Aadhaar and social assistance programming: local bureaucracies as critical intermediary

Shirin Madon, C.R. Ranjini & R.K. Anantha Krishnan

Aadhaar and social assistance programming: local bureaucracies as critical intermediary

Shirin Madon [a], Ranjini C.R. [b] and Anantha Krishnan R.K.[c]

aDepartment of International Development, Department of Management, LSE, London, UK; bCentre for Public Policy, Indian Institute of Management, Bangalore, India; cGovernment of Andhra Pradesh, Jubilee Hills, India

ABSTRACT

Digital identity platforms are a recent e-governance innovation for improving social assistance programming in the development context, the most well-known of which is India's Aadhaar. While a significant number of studies have accumulated on Aadhaar, so far under-researched is the importance of local government practices and processes in shaping usage of the platform to support social assistance programming. In this paper we theorize how local government intermediation on digital identity platforms can improve social assistance programming through a case study of the Aadhaar-enabled Fertilizer Distribution System (AeFDS) in Andhra Pradesh. Our findings show how the relevance of the platform for low-income farmers depends crucially on the proactive adaptation of the technology by key local government intermediaries. From a policy perspective, this result emphasizes the importance of supporting efforts to acknowledge the role of responsive local government agencies in ensuring that centralized digital identity platforms remain relevant for implementing social assistance programming.

1. Introduction

In recent years, digital identity platforms have been implemented in many developing countries with the goal of improving the administration of social assistance programming and reducing leakages in the system (Barrientos & Pellissery, 2015; Sud & VanSandt, 2015). While earlier e-governance interventions were largely driven by individual government departments, the platform architecture provides scope for government to orchestrate the functioning of a range of local government and third-party players towards service delivery. A major trigger for digital identity platforms for social assistance programming has been the focus on the right to identity as a core development priority[1] for low and middle-income countries where a large proportion of the population has been unable to access basic government services because they lack formal means of identification.

The most ambitious of national digital identity platforms is India's Aadhaar,[2] the focus of this paper and of many recent studies. Aadhaar was introduced in 2009 by UIDAI,[3] the organization set up to implement the platform, received legislative backing in 2016 and by 2019 the government had issued a 12-digit unique identity to nearly every adult resident in India compiled into a centralized database comprised of biometric and demographic data. The UIDAI has issued over

one billion unique identifier numbers for use across several government assistance programs and has become a critical infrastructure for socio-economic activity in India. There is now an abundance of critical literature on Aadhaar that focuses on its impact for different stakeholders. On the one hand, scholars have argued that the enhancement of identification systems through biometrics enables the government to achieve more accurate and objective modes of population management to alleviate persistent inequalities by ensuring that marginalized sections of the population receive essential social assistance such as food rations, subsidies, and pensions (Mir et al., 2019). On the other hand, critics have argued that surveillance enabled through unique identification numbers leads to a distinct mode of governance that can bears risks for vulnerable sections of the population (Bhatia & Bhabha, 2017; Henne et al., 2019; Krishna, 2021). For example, Bhatia & Bhabha argue that risks emerge which are especially relevant to marginalized groups within society as technology "makes truth claims about individuals in ways that may divert attention away from larger issues of inequality." Much concern has also been expressed about data security as the linking of the identity data to more databases increases the likelihood of 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 (Arora, 2016). Some studies have revealed how exclusion errors with Aadhaar's use of biometric technology have prevented eligible beneficiaries from accessing much-needed entitlements, for example in the case of elderly persons with faded fingerprints (Mahapatra, 2018). Research also questions the extent to which Aadhaar meets its objective of reducing corruption as well as whether it generates other forms of incentives for diversion (Dreze et al., 2017; Masiero & Maiorano, 2017). More recently, Masiero and Arvidsson (2021) demonstrate how Aadhaar has enabled the weakening and deterioration of India's public distribution system by excluding entitled users, by omitting to monitor leakages in the earlier phases of the supply chain of social benefits, and by redirectiing India's social protection policy away from its original mandate.

A fundamental and hitherto under-researched question which we address in this paper is the following: "How do local government practices and processes shape usage of the Aadhaar digital platform for social assistance programming?" Specifically, as Bhatia and Bhabha (2017) argue, the government's responsibility for providing social assistance to its residents goes beyond the creation of a biometric identity platform and involves social mediation to address the needs and priorities of low-income and marginalized sections of the population. We argue that the role of human intermediaries, a recurring topic in the ICT for Development discourse, resurfaces as crucial for the way in which digital identity platforms can improve service delivery. While accurate identification data about subjects is a foundation for governance and can constitute a stable core, this is not complete knowledge as it misses information about the needs of local organizations that are motivated to adopt specific work practices and tactics to expedite work. This was the findings of a recent survey carried out on people's experience and perception of Aadhaar in which it was revealed that providing an identity is a necessary but insufficient condition for poverty alleviation as it has to mesh with "the complex mosaic of norms and practices on the ground" (Totapally et al., 2019). While central government may provide the technology and algorithms to securely identify eligible individuals for service delivery through digital identity platforms, what is of most interest to us is the way in which this central core integrates with processes and activities at local government level. We show through our research that online and offline processes at the point where social assistance is delivered on the ground are crucial inputs for improving the effectiveness of social assistance programming through digital identity platforms.

Our research question resonates well with the words of Nilekani, founding Chairman of UIDAI recorded during an interview we conducted in 2016:

> Aadhaar is only a platform on which others can build applications … Now it's up to local 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)

In the next section, we trace the political motivations that have influenced the implementation of digital technologies for social assistance programming in India from earlier e-governance initiatives to the current day Aadhaar digital identity platform. Following a description of our methodology, we then present the findings of our study on the Aadhaar-enabled Fertilizer Distribution System (AeFDS) in Krishna district of Andhra Pradesh where it was first piloted in 2016. In the final section, we draw on our conceptual framework to interpret our findings and reflect on the implications of our study for theory and policy.

1.1. Digital systems for social assistance programming: theorizing local government as critical intermediary

Aadhaar, and the digital systems before it, reflect different ideologies related to the implementation of social assistance programming. In particular, we focus in this section on the role of intermediaries in the governance of these programs.

1.2. Early experience with decentralization of social assistance programming

From the mid-1980s, a central tenet of policymaking among international development agencies such as the World Bank was to decentralize the planning and administration of social assistance programming and this mandate attracted attention amongst policymakers in India and many other developing countries with systems and structures designed to support this drive (Rondinelli et al., 1983). While recognizing concerns related to the threat of elite capture, decentralization was intended to identify and capture local knowledge and practices in order to improve the implementation of social assistance programming. Many large-scale investments were made in developing countries to introduce computer-based systems at district level for this purpose, for example, a major early project in India was the Computerized Rural Information Systems Project (CRISP) designed and developed to prioritize the planning and implementation of rural development programs at district level. Key intermediaries involved in implementing the CRISP project were government functionaries who were based at the district and block levels and had an intimate knowledge of the priorities of different beneficiary households within the locality (Madon, 1993). However, the CRISP system was initially designed and developed as a menu-driven system by the National Informatics Centre without consulting the state and district authorities and therefore did not appear relevant to local government functionaries. The system became redundant in some states and district functionaries began to innovate by designing simple tools using spreadsheets and databases to assist them in making local decisions to improve the implementation of social assistance programming. For example, tools were designed by local bureaucrats to categorize beneficiary households in a catchment area according to income and to match them with assets based on local knowledge about whether they could be procured (Madon, 2009). However, this experience of attempting to decentralize social assistance programming by introducing computers at district level was short-lived. From early 2000 "good governance" policy prescriptions put the spotlight on front-end e-services applications rather than on using digital solutions that could enable district-level staff to contribute to program implementation.

1.3. E-Governance projects: disintermediating the role of local agents

"Good Governance" was a key policy prescription driven by international development agencies and country governments to increase the efficiency of public service delivery through public-private partnerships and developing e-governance applications. A key objective of the e-governance agenda was to improve the front-end interface between government as provider of services and citizens as recipients by establishing e-payment kiosks in urban centres and multi-purpose telecenters in rural areas offering a seamless interface for a variety of different government services. In India, the National E-Governance Action Plan (NeGP) 2003–2007 was launched with the goal of increasing

efficiency of public service delivery by eliminating the need for manual transactions by local government intermediaries and the potential this offered for rent-seeking opportunities.

For some of the processes involved in government-citizen interaction that could be readily automated these types of interventions demonstrated efficiency gains to government further fueling this policy imperative (Bhatnagar & Singh, 2010). However, evidence also showed the negative impact of e-governance projects which tended to crowd out local government human intermediaries who were often essential for last-mile delivery of government services to disadvantaged members of the community. For example, 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 had earlier served as a crucial local intermediary in helping smallholder farmers and landless laborers to access social assistance programs and bank loans (Prakash & De, 2007). The concept of functional simplification and closure from information systems has been found useful to explain how organizations identify processes for automation that can be readily reduced to a set of simplified functions which get black-boxed to ensure their continuation without interference (Kallinikos, 2005). Kiran (2014) drew on the concept to analyse e-governance in Kerala arguing that while some services could be offered online, reducing all government services to simplified functions with clear procedural sequences led to implementation challenges. Instead, Kiran's study showed how the sheer diversity and complexity of social assistance programming required local government intermediaries to be involved in program implementation before the service could be offered online. More recently, Masiero and Maiorano (2017) noted how the centralized management information system for implementing India's National Rural Employment Guarantee Act 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 restructuring power to wage-seekers or to local government agencies. While the government intended to circumvent the practice of corrupt wage seekers trying to make money by giving bogus names to obtain services, agencies at local level who are more aware of which are legitimate requests for employment and who can provide a vital support structure to low-income laborers were crowded out.

1.4. Digital identity platforms: orchestrating relations between central and local government

Digital platforms have emerged as an important mechanism in contemporary society for the conduct of market activity as well as for government service delivery including social assistance programming (Gorwa, 2019). In the public sphere, a platform-centric design provides scope for centralized identification functionality which allows the system to achieve scale in terms of the number and reach of services to citizens (Cohen, 2019; Mukhopadhyay et al., 2019). For example, UIDAI's centralized identity database enables the government to securely and efficiently manage, label and categorize eligible individuals for receiving government subsidies. At the same time, a public sector platform for service delivery can provide a mechanism whereby government controls the core identity database but opens up space for an ecosystem of complementary platform users to co-create value by designing innovative applications that integrate with the platform (Cordella et al., 2018). While the UIDAI as Aadhaar platform owner maintains overall control of the identity database of residents, the central authority also has to mediate relationships with third-party app developers by setting standards and interface protocols as well as supporting them to innovate and offer additional functionality on top of Aadhaar's basic identity services, for example through the development of mobile banking apps (Singh, 2019). Similarly, other complementors include enrollment and authentication agencies who interface with the digital identity platform as they develop technology to generate the unique identifier.

Aside from orchestrating relations with organizations to support the platform's technical functionality, the central government also needs to maintain relations with the institutions and practices

that prevail in different arms of government. For example, Effah and Owusu-Oware (2020) show how the lack of political consensus between the government and opposition party in Ghana led to the national biometric project resulting in the existence of multiple sector-specific biometric systems with consequent duplication of technological infrastructure and biometric data. Orchestration of social relations also takes place between different levels of bureaucracy, for example, one of the aims of Aadhaar has been to improve the effectiveness of social assistance programming by eliminating local intermediaries such as telecenter kiosk operators who offer public services to support citizens applying for social assistance programs. However, as Chaudhuri (2019) shows, it is precisely the discretionary practices and active agency of ration shops and kiosk owners who use the biometric data that contribute to creating value to beneficiaries.

In this paper, we respond to Chaudhuri's (2021) call for further research specifically on how Aadhaar shapes the orchestration of relations between central government and local bureaucracies for social assistance programming. On the one hand, Aadhaar is increasingly perceived not only as mechanism for implementing social assistance programming, but as a foundational component of the central government's Digital India initiative aimed at enhancing the country's online infrastructure. Following this line of thought, Chaudhuri argues that Aadhaar's mandatory usage for social assistance programming in India can lead to further centralization as UIDAI sets the design rules for user authentication and subsidy allocation making the system opaque to citizens and local government. On the other hand, digital identity platforms constitute important governance mechanisms for social assistance programming as they can help eliminate the risk of functional simplification and closure if multiple users work together to co-create value. In theory, the possibility of intermediation by local bureaucracy can help make the state more "supple" in the long term by identifying and addressing operational challenges (Faguet et al., 2015). This is particularly important for services that involve the dispersal of goods and services that cannot readily be standardized as in agriculture where the need to tap local knowledge and resources becomes crucial (Evans et al., 2015). Our aim in this paper is to offer a new theory to help improve understanding of how local government "intelligence" can be integrated with Aadhaar's core identity database to improve social assistance programming. As Figure 1 illustrates, the UIDAI's centralized identity database is used as Aadhaar's core and the platform is designed in such a way as to combine identity data with analytics in order to provide the required social assistance to beneficiaries. However, at different stages of program implementation, local government agents serve as critical intermediary as they need to combine the identity data and the centrally-designed algorithm for fertilizer allocation with their own knowledge about work processes and beneficiary needs in order to deliver social assistance to beneficiaries.

In the rest of the paper, we document how Aadhaar usage by sub-national agents in the implementation of social assistance programming can help in the co-creation of value to beneficiaries. We document four key practices and adaptations that were enacted for the AeFDS in Krishna District of Andhra Pradesh in order to improve fertilizer subsidy disbursement to low-income farmers. Agriculture remains the most important sector of the Indian economy with almost 50% of India's total population consisting of smallholder farming households. Fertilizer subsidy can bring economic benefits to these low-income farmers but can also be a major cause of negative environmental externalities when fertilizer is used excessively. While the amount of fertilizer 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, fertilizer subsidy distribution was one of the key application areas for social assistance programming when Aadhaar was being piloted in the country.

2. Methods

To study the implementation of the AeFDS, we adopted a qualitative case study approach for its value in generating theory on the relevance of local government intermediation for social assistance programming (Myers & Avison, 2002). Our study follows an inductive method of research in which the aim is to
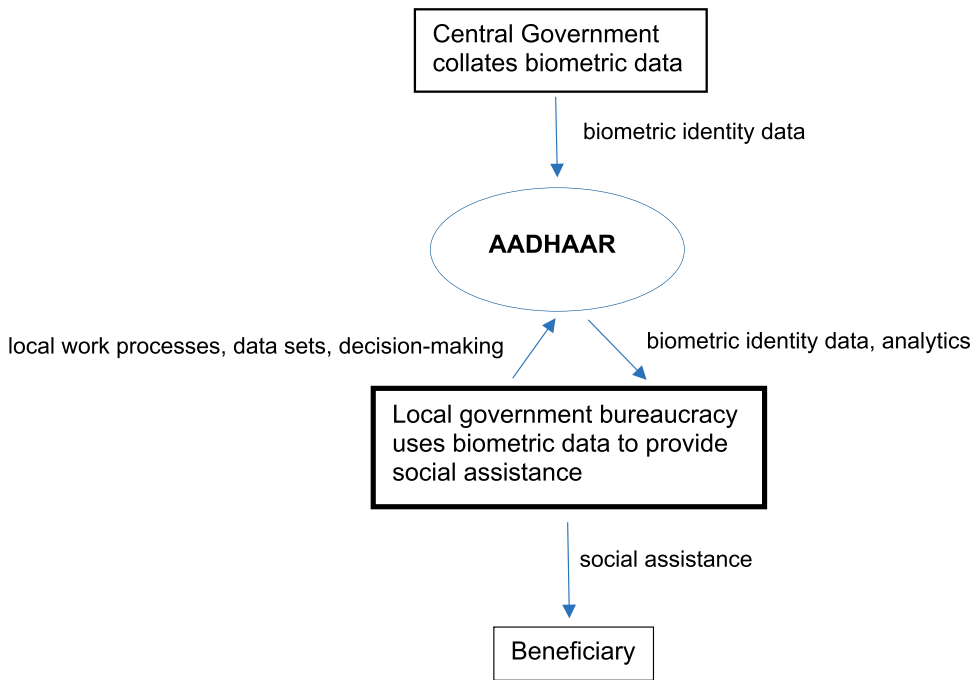
Figure 1. Aadhaar and social assistance programming: Theorizing local government as critical intermediary.

search for patterns from field data in order to support theory building (Walsham, 2006). The location of our study is Krishna district, Andhra Pradesh which was selected as one of the initial 16 pilot districts by central government in 2016 for the AeFDS scheme.[4] While Krishna district is widely acknowledged as being a successful example of using information technology to improve the delivery of public services (Aadil et al., 2019) and therefore may not be representative of other locations in India, our interest in selecting this case was to study *why* this was so with respect to the AeFDS.

Secondary data sources included policy documents, academic literature and newspaper briefs on the status of Aadhaar, and on low-income farmers in Andhra Pradesh. Primary data were used to obtain a first-hand understanding of how Aadhaar was both perceived and used at the level of retail outlets to improve the system of fertilizer distribution to low-income farmers. Interviews were conducted at district, block and retail outlet level with a random selection of informants who were engaged with the AeFDS. Data were collected during two field visits to Krishna district by one of the authors in July 2016 and September 2017 as detailed in Table 1.

We used a thematic analysis approach identified as relevant for case study research to examine themes or patterns of meaning within data to guide the coding process (Mills et al., 2010). The first stage involved the selection of narratives related to the design features of the AeFDS and how they were enacted for retailer login and sale of fertilizer to farmer. The second stage of analysis related to narratives from district and sub-district officers and retailers that provided details of the local adaptations to the AeFDS implemented in Krishna district. Table 2 provides examples of themes identified at the two stages.

3. Case study

3.1. Background

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 pulses.

Table 1. Listing of interviews.

Interviewee	Affiliation/Agency	Date
Founding Chairman	UIDAI	19/7/2016
District Collector	District Administration, Krishna district	25/7/2016
District Development Officer, Agriculture	District Administration, Krishna district	24/7/2016–25/7/2016
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

Table 2. Examples of themes identified through respondent narratives.

Stage of analysis	Theme
Central design features	login procedures; fertiliser sale; data integration
Local adaptation	retailer routines; tenant farmer claim; missing Aadhaar ID; subsidy demand overload; different type/amount of subsidy requested; in-kind subsidy rather than direct benefit transfer

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, 1513 farmers committed suicide (The Hindu, 2019).

The AeFDS was first piloted in Krishna district in March 2016. The objective of the pilot was to effectively monitor the distribution of fertilizer 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 fertilizers 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 fertilizer 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 point-of-sale (PoS) device at the retail outlet. Aside from reducing fraudulent activity, a key objective of the AeFDS was to help bring about positive change in farmers' behavior encouraging them to use only optimal quantity and type of fertilizers for their fields resulting in better yield, improved soil health and reduced input cost to farmers (MicroSave, 2017).

3.2. Commencement of the AeFDS pilot

From commencement of the pilot in 2016 there was an incremental increase in the number of fertilizer retail shops in the district and by the time of our second visit to Krishna district 1065 outlets

existed, each with 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 reporting that he has received fertilizer 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 exact quantity of the received product. The second function involves the selling of fertilizer to the farmer once he has been successfully authenticated through his Aadhaar number and fingerprint. The selling of fertilizer 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[5] 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 fertilizer 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 fertilizer 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 2.

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,
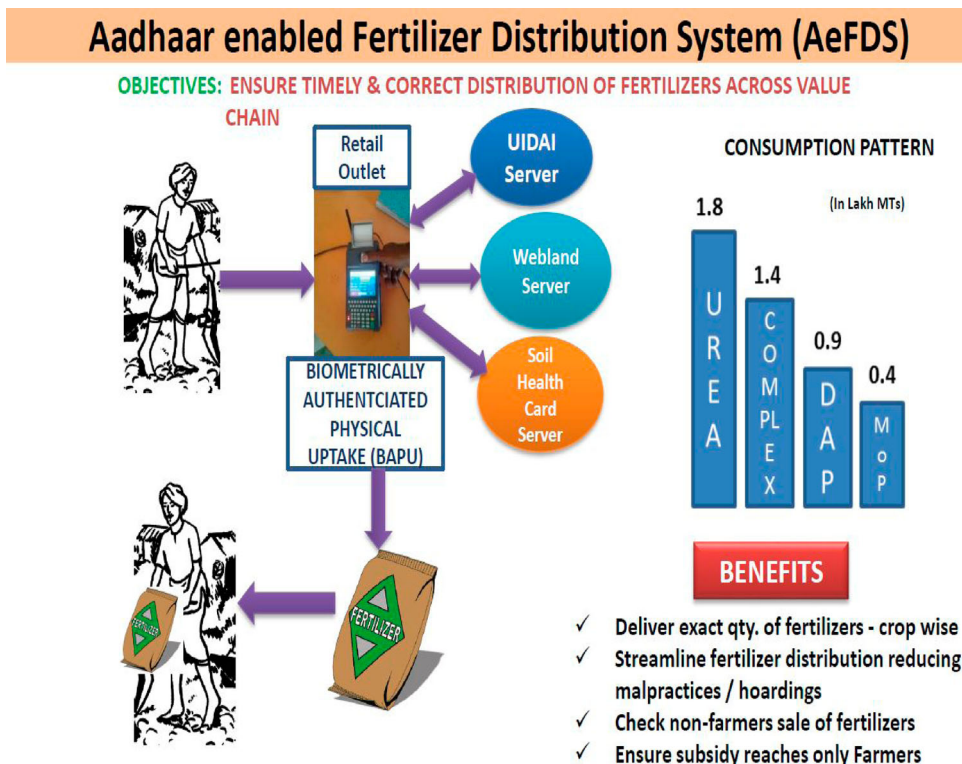

Figure 2. Krishna district's Fertilizer Distribution System. Source: Internal Document of Department of Agriculture, Krishna District, Andhra Pradesh[1]. Note: Urea, Complex, DAP and MOP are different types of fertilizer.

> 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 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 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[6] number by visiting his local MeeSeva[7] 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 follow-up 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 at district level. During 2016-2017, 94,000 samples had been analysed in Krishna district.

Once a decision is taken about the type and quantity of fertilizer to be purchased, the retailer generates a transaction receipt for the sale and the farmer receives the fertilizer at subsidized prices. For the District Agricultural Department, the AeFDS facilitates real-time monitoring of fertilizer 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.

By the end of 2017, there had been a reduction in the quantity of fertilizer sales and in the amount of subsidy distributed to farmers in Krishna district resulting in cost savings for the government as shown in Table 3.

3.2.1. Local adaptations to the AeFDS implemented in Krishna district between 2016 and 2017

Since the initial launching of the AeFDS in Krishna district several adaptations have been made to the system by local agencies who are users of the biometric data in order to make the system relevant for retailers and farmers. 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 fertilizer to farmers at the time of sale and it was common for them to delegate this task to another person while being occupied with

Table 3. Comparing Fertilizer Sale and Subsidy Pattern between 2015–16 and 2016–2017.

Year	Area (Ha)	Qty. of sales (MTs)	Subsidy Amount (in crores)
2015–2016	588,102	335,060.50	432.27
2016–2017	603,678	309,129.50	387.43
	3% increase	8% decrease	10% decrease

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 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 [who resisted] 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 fertilizer 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 subsidized fertilizer to landowner farmers could not accommodate the high number of tenant farmers prevalent in Krishna district. The District Development Officer 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" 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 fertilizer 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 on paper 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 had forgotten to bring his Aadhaar card, or had misplaced it. Many retail outlets also 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 PoS 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-peak 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 by the district authority which could handle larger volumes of transactions.

Finally, while the AeFDS was designed to recommend optimal type and quantity of fertilizer to the farmer, we observed that these recommendations were not always enforced as Krishna district was 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 fertilizer to purchase through the PoS device was sometimes disregarded by the retailer because of the

farmer's situation and the farmer was allowed to purchase a different quantity and type of fertilizer 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 supports local farmers is by resisting the central government's preferred approach of transferring subsidy to Aadhaar-authenticated beneficiaries through direct benefit transfer system into their bank account after the farmer has purchased fertilizer at market price. Given the large percentage of tenant farmers in the district, at local government level it was decided that direct benefit transfer would incur a huge financial burden on this category of beneficiary. For example, purchasing one bag of urea fertilizer at subsidized cost would come to around Rs. 295 (approx. US$4.17) while the market price would be Rs. 800–900 (approx. US$12) which would drastically reduce the farmer's ability to purchase other vital inputs needed.

By 2017 all the PoS devices in Krishna district 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 organized 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 were compiled into mandal-wise cumulative figures showing the quantity of fertilizer 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 fertilizer. 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 in the district receive their required type and amount of fertilizer. Second, the district authority needs to be aware of the various transactions taking place at all the outlets thereby reducing the chance of diverting fertilizer to the black market.

4. Analysis and discussion

While Aadhaar is an important enabler for curtailing corruption and promoting inclusion, we have argued in this paper that to remain relevant the platform needs to be integrated with the practices of local bureaucracies who are important intermediaries that make use of biometric authentication. The AeFDS is more complex than other subsidy-dispersal programs such as food ration or liquefied gas as there are numerous types of fertilizers that can be used for a particular landholding, as the customer base is not fixed in contrast to ration subsidies, and as there is seasonality of demand for fertilizer by farmers depending on the crop they opt to grow. As our case study has shown, these complexities require input by local government users at the operational level in order to address the priorities of retailers, landowner farmers and tenant farmers. The previous section showed how adaptations have taken place at local government level following implementation of the AeFDS which we described through five key processes, (1) facilitating the dispersal of subsidized fertilizer to farmers even when the retailer is absent, (2) permitting the handing over of fertilizer to persons other than the landowner farmer, (3) enabling the farmer to procure fertilizer even without his Aadhaar card, (4) making it possible for the claimant to purchase a different type/amount of fertilizer to that which is recommended by the centrally-designed 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 of Aadhaar highlights how the derivation of value from the digital identity platform depends not only on the accuracy of the centralized database but on how local government agencies serve as critical intermediaries by performing local analytics which can be useful for improving the overall effectiveness of social assistance programming. This finding supports earlier work on the role of human intermediaries in e-governance implementation but also extends it by providing empirical insights into the multi-user nature of digital identity platforms and the scope this provides for decentring the governance of social assistance programming. The five key processes identified through our empirical work at retail outlets in Krishna district provide a natural laboratory for experimenting with how the centralized biometric server meshes with local data and processes. Some of these were identified as digital services such as recommending optimal fertilizer to farmers while others were offline processes and adaptations such as manually recording information about farmers on chits of paper. From a technical perspective, the Aadhaar platform can be designed to enable the core database to link to local processes and data sources to increase the efficiency of fertilizer subsidy delivery to farmers as well as to sensitize farmers into using optimal type and quantity of fertilizer on the land.

The multi-sided nature of digital platforms can also help to address other indices of vulnerability that affect the lives of poor farmers such as 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 (Devereux & Sabates-Wheeler, 2004). Complementary applications that can be integrated with the AeFDS have already been piloted at the state government level to enable direct benefit transfer of subsidies to poor farmers hit by drought[8] and to routinely survey households using a biometric sensor that is linked to the core identity database allowing individual citizens to locally update information on health and migration.[9] To ensure accuracy of the survey data, the proactive role of local government intermediaries is needed to verify the status of assets such as land plots through physical site visits. Other potential complementary applications for AeFDS relate to the continued need for agricultural extension services to sensitize farmers about higher productivity technologies such as drip irrigation or better seeds as well as the need to move to organic farming. In Andhra Pradesh, a state-level initiative called Polam Pilusthondi (farmer's outreach) commenced in 2014 where agricultural extension officers meet farmers twice weekly covering all the villages in a mandal. Table 4 provides data on progress made with this program in Krishna district.

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 be able to market their produce and obtain sufficient returns.

Access to agricultural credit is another important need for low-income farmers. Although the Webland database certifies the legitimacy of a tenant farmer, to apply for a loan he still has to visit the village 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,

Table 4. Performance of Polam Pilusthondi program in Krishna district, October 2017.

Targeted number of village visits for 2017–2018	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)	88,299
Number of farmers attended (female)	5462

> 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.

Krishna district is making provision for the formation of groups of approximately 5–10 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 who could potentially be third-party players on the AeFDS thereby enabling members of the group to use the loan for their cultivation needs. A further potential complementary application that links to the core identity database can help provide detailed analysis regarding the extent of institutional support that is available for low-income farmers to sell their crops. In Andhra Pradesh, government procurement centers that offer cultivators a minimum price 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.

In terms of policy implications, the design of Aadhaar can either consolidate power in the hands of centralized authorities or enable a decentring of social assistance programming depending on how the platform is governed. On the one hand, Aadhaar holds potential for administrative decentralization integrating the knowledge base of local government functionaries who work with an ecosystem of actors including cooperatives and farmer associations. In line with Nilekani's comment referred to earlier in the paper, if local government can create applications that are linked to the Aadhaar system, analytics will take a more sophisticated approach. On the other hand, using Aadhaar to decenter social assistance programming requires proactive support from the central and state governments enabling local government to contribute to the design and implementation of social assistance programming through experimentation and local adaptation of processes (Ghani, 2020). The real challenge lies in encouraging the cultivation of skills amongst local government intermediaries to source accurate information, analyse it and establish continuous monitoring to improve service delivery and more accurate measurement of developmental progress. By doing so, the creation and management of local databases and functionality could be integrated as complementary applications to the core identity database so that the platform as a whole can innovate and evolve to respond to the demands of the smallholder farming sector.

More broadly, the increasing integration of digital identity platforms into socio-economic activities has recently prompted interest amongst scholars to study their nature, significance and impact on development processes (Nicholson et al., 2021). One aspect of relevance is to examine the nature of platform governance from the perspective of the range of players involved in welfare provision, including local players. The concept of semi-decentralized governance of digital platforms proposed by Chen et al. (2021) may be an effective strategy whereby the platform owner shares governance control with platform participants thereby representing their interests and leveraging local information. With the increased usage of digital identity platforms by the central government in India, our paper is a reminder of the prominent role that local government can play as vital intermediaries in creating effective and equitable value creation for social assistance programming as well as in other domains. For example, digital platforms for tracking COVID-19 in India such as *Aarogya Setu* and vaccination registration portal *CoWin* are centralized. With due consideration to ensuring that ethical frameworks and adequacy privacy safeguards are in place, a semi-decentralized governance structure can enable local officials at the constituency or taluk level to use data to help build resilience in the overall public health system (Ranjini, 2021).

5. Conclusion

Digital identity platforms for social assistance programming have become an increasingly significant part of the governance reform agenda in India as well as other 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 fertilizer subsidy to low-income farmers in Krishna district of Andhra Pradesh. Our aim in this paper was to investigate the platform's potential role in reorganizing the governance of social assistance programming. While in theory, the open architecture of digital platform provides scope for decentring the governance of social assistance programming, in practice this involves a complex political process which relates to how local priorities are negotiated to work with more centralized objectives. As the risks of Aadhaar transferring governance functions to the market continue to be vehemently debated, we hope that our study will encourage further research on local government as innovators for ensuring that social assistance schemes remain relevant to the local context.

Notes

1. As articulated in the UN Sustainable Development Goals.
2. Literally means 'support' in Hindi.
3. Unique Identification Authority of India.
4. This was increased to 19 districts in January 2017.
5. Mandal is the name given to a sub-district administrative unit in Andhra Pradesh
6. This is a plot number.
7. MeeSeva is the official government portal in Andhra Pradesh.
8. This can be modelled on the Parihara web-based application developed in Karnataka http://parihara.karnataka.gov.in/Pariharahome/PHHome.
9. The application is called Praja Sadhikara which literally means People Empowerment Survey.

Acknowledgement

Disclosure statement

Notes on contributors

Shirin Madon is Associate Professor at the LSE teaching courses on ICT and Socioeconomic Development, and Digital Innovation for Humanitarian Intervention. Her current research focuses on two themes. First, on the implementation of digital identity platforms for social assistance programming and for disaster management. Second, on building capacity for health systems resilience at primary healthcare level. She currently leads a research project in Karnataka, India to study how health facilities develop capacity to improve routine public health management and disease surveillance during pandemic.

Ranjini, C.R. joined the Public Affairs Centre in Bengaluru in 2021. There she is Lead at the Centre for Open Data Research. She is also a Mellon Sawyer Fellow involved in a programme entitled 'Histories of Artificial Intelligence: Genealogies of Power' at the Department of History and Philosophy of Science, University of Cambridge, UK. She was earlier a Post-Doctoral Fellow at the Centre for Public Policy, Indian Institute of Management Bangalore. Her research interests include artificial intelligence and ICT4D, localising sustainable development goals, public health informatics, gender and e-governance.

Anantha Krishnan, R.K. is a development professional working on governance and public reforms in Telangana, India. He was selected for the coveted Prime Minister's Rural Development Fellowship Programme by the Govt. of India in 2012 - a program to nurture young professionals to facilitate development in some of the most backward districts in India. His main areas of interest are digital governance, fintech, good governance.

ORCID

Shirin Madon 🔵 http://orcid.org/0000-0002-4497-2165
Ranjini C.R. 🔵 http://orcid.org/0000-0002-0704-8088

References

Aadil, A., Gelb, A., Giri, A., Mukherjee, A., Navis, K., & Thapliyal, M. (2019). Is Krishna a glimpse of the future? CGD Working Paper 512, Center for Global Development, Washington DC. https://www.cgdev.org/ publication/digital-govern-ance-krishna-glimpse-future-working-paper

Arora, P. (2016). The bottom of the data pyramid: Big data and the global south. *International Journal of Communication*, *10*, 1681–1699.

Barrientos, A., & Pellissery, S. (2015). Political factors in the growth of social assistance. In S. Hickey, K. Sen, & B. Bukenya (Eds.), *The politics of inclusive development: Interrogating the evidence* (pp. 146–174). Oxford University Press.

Bhatia, A., & Bhabha, J. (2017). India's aadhaar scheme and the promise of inclusive social protection. *Oxford Development Studies*, *45*(1), 64–79. https://doi.org/10.1080/13600818.2016.1263726

Bhatnagar, S. C., & Singh, N. (2010). Assessing the impact of E-government: A study of projects in India. *Information Technologies and International Development*, *6*(2), 109–127.

Chaudhuri, B. (2019). Paradoxes of intermediation in Aadhaar: Human making of a digital infrastructure. *South Asian Studies*, *42*(3), 572–587. https://doi.org/10.1080/00856401.2019.1598671

Chaudhuri, B. (2021). Distant, opaque and seamful: Seeing the state through the workings of Aadhaar in India. *Information Technology for Development*, *27*(1), 37–49. https://doi.org/10.1080/02681102.2020.1789037

Chen, Y., Pereira, I., & Patel, P. (2021). Decentralized governance of digital platforms. *Journal of Management*, *47*(5), 1305–1337. https://doi.org/10.1177/0149206320916755

Cohen, L. (2019). The "social" De-duplicated: On the Aadhaar platform and the engineering of service. *South Asia: Journal of South Asian Studies*, *42*(3), 482–500. https://doi.org/10.1080/00856401.2019.1593597

Cordella, A., Paletti, A., & Shaikh, M. (2018). Renegotiating public value with co-production. In C. Tucci, A. Afuah, & G. Viscusi (Eds.), *Creating and capturing value through crowdsourcing*. Oxford University Press.

Devereux, S., & Sabates-Wheeler, R. (2004). Transformative social protection. Institute for Development Studies, Working Paper 232.

Dreze, J., Khalid, N., Khera, R., & Somanchi, A. (2017). Aadhaar and food security in Jharkhand: Pain without gain?. *Economic and Political Weekly*, *52*(50), 50.

Effah, J., & Owusu-Oware, E. (2021). From national to sector level biometric systems: The case of Ghana. *Information Technology for Development*, *27*(1), 91–110. https://doi.org/10.1080/02681102.2020.1818543

Evans, P., Heller, P. (2015). Chapter 37 of Human development, state transformation, and the politics of the developmental state. In S. Leibfried et al. (Ed.), *The Oxford handbook of transformations of the state*. Oxford Handbooks Online.

Faguet, J. P., Fox, A. M., & Poschl, C. (2015). Decentralization for a deeper, more supple democracy. *Journal of Democracy*, *26*(4), 60–74. https://doi.org/10.1353/jod.2015.0059

Ghani, E. (2020). Will decentralisation help India? *Financial Express* 18th March.

GOI. (2016). *Economic survey 2015-16*. Ministry of Finance, Government of India.

Gorwa, R. (2019). What is platform governance? *Information, Communication & Society*, *22*(6), 854–871. https://doi.org/10.1080/1369118X.2019.1573914

Henne, K. (2019). Surveillance in the name of governance: Aadhaar as a fix for leaking systems in India. In B. Haggart et al. (Ed.), *Information, technology and control in a changing world*. International Political Economy Series. https://doi.org/10.1007/978-3-030-14540-8_11

Kallinikos, J. (2005). The order of technology: Complexity and control in a connected world. *Information and Organization*, *15*(3), 185–202. https://doi.org/10.1016/j.infoandorg.2005.02.001

Kiran, G. R. (2014). *Multipurpose nature of telecentres: The case of e-governance service delivery in Akshaya telecentres project* (Doctoral dissertation). The London School of Economics and Political Science (LSE). http://etheses.lse.ac.uk/935/1/Kiran_Multipupose-nature-of-telecentres.pdf

Krishna, S. (2021). Digital identity, datafication and social justice: Understanding aadhaar use among informal workers in south India. *Information Technology for Development*, *27*(1), 67–90. https://doi.org/10.1080/02681102.2020.1818544

Madon, S. (1993). Introducing administrative reform through the application of computer-based information systems: A case study in India. *Public Administration and Development*, *13*(1), 37–48. https://doi.org/10.1002/pad.4230130104

Madon, S. (2009). *E-governance for development: A focus on rural India*. Palgrave Macmillan.

Mahapatra, S. (2018). SC: How many denied benefits due to Aadhaar authentication failure, *The Economic Times*, 23 March 2018.

Masiero, S., & Arvidsson, V. (2021). Degenerative outcomes of digital identity platforms for development. *Information Systems Journal*, https://doi.org/10.1111/isj.12351

Masiero, S., & Maiorano, D. (2017). NGNREGA, power politics, and computerization in Andhra Pradesh. *Forum for Development Studies*, https://doi.org/10.1080/08039410.2017.1345785.

MicroSave. (2017). Assessment of AeFDS (Aadhaar enabled Fertilizer Distribution System) Pilot. Submitted to Government of India. Available at: http://www.microsave.net/files/pdf/Assessment_of_AeFDS_Aadhaar_enabled_Fertilizer_Distribution_System_Pilot.pdf

Mills, A. J., Durepos, G., & Wiebe, E. (2010). *Encyclopedia of case study research*. (Vols. 1–0). SAGE, Inc. https://doi.org/10.4135/9781412957397

Mir, U. B., Arpan, K., Kar, N. P., & Gupta, R. S. (2019). Prioritizing digital identity goals – The case study of Aadhaar in India. In I. O. Pappas (Ed.), *Digital Transformation for a sustainable society in the 21st century* (Vol. 11701, pp. 489–501). Springer International. https://www.researchgate.net/deref/https%3A%2F%2Fdoi.org%2F10.1007%2F978-3-030-29374-1_40

Mukhopadhyay, S., Bouwman, H., & Jaiswal, M. P. (2019). An open platform centric approach for scalable government service delivery to the poor: The Aadhaar case. *Government Information Quarterly*, https://doi.org/10.1016/j.giq.2019.05.001

Myers, M. D., & Avison, D. (2002). *Qualitative research in information systems: A reader*. Sage.

Nicholson, B., Nielsen, P., & Saebo, J. (2021). Editorial – digital platforms for development. *Special Issue: Digital Platforms for Development*, *31*(6), 863–868. https://doi.org/10.1111/isj.12364

Prakash, A., & De, R. (2007). Importance of development context in ICT4D projects: A study of computerisation of land records. *Information Technology & People*, *20*(3), 262–282. https://doi.org/10.1108/09593840710822868

Ranjini, C. R. (2021). Controversial COVID-19 contact-tracing App in India: Digital self-defence, governance and surveillance. In C. Garvey & A. Hanemaayer (Eds.), *Artificial intelligence and Its discontents: Histories of AI across the social sciences and humanities*. Palgrave.

Rondinelli, D., Nellis, J., & Shabbir Cheema, G. (1983). Decentralization in developing countries: A review of recent experience, World Bank Staff Working Papers No. 581, Management and Development Series, No. 8, World Bank, Washington DC.

Singh, R. (2019). Give me a database and I will raise the nation-state. *South Asia: Journal of South Asian Studies*, https://doi.org/10.1080/00856401.2019.1602810.

Sud, M., & VanSandt, C. (2015). Identity rights: A structural void in inclusive growth. *Journal of Business Ethics*, *132*(3), 589–601. https://doi.org/10.1007/s10551-014-2359-5

The Hindu. (2019). 1,513 Farmers committed suicide since Mid-2014 in State, 1st June.

Totapally, S., Sonderegger, P., Rao, P., Gosselt, J., & Gaurav, G. (2019). *State of Aadhaar Report 2019*. Dalberg.

Walsham, G. (2006). Doing interpretive research. *Journal of Information Systems*, *15*(3), 320–330. https://doi.org/10.1057/palgrave.ejis.3000589