device were not always enforced, for example it was permissible for a farmer to purchase a different quantity and type of fertiliser than the recommendations. As the Mandal Agricultural Officer at Vijayawada Urban explained to us,

> *'A tenant farmer might have one acre registered on Webland under his name but might be doing work on another ten acres of land and would therefore require more fertiliser than the system recommends which he has the option to purchase at market price'.*

Another way in which the AeFDS in Krishna district is winning the support of the local public is by resisting the approach promoted by the UIDAI of transferring subsidy to Aadhaar-authenticated beneficiaries through direct benefit transfer system into their bank account after the farmer has purchased fertiliser at market price. Given the large percentage of tenant farmers in the district, this would incur a huge financial burden on this category of beneficiary, for example one bag of urea fertiliser costs around Rs. 295 (approx. US$4.17) at subsidised price while the market price would be Rs. 800-900 (approx. US$12) which would reduce his ability to purchase other inputs needed for farming.

Over the course of the two years of our study, several adaptions were made of the AeFDS and by 2017 the device had been equipped with Wifi connectivity and 3G SIM. for faster data transmission at the retail outlet. Since the commencement of the pilot, 97% of district, divisional and mandal level functionaries along with retailers in Krishna district had received training on how to operate the PoS device with periodic refresher training organised as and when required (MicroSave, 2017). A Support Cell located at the Office of the District Collector in Krishna district was set up to address technical issues and collate retailer statistics which are compiled into mandal-wise cumulative figures showing the quantity of fertiliser sold and sales transactions for reporting. These reports are used for different types of local analysis. First, the district needs to know the demand for various types of fertiliser. Based on this demand, the local administration can plan for ensuring ready availability of stock. This is an important management activity to ensure all farmers receive their required type and amount of fertiliser. Second, the district authority needs to be aware of the various transactions taking place at all the outlets thereby reducing the chance of diverting fertiliser to the black market. So far, the guidance provided by AeFDS to farmers for optimal quantity and type of fertiliser usage has resulted in positive change in farmers' behaviour resulting in less fertiliser being sold and less subsidy dispersed as shown in Table 2 below.

Table 2: Comparing Fertiliser Sale and Subsidy Pattern between 2015-16 and 2016-17

Year	**Area (Ha)**	**Qty. of Sales (MTs)**	**Subsidy Amount (in crores)**
2015-16	588102	335060.50	432.27
2016-17	603678	309129.50	387.43
	3% increase	**8% decrease**	**10% decrease**

DISCUSSION

Drawing on our conceptualisation of digital identity platforms for social assistance programming, in this section we reflect on our findings of the AeFDS in Krishna district. The AeFDS is more

complex than other subsidy-dispersal programmes such as food ration or liquefied gas as there are numerous types of fertilisers that can be used for a particular landholding, the customer base is not fixed as with ration subsidies and consists mostly of tenant farmers, and there is seasonality of demand for fertiliser by farmers depending on the crop. Beyond more accurate targeting as a result of the core biometric database, these complexities have necessitated a greater role for local government input at the operational level in order to address the priorities of retailers, landowner farmers and tenant farmers. The previous section described the five key processes enacted by local government, (1) facilitating the dispersal of subsidised fertiliser to farmers even when the retailer is absent, (2) permitting the handing over of fertiliser to persons other than the landowner farmer, (3) enabling the farmer to procure fertiliser even without his Aadhaar card, (4) making it possible for the claimant to purchase a different type/amount of fertiliser to that which is recommended by the PoS device, and (5) resisting the central government drive towards subsidy provision through direct benefit transfer, rather than subsidy at source. Some of these local adaptations made at the level of retail outlet may require further procedures and processes to mitigate against the risk of corrupt practices. For example, when a farmer forgets to bring his Aadhaar number to the retail outlet, there is need to ensure that the details recorded on manual collection chits when subsidized fertilizer is handed over to him are correctly attributed to the parcel of land that it corresponds to. Similarly, when a farmer chooses to override the type and quantity of fertilizer recommended by the PoS device, there is need to monitor the effects of this on the health of the soil and to ensure that the farmer is using the fertilizer for his own cultivation.

In terms of theoretical implications, our study highlights how the benefits derived from a digital identity platform co-exist with local systems and processes. The five key processes identified through our empirical work at retail outlets in Krishna district have provided a natural laboratory for experimenting with how the centralised biometric server can work with local data and processes. Some of these were identified as digital services such as recommending optimal fertiliser to farmers while others were offline processes and adaptations such as manually recording information about farmers on chits of paper. The current challenge relates to ensuring how 'design' and 'practice' co-evolve over time. The AeFDS was designed to coordinate three different databases, namely the core biometric database with Webland and the soil health database to increase the efficiency of fertiliser subsidy delivery to farmers as well as to sensitise farmers into using optimal type and quantity of fertiliser on the land. However, in practice, we find a lax in adhering to these design features of the platform, for example with non-use of biometrics to authenticate retailers and farmers and with the frequent overriding of fertiliser recommended through the Webland and soil health databases. The lived reality of farmers is that they may need more quantity of fertiliser than the system recommends through its design in order to mitigate against the consequences they will endure for poor yield. Similarly, the lived reality of retailers is that if farmers insist on a particular type and quantity of fertiliser, they will ignore the machine and sell it to him in order to make a sale[5]. This eclectic usage of the core of the platform with complementary solutions reflects the very essence of digital platforms and their usage encourages the cultivation of skills amongst local actors to ensure that the system remains relevant on the ground.

There also remains additional local online and offline processes that need to be cultivated to work with the core biometric platform in order to support low-income farmers. First, the AeFDS is limited in terms of its impact on smallholder farmers unless it is linked to other indices of vulnerability that affect the lives of this section of the population. Low income farmers may rapidly shift from a state of food secure to food insecure due to a variety of reasons including crop failure due to drought, sharp rise in the price of food, and health issues that may necessitate a diversion of household spending from basic items. A useful application that can be integrated to work with the

[5] https://scroll.in/article/853258/how-the-government-quietly-scaled-back-its-ambitious-plans-to-reform-fertiliser-subsidies

AeFDS for the benefit of poor farmers can be modelled on the Parihara web-based application developed in Karnataka to enable direct benefit transfer of subsidies towards inputs through Aadhaar to farmers hit by drought[6]. The government of Andhra Pradesh is also currently experimenting with a program called Praia Sadhikara[7] in which a survey is administered to all households and citizens in the state by local functionaries on a tablet which is attached to a biometric sensor and linked to the Aadhaar database. All the survey details are entered in an application which has an inbuild geofencing capability enabling the enumerator conducting the survey (typically a local health worker) to automatically take coordinates of the land plot. This is the first time that this type of dynamic survey has been institutionalised in the country providing flexibility for individual citizens to update their information, for example on health and migration locally through biometrics for use by different government departments. Most data are verified with departmental databases such as land registry for updates on land. Other updates related to assets such as a home are verified by a village functionary who will inspect the asset and its dimensions using a GPS application emphasising the role of local government intermediaries.

Second, while the AeFDS has succeeded in persuading farmers to use less fertiliser as shown in Table 2 above, extension services are also required to sensitise them to use the money for investing in higher productivity technologies such as drip irrigation or better seeds as well as move to organic farming. This type of education necessitates investment in agricultural extension services. However, at present there are more private retailers than public agricultural cooperatives in Krishna district and the former are more motivated and trained to promote their own products rather than provide extension services. This state of affairs has prompted the launching of another state-level initiative called Polam Pilusthondi (farmer's outreach) in 2014 where agricultural extension officers meet farmers every week on Tuesdays and Wednesdays covering all the villages in a mandal. Table 3 below provides data on progress made with this program in Krishna district.

Table 3: Performance of Polam Pilusthondi program in Krishna district, October 2017

Targeted number of village visits for 2017-18	6435
Targeted number of village visits until October 2017	3069
Number of village visits covered as of October 2017	3069
Number of farmers attended (male)	88299
Number of farmers attended (female)	5462

A farmer focus group held at Kankipadu mandal provided insights into the conduct of these meetings,

> *'Various issues are covered such as status of crops, market information, new technologies, pest control, new government programs and other topics. Crop diversification is suggested in cases where the farmer can earn better price but this requires farmers to market their produce and obtain sufficient returns'.*

Third, the linking of the Aadhaar biometric database to the Webland server has required the maintenance of an up-to-date record of owners and cultivators. However, beyond the distribution of subsidised fertiliser, the Webland database serves the important function of certifying the legitimacy of a tenant farmer for credit. For a tenant farmer to get a loan, he has to visit the village

[6] http://parihara.karnataka.gov.in/Pariharahome/PHHome
[7] Literally means People Empowerment Survey

revenue officer who will confirm that he is a tenant farmer and issue a certificate of cultivation. However, as remarked by the mandal revenue officer in Kankipadu,

> *'Even with a certificate of cultivation, tenant farmers find it hard to get a loan. Banks are not interested in them because they have no security. This year 1,500 loan eligibility certificates were issued in our mandal but only 150 tenant farmers got a loan. Hence the actual cultivator (the majority of farmers in the district) cannot get a loan and still needs to go to a money lender or to a private retailer'*

Currently, Krishna district is making provision for the formation of groups of approximately five to ten tenant farmers which will be certified by the Mandal Agricultural Officer as tenant cultivators along with their land plot survey numbers. The Group will then be financed by banks as per the scale of finance for a particular crop per acre and members of the group will use the loan for their cultivation needs. Apart from reducing the cost of inputs such as fertilisers and seeds through biometric subsidy dispersal systems, there is an urgent need for institutional support of government to promote research into organic farming practices for smallholder agriculture, drawing on pioneering examples from other states in the country[8]. Further investment is required to support bio-technology innovations and rebuilding public agriculture universities as remarked by the mandal agricultural officer (inputs) from Vijayawada urban district,

> *'What is missing to help small farmers and tenant farmers in Krishna district is research related to smallholder agriculture. There is need to promote and motivate organic consumption of fertiliser using locally available materials'.*

A mechanism needs to be introduced to disseminate research findings from agricultural institutions to local farmers' associations such as Polam Pilusthondi in Andhra Pradesh in order to educate farmers on practical alternatives they can turn to in their daily practices.

Finally, institutional support is also needed for the selling of crops. Marketing Boards procure certain products like cotton, paddy, maize and pulses providing support to cultivators by offering them a minimum support price to cover their costs of production. However, procurement centres are few and may not be located within the proximity of many low-income tenant farmers who are therefore compelled to sell their produce to local traders at whatever price they are offered. For example, in the case of cotton which is one of the main crops in Krishna district, traders were paying half of the government's minimum support price causing huge losses and hardship to farmers. Local cooperatives are also needed to encourage small and tenant farmers to diversify their crops in order to guard against sudden price fluctuation that may arise due to lack of demand for any single crop.

CONCLUSION

Digital identity platforms for social assistance programming have become an increasingly significant part of the governance reform agenda in many low and middle-income countries. This paper has focused on Aadhaar, the world's most ambitious identity system and investigated its implementation for the disbursement of fertiliser subsidy to low income farmers in Krishna district of Andhra Pradesh. While in recent years Aadhaar has attracted a great deal of scholarly attention in terms of identifying challenges which confront the programme such as whether the system

[8] For example, organic farming promotional programmes that have been launched in Karnataka since 2004 – see www.kssoca.org

addresses marginalised sections of the population and data privacy, in this paper we set out to investigate the platform's role in reorganising the governance of social assistance programmes. In theory the open architecture of digital platform provides scope for decentring the governance of social assistance programmes. However, in practice this involves a complex political process which relates to how local priorities are negotiated to work with more centralised objectives.

From a policy perspective, the possibility of decentralising social assistance programmes through digital identity platforms requires proactive support from the central and state governments to nurture local agencies at district and sub-district levels to use discretion and to learn through experimentation. It is important to remember that the problems digital identity platforms are deployed to solve are political, rather than technical: the challenges faced by low-income farmers are as a result of long-standing economic and social disadvantage. This suggests that although centralised identification databases are important for improving the efficiency of service delivery, there is a greater need to acknowledge the prominent role that local government fulfils as vital intermediaries providing ground level 'intelligence' for social assistance programmes. This insight provides an impetus for encouraging further longitudinal research on how digital platforms evolve over time and to evaluate their developmental worth to the communities they are designed to serve.

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