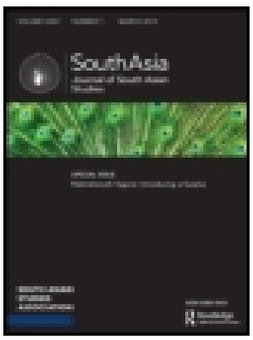

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Ranjit Singh

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ARTICLE

Give Me a Database and I Will Raise the Nation-State

Ranjit Singh

Department of Science and Technology Studies, Cornell University, Ithaca, NY, USA

ABSTRACT

This paper draws on an ethnographic study of Aadhaar, India's biometrics-based national identification infrastructure, to investigate how members of its design team conceptualised and understood their techno-bureaucratic enterprise of assigning unique numbers to Indian residents. Members described their work using the metaphor of building an hour-glass: the Aadhaar number and its authentication services constitute the waist of this hour-glass; below were innovations in biometric devices and above were applications requiring identity verification services. They believed the entire ecosystem sustaining Aadhaar could be controlled by prescribing interactions between the waist and the components above and below. They extended this metaphor to reimagine the Indian government as a platform of services controlling only a specific part of a service—the waist—while opening space for innovation by integrating it with other market services above and below. This paper documents the emergence of this imaginary of 'platformised' government collecting real-time citizen data to support personalised state–citizen interactions to unpack how the future(s) of Indian government services shapes and is shaped by it. Such future(s) constitute the Indian population as a database, bureaucracies as centralised dashboards, and government as arbiter in the circulation of citizen data.

KEYWORDS

Aadhaar; biometrics; bureaucracy; data politics; digital governance; identification infrastructure; infrastructure development; pipes; platforms; UIDAI

Introduction: Building a 'platformised' identification infrastructure

As an ethnographer following Aadhaar-mediated state–citizen relationships,[1] I have encountered several aphorisms in the field encompassing observations on everyday life in contemporary India. A Right to Food activist once told me: 'Numbers are always against India';[2] he explained that India's huge population exacerbates every problem the country faces. For example, a 1 percent error rate in digital services used by all

CONTACT Ranjit Singh rps244@cornell.edu

1. An Aadhaar number is issued to an Indian *resident*. Residents become *citizens* when they use Aadhaar to secure other government services, and *customers* when they use it to interact with private agencies. An Aadhaar *enrollee* is simultaneously a resident, a citizen and a customer depending on where they use Aadhaar and for what purpose. The 2018 Supreme Court ruling prohibited the use of Aadhaar by private agencies. Ashok Kini, '[Aadhaar] Read the Summary of Majority (4:1) Judgment', LiveLaw.in (26 Sept. 2018) [https://www.livelaw.in/aadhaar-read-the-summary-of-majority-41-judgment/, accessed 9 May 2019]. Before the ruling, Aadhaar was actively used by mobile service providers and private banks to register their customers.
2. Right to Food activist, personal communication, 4 Aug. 2015, New Delhi.

Indians translates into challenges faced by approximately 13 million people. Numbers, however, are indexical: the massive youth population of India is simultaneously valorised in terms of 'demographic dividend' for its economic potential.[3] In any case, India's population raises the inevitable challenges of managing scale for any project spanning its infrastructural and socio-economic diversity. This paper describes how these challenges were resolved by members of Aadhaar's design team in building an identification infrastructure for India.

Securing a unique ID was consistently promoted by members[4] to fix the problem of de-duplicating[5] citizen records across government databases. As the Unique Identification Authority of India (UIDAI) in charge of implementing Aadhaar explained:

> It is not possible to de-duplicate 1.2 billion residents by using demographic fields only (like name, address, age, gender etc.) and moreover identity documents that rely only on demographic fields and personal reference checks are surrogates of identity and are vulnerable to forgery, falsification, theft, loss and other corruptions. In [the] Indian context, biometrics were determined to be the most suitable factors for carrying out de-duplication. Hence it is necessary to enrol all residents along with their biometrics and build a clean database for the purposes of a National Identity system.[6]

According to the UIDAI, the absence of standardised citizen identity across databases has impeded efforts to computationally streamline government services.[7] Members wanted to start Aadhaar from 'scratch' and build a 'clean' database of unique enrollees. Adding Aadhaar numbers to pre-existing citizen records in other government databases will then, by extension, clean or de-duplicate them and standardise the mechanism for authenticating citizen identity across services. Aadhaar's three infrastructural processes reflect these ideas:

- *Enrolment*: the process of residents providing biometric and demographic information to register for a unique entry in Aadhaar.[8]
- *Seeding*: the process of adding a resident's Aadhaar number to their records in other databases of public/private organisations to de-duplicate them.[9]

3. The demographic dividend refers to the potential for economic growth embedded in the rising share of working-age population in any country. For India, see Nandan Nilekani, *Imagining India*: *The Idea of a Renewed Nation* (New York: Penguin Press, 2009).
4. 'Members' refers to the members of Aadhaar's design team. The term 'members' also serves a dual purpose, indicating ethnomethodological engagement with members of a practice to provide an account of how the setting of their work (here, Aadhaar) is organised. Garfinkel argues in this regard that 'in exactly the way that persons are members to organized affairs, they are engaged in serious and practical work of detecting, demonstrating, persuading through displays in the ordinary occasions of their interactions the appearances of consistent, coherent, clear, chosen, planful arrangements'. Harold Garfinkel, *Studies in Ethnomethodology* (Cambridge: Polity Press, 1967), p. 34. I describe how the hour-glass metaphor becomes a planful arrangement in organising for Aadhaar.
5. De-duplication is the removal of duplicate or redundant copies of data.
6. UIDAI, 'Role of Biometric Technology in Aadhaar Enrollment' (New Delhi: UIDAI, 2012), p. 2 [https://www.dropbox.com/s/0vgqcsn6gcmer5i/role_of_biometric_technology_in_aadhaar_jan21_2012.pdf?dl=0, accessed 9 May 2019].
7. UIDAI, 'Aadhaar Enabled Service Delivery' (New Delhi: UIDAI, 2012) [https://www.dropbox.com/s/zk6zd7p53prw0wh/whitepaper_aadhaarenabledservice_delivery.pdf?dl=0, accessed 9 May 2019].
8. Sujata Chaturvedi, 'Resident Enrollment Process Version 2.2.1' (New Delhi: UIDAI, 12 Dec. 2014) [https://www.dropbox.com/s/5u4tidybujd51z1/resident_enrolment_process_ver_2.2.1.pdf?dl=0, accessed 9 May 2019].
9. UIDAI, 'Standard Protocol Covering the Approach and Process for Seeding Aadhaar Numbers in Service Delivery Databases' (New Delhi: UIDAI, June 2015) [https://www.dropbox.com/s/jxu98lpap1a4qk8/Aadhaar%20Seeding%20June%202015%20v1.1.pdf?dl=0, accessed 9 May 2019].

- *Authentication*: the process of verifying the identity of Aadhaar enrollees as they avail public/private services.[10]

These processes *together* operationalise Aadhaar as a 'root identity' from which all other domain-specific identities (such as ration cards) could eventually be derived.[11]

This paper explores how members implemented these processes. Aadhaar marks a new way of thinking about information technology (IT)-based government projects in India;[12] it is designed as a digital platform.[13] Like other platforms,[14] Aadhaar was designed with an hour-glass architecture[15] in which:

> a simple, easy-to-use solution forms the waist of the hourglass, while allowing for innovation in multiple spheres both above and below .... [In Aadhaar's case] the waist consists of the Aadhaar number—a unique identifier for every individual—and authentication services linked to this number. Below the waist lies innovation in design, in this case biometrics devices that can capture fingerprints and iris data .... Above the waist lies any application that might require an identity verification service.[16]

The waist standardises interactions between highly variable components above and below. This paper shows how members mobilised the hour-glass as a metaphor for control not only in technically implementing Aadhaar, but also in organising its logistics.[17] Building on the success of enrolling more than a billion residents of India,[18] members ultimately extended the hour-glass metaphor to envision and build new mechanisms to govern a 'data-rich' India.[19]

10. UIDAI, 'Aadhaar Authentication Document for Delivery of Services Version 1.0' (New Delhi: UIDAI, June 2015) [https://www.dropbox.com/s/zlfntmhwztq3yww/aadhaar_authentication_document_for_delivery_of_services_v1_0.pdf?dl=0, accessed 9 May 2019].
11. UIDAI, 'Aadhaar Technology and Architecture' (New Delhi: UIDAI, 2014), p. 32 [https://www.dropbox.com/s/i9wj30isb0up9yd/AadhaarTechnologyArchitecture_March2014.pdf?dl=0, accessed 9 May 2019].
12. TAGUP, 'Report of the Technology Advisory Group for Unique Projects' (New Delhi: Ministry of Finance, 31 Jan. 2011) [https://www.dropbox.com/s/jmirutuseozugse/Nandan%20Nilekani-chaired%20Technology%20Advisory%20Group%20for%20Unique%20Projects%20(TAG-UP).pdf?dl=0, accessed 9 May 2019].
13. UIDAI, 'Aadhaar Product Document' (New Delhi: UIDAI Technology Center, Mar. 2014), p. 91 [https://www.dropbox.com/s/auhtwr6pfpaap9o/AadhaarProductDoc_march2014.pdf?dl=0, accessed 9 May 2019].
14. Plantin *et al*. summarise the work of platform studies scholars as explorations of 'how modularity and power are negotiated between a core unit with low variability and heterogenous components of high variability'. Jean-Christophe Plantin, Carl Lagoze, Paul Edwards and Christian Sandvig, 'Infrastructure Studies Meet Platform Studies in the Age of Google and Facebook', in *New Media & Society*, Vol. 20, no. 1 (2016), p. 298.
15. Hour-glass architecture is reminiscent of discussions on modularity in building information infrastructure as layers of stacks placed on top of each other. While Yochai Benkler, in *The Wealth of Networks* (New Haven, CT: Yale University Press, 2006), extends this discussion to theorise the emergence of a networked information economy, Benjamin Bratton, in *The Stack* (London: MIT Press, 2016), explores infrastructure-as-stacks to postulate the formation of a new geopolitical architecture for governance. However, other theorists have contested portrayals of infrastructure-as-stacks to argue that infrastructure, like a good stone wall, is held together by an uneven imbrication of uncemented things, 'including discourses, actions, architecture, work, and standards/quantifications/models'. See Martha Lampland and Susan Leigh Star, *Standards and Their Stories* (Ithaca, NY: Cornell University Press, 2009), p. 20.
16. Nandan Nilekani and Viral Shah, *Rebooting India*: *Realizing a Billion Aspirations* (Gurgaon: Penguin Books, 2015), p. 224.
17. While ex-members Nilekani and Shah describe hour-glass as a model of innovation, they also envision the government regulating the resulting market of innovations. Their primary concern, also evident in my conversations with other members, centres on how the waist controls the ecosystem around it. Nilekani and Shah, *Rebooting India*, p. 224.
18. Ministry of Communications, Government of India, 'UIDAI Generates a Billion (100 Crore) Aadhaars, A Historic Moment for India', Press Information Bureau (4 April 2016) [http://pib.nic.in/newsite/printrelease.aspx?relid=138555, accessed 26 Dec. 2018].
19. Nilekani has actively promoted Aadhaar as a resource to turn India into a data-rich country. DHNS, 'India to Turn Data-Rich in 5 Yrs', *Deccan Herald* (8 Sept. 2015) [https://www.deccanherald.com/content/499677/india-turn-data-rich-5yrs.html, accessed 9 May 2019].

By focusing on members who designed Aadhaar,[20] I wish to make two points. First, managing scale requires two kinds of translations (real-to-abstract and abstract-to-real) that *together* constitute any large-scale enterprise. Aadhaar enrolment is the process of translating a unique real person into an abstract data record of biometric and demographic data (real-to-abstract translation), while authentication is the process of translating an abstract data record into a unique real person (abstract-to-real translation). Seeding remains an in-between process of mapping abstractions; it maps data records on Aadhaar with data records on other databases. Aadhaar's utility and power are embedded in its ability to practically sustain *both* these translations. Second, members artfully blended the entrepreneurial culture of IT start-ups with the bureaucratic culture of the Indian government to accomplish these translations. They employed techniques of building and marketing start-up products to turn Aadhaar into a digital platform. Aadhaar's hour-glass architecture reflects cultural ideals of openness and modularity espoused by IT start-ups in building their own businesses. However, Aadhaar is also a state-managed identification infrastructure that is embedded in the work of an Indian bureaucracy which (re)produces and values replicability and consistency.[21] These contrasting cultural ideals—openness versus consistency[22]—are difficult to reconcile. Aadhaar exemplifies the challenges of building or reorganising infrastructures as platforms. My fieldwork illustrates these challenges by documenting how openness, modularity, consistency in legitimate use[23] and power were negotiated between the relatively stable waist and the highly variable components above and below in Aadhaar's implementation.

Starting with scale, Bruno Latour, in his seminal work, 'Give Me a Laboratory and I Will Raise the World', argues that a laboratory's locus of power is situated in its ability to translate macro-scale real-world phenomena into micro-scale abstract objects of study.[24] He contends that such translation remains weak until these abstract objects are scaled up to have demonstrable real macro-scale consequences. By dissolving the boundaries between micro- and macro-scales, Latour demonstrates how scientists manifest changes in the real world by turning laboratories into obligatory passage points.[25] Thus, the role of an ethnographer in laboratory studies is to follow how scientists

20. For an in-depth exploration of citizens' perspectives on Aadhaar, see the papers by Ursula Rao and Parul Baxi in this issue, *South Asia: Journal of South Asian Studies*, Vol. 42, no. 3 (June 2019).
21. Gupta succinctly accounts for how replicability and consistency drive the Indian bureaucracy. Akhil Gupta, *Red Tape* (Durham, NC: Duke University Press, 2012).
22. Just as layering and openness in infrastructure-as-stacks is difficult to maintain practically, replicability and consistency are difficult to practically achieve in bureaucracies. However, they remain the cultural ideals of IT start-ups and bureaucracies, respectively.
23. Aadhaar's use raises regulatory concerns in distinguishing between legitimate participation in its ecosystem and illegitimate manipulation of its services. The proliferation of Aadhaar-enabled services also raises potential risks in securing citizen data and protecting citizens' privacy. 'Consistency in legitimate use' refers to bureaucratically managing legally-appropriate means of using Aadhaar.
24. Bruno Latour, 'Give Me a Laboratory and I Will Raise the World', in Karin D. Knorr-Cetina and Michael Mulkay (eds), *Science Observed* (London/Beverly Hills, CA: Sage, 1983), pp. 141–70.
25. Actor–network theorists argue that translating macro-scale real phenomena into micro-scale abstractions requires defining the problem that such translation would resolve. While actors may define this problem differently, certain actors such as scientists become 'obligatory passage points' that configure and enrol the interests of other actors in a particular definition of the problem to exercise control over how the problem is solved. See Michel Callon, 'Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay', in John Law (ed.), *Power, Action, and Belief* (Boston, MA: Routledge & Kegan Paul, 1986), pp. 196–233.

manage scale. David Ribes makes a similar argument in studying the scale of information infrastructures: 'Rather than seeking to investigate the large-scale thing itself, the ethnographer asks of the actors: how do you know your enterprise? *The key insight in this method is the recognition that anytime there is a "large" endeavor you will find actors tasked with managing the problems associated with its scale*'.[26] The techniques and tools used by actors such as surveys and descriptive statistics, standards, and meetings of key stakeholders to represent and cope with the size of infrastructure projects are ethnographic resources to unpack scale. Ribes addresses such tools and techniques as scalar devices. I consider the hour-glass as a scalar device in members' work of turning Aadhaar into an obligatory passage point for unique identification.

State-orchestrated practices for identifying citizens have a long history.[27] They range from the use of permanent patronyms in written records of state–citizen transactions in fourteenth- and fifteenth-century England[28] to the current development of biometric databases.[29] The proliferation of IT-based identification engenders new challenges of aligning such technologies with bureaucratic work. Members technologically embedded Aadhaar's infrastructure in the open source culture of the bazaar:[30] 'Linus Torvalds's style of [software] development—release early and often, delegate everything you can, be open to the point of promiscuity'.[31] Simultaneously, they had to control Aadhaar's implementation to remain within the bounds of the Indian bureaucracy and maintain replicability and consistency in the legitimate use of its infrastructural processes. While infrastructure as a distinct form of authority, discourse and action can impact upon a nation's political culture, this political culture has its own repertoire of norms, institutions and traditions that push back.[32] This back and forth is most evident in the period of transition as infrastructures slowly turn into the 'invisible background'[33] of state–citizen interactions. This transition—especially in the context of platformised state-managed infrastructure—requires a 'delicate balance' between public and corporate interests to preserve social

26. David Ribes, 'Ethnography of Scaling, or, How to a Fit a National Research Infrastructure in the Room', in *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing* (New York: ACM, 2014), p. 158, emphasis in original.
27. The Introduction to this special section provides a detailed account of the problem of identification in modern governance and the history of Aadhaar's development.
28. James Scott, *Seeing Like a State* (New Haven, CT: Yale University Press, 1998).
29. Alan Gelb and Julia Clark, 'Identification for Development: The Biometrics Revolution—Working Paper 315', *Center for Global Development* (2013) [https://www.cgdev.org/publication/identification-development-biometrics-revolution-working-paper-315, accessed 9 May 2019].
30. E.S. Raymond, *The Cathedral and the Bazaar* (Sebastopol, CA: O'Reilly Media, 2001).
31. Kieran Healy and Alan Schussman, 'The Ecology of Open-Source Software Development', CiteSeer^{x} (2003) [http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.13.4850, accessed 25 May 2018].
32. Science and technology studies researchers have a long-standing interest in mapping socio-technical change through the mutually constitutive relationship between the social shaping of technology and the technical building of nation-states. See, for example, Wiebe Bijker, 'Dikes and Dams, Thick with Politics', in *Isis*, Vol. 98, no. 1 (2007), pp. 109–23; and Sheila Jasanoff and Sang-Hyun Kim, 'Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea', in *Minerva*, Vol. 47, no. 2 (2009), pp. 119–46. Theorists of infrastructure have explored how infrastructures engender a socio-technical culture of their own, 'a language to be learned, a way of tuning into the desire and sense of possibility expressed in the very materials of infrastructure'. See Brian Larkin, 'The Politics and Poetics of Infrastructure', in *Annual Review of Anthropology*, Vol. 42, no. 1 (2013), p. 337.
33. Star and Ruhleder describe infrastructure as the fundamentally-relational invisible background that shapes and is shaped by the practical organisation and accomplishment of distributed work. Infrastructure becomes visible upon breakdown. See Susan Leigh Star and Karen Ruhleder, 'Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces', in *Information Systems Research*, Vol. 7, no. 1 (1996), pp. 111–34.

justice.[34] This paper traces this transition as a process by following members' work in imagining and actualising it. Their limited experience with government prior to Aadhaar left them unencumbered by its bureaucratic culture and uniquely positioned to change its workings. Thus, I ask how members conceptualised the role of government in India's development to establish the hour-glass as an emergent distributive regime of control in public–private partnerships. I pay attention to how they imagined new start-ups within government to leverage citizen data for governance.

The rest of this paper is divided into two sections. The first is based on eighteen months of ethnographic fieldwork in start-up workspaces in Bengaluru, bureaucratic offices of Aadhaar-related services, and Right to Food activist organisations in Delhi.[35] It provides an account of how the technical hour-glass of Aadhaar's data architecture was built and shows how this architecture became a heuristic for managing organisations conducting Aadhaar enrolment. I also document how members envision a new approach to India's development by platformising the Indian government, which they characterise as moving from pipes to platforms. My fieldwork stories document how specific ideas about India's development were generated in practice, how they were deployed and their consequences for governance. In the final section, I discuss the larger implications of using Aadhaar as the first database covering most of India's population. Aadhaar will continually encounter tension between maintaining openness to participation and consistency in legitimate use. This tension will shape the emergent socio-technical culture of data-rich India.

Governing with data

I arrived in Bengaluru on 4 June 2015. The cityscape was filled with billboards advertising mobile apps; their sheer ubiquity in Bengaluru compared to other cities tells a story. A platform-based service economy is slowly taking over the entrepreneurial imagination of Bengaluru where smartphones are positioned as the future of business and digital innovation in India: 'The number of smartphone owners in India will further increase to 58 percent [of the population] by the end of 2021'.[36] The Bengaluru IT industry is proselytising this trend as did Aadhaar's design team.

Most original members are no longer a part of the UIDAI. They have moved on, but they still talk about working on Aadhaar as one of the most exciting times of their lives. Things were new; there was enough freedom and space, if not time, to think through technological choices for the project.[37] All of them were nostalgic about their

34. Plantin *et al.* warn that 'it has become too easy to conflate the economic logics typical of platforms with the public interests .... The question is not only who profits and controls, but who, and what, is cast aside along the way'. Plantin *et al.*, 'Infrastructure Studies Meet Platform Studies', p. 306. An analytically-rigorous discussion of reconfigurations of public goods in India and the resulting forms of precarious citizenship can be found in Laura Bear and Nayanika Mathur, 'Introduction: Remaking the Public Good', in *Cambridge Journal of Anthropology*, Vol. 33, no. 1 (2015), pp. 18–34.
35. The fieldwork was conducted in three rounds: between June 2015 and Jan. 2016; between July 2016 and Jan. 2017; and between Jan. 2018 and Mar. 2018.
36. 'India: Ericsson Mobility Report', Ericsson, Sweden (June 2016) [https://www.dropbox.com/s/4k72dkz6w9h9ufq/emr-rina-june-2016.pdf?dl=0, accessed 9 May 2019].
37. Conversations on building a biometric-based ID for below poverty line families began in 2006. The UIDAI was set up under the chairmanship of Nandan Nilekani in 2009 with the goal of issuing the first Aadhaar number by 2010. PSCoF, 'Forty-Second Report: The National Identification Authority of India Bill, 2010' (New Delhi: Lok Sabha Secretariat, Dec. 2011) [https://www.dropbox.com/s/lthrq7gcd2yl7yr/Forty-Second_Report_NIAI.pdf?dl=0, accessed 9 May 2019].

interactions with bureaucracy; while difficult on occasion, they reminisced about their exposure to a different world-view: 'The government folks were surprisingly, very very accommodative. Maybe not surprising to them, but it was surprising to us because we weren't sure what to expect …. After the initial one year or so, they really understood that we are practitioners, we understand the system, we are just there to help'.[38] Members were quick to draw out the difference in expertise between them and the bureaucrats: while they understood technical implementation better, the bureaucrats knew the administrative procedures needed to run a state-managed infrastructure. Building Aadhaar required a mix of *both*.

Of course, there were moments when the hierarchical bureaucratic structure of the government did not align with the expectations of members coming from a start-up culture, where 'you called the CEO by his first name'.[39] 'Each group had their own impenetrable jargon'[40] and expectations. Discussions on Aadhaar enrolment provide an illustrative example of this dissonance. Enrolment presented a unique opportunity within bureaucratic circles to gather broader data on enrollees such as blood group, caste and other attributes.[41] Members, however, had a different perspective: 'Identity should be inclusive. The more questions we ask, the more filter criteria we are putting, [the] more exclusive [Aadhaar] will become. If you cannot provide proof [for data fields], somebody will reject you. We removed literally everything into just four [demographic] attributes'.[42] While the UIDAI was set up as a bureaucratic office, its operational procedures were created in 'the chaotic, frenetic environment' of start-ups.[43]

I met most members in start-ups they had launched after leaving the UIDAI. I slowly started exploring the mutually constitutive relationship between Aadhaar and the Bengaluru start-up culture. My exploration had several threads such as exploring members' accounts of dealing with paperwork and unpacking the role of IT companies in material practices of Aadhaar-enabled bureaucratic services. In choosing a thread for this paper, I rely on members' articulations of a fundamental problem in building information infrastructure to govern India: the lack of a universal means of identifying Indian residents.[44] They strongly believe that India needs a standardised biometric identity for its residents to turn digital.

However, creating a standardised biometric identity comes with the complex problem of collecting data at the scale of India's population. But Kairav, involved in designing the data architecture of Aadhaar, rejected this premise of complexity:

> It's not actually complex. It's not complex because you break down your problem to smaller pieces of the puzzle and then, you compose the puzzle back into a larger puzzle. Otherwise, everything looks complex. If you, say, issue a biometric identity, unique, for a billion people, never been done in the world, you have to do it all in three months, all within the constraints of government, and you have to do RFP (request for proposal),

38. Kairav, personal communication, 24 Sept. 2015, Bengaluru. Kairav was my primary informant on Aadhaar's data architecture. I have changed the names of all my informants to protect their identities.
39. Nilekani and Shah, *Rebooting India*, p. 29.
40. *Ibid*.
41. *Ibid*., pp. 32–5.
42. Kairav, personal communication.
43. Nilekani and Shah, *Rebooting India*, p. 27.
44. Nilekani, *Imagining India*.

> you have to do lowest price guy, it all looks very complex. But, you break down. You break down in pieces, pieces, and pieces.[45]

Members broke down the larger problem of data collection into a set of parallelisable smaller problems. They drew a distinction between the technical and organisational implementation of Aadhaar.[46] While the technical challenge was to manage storage and processing of collected data, the organisational challenge was to administer human resources and the logistics of enrolment. Since the team's core competence was developing the technical system, I describe their efforts to commoditise Aadhaar's technical infrastructure first.

The technical hour-glass of Aadhaar

Members knew that Aadhaar-based applications would need trillions of computations every day and petabytes of data storage.[47] Kairav recalled moments of doubt when it seemed that Aadhaar was technically unfeasible because of its scale; it seemed impossible to conduct a 1:N check to compare the biometric information of a new enrollee against all existing Aadhaar records. It is computationally easier to make comparisons when there are only 100 existing Aadhaar records than when there are a billion. The team received a note from a biometrics expert in mid 2009 which stated: 'You will require thousands of million-dollar computers. It is going to be so cost prohibitive to do a billion people's de-duplication that it is not yet time'.[48] Managing de-duplication on such a scale seemed impossible. They also realised that 'most biometric systems are very proprietary'.[49] Members eventually translated these problems into making a technical choice between computing architectures: 'Choice existed from custom computers with massive parallel computing capability … and use of commodity x86 platforms'.[50] Unsurprisingly, this entailed tight coupling with the vendor supplying the chosen solution.

In architectural terms, the choice was between designing Aadhaar with scale-up architecture or open scale-out architecture. On the one hand, information systems with scale-up architecture are 'built using specific technologies provided by one vendor who also provides the large hardware'.[51] The scale-up approach relies on buying customised hardware from a single vendor. On the other hand, information systems with scale-out architectures are 'built completely using open source or open technologies … and allow [the] co-existence of heterogeneous hardware within [the] same application'.[52] The scale-out approach relies on combining standardised off-the-shelf hardware from multiple vendors for parallel computing. As members gathered insights into de-duplication by workshopping with biometrics experts in August 2009, it became evident that de-duplication 'is a completely parallelisable problem. If the problem remains embarrassingly parallel … commodity computing must work. I must be able to throw 20,000

45. Kairav, personal communication.
46. Fieldnotes on conversation with Dakshin, 29 Sept. 2015, Bengaluru.
47. UIDAI, 'Aadhaar Technology and Architecture', p. 75.
48. Kairav, personal communication.
49. *Ibid.*
50. UIDAI, 'Aadhaar Technology and Architecture', p. 75.
51. *Ibid.*, p. 72.
52. *Ibid.*, p. 74.

blade servers running on Linux and they will solve the problem'.[53] The UIDAI eventually chose an open scale-out architecture to avoid vendor lock-ins, and to create an 'incentive aligned design' that allowed constant comparisons of performance and cost between different vendors.[54]

This choice marked a shift in the Indian government's approach to procuring IT services for governance. Typically, large IT projects for government services are outsourced to one or more vendors through bids on RFPs crafted by government-designated project teams.[55] However, members used their expertise in designing large-scale information infrastructures to mediate between the government and vendors: 'Traditionally because of the lack of people like us in the system, when you ask for an identity solution, you get all-proprietary, all-in-a-box solution … . We unpacked them and sort of commoditised them'.[56] Rather than giving up control over Aadhaar to a vendor, members commoditised vendor expertise by creating a government-oriented market for IT products and services and a new form of public–private partnership: 'It is not a good idea to force the use of specific software [or hardware] of any type; instead, the focus should be on adopting open standards, and using open source as prudent'.[57] Members relied on open source technologies to build Aadhaar unless they did not have this option: 'We argued open source more for security reasons than cheap reasons. I would rather know what is going into a country's backbone'.[58] However, biometric de-duplication remains a proprietary technology.

Biometric de-duplication is the only proprietary component in Aadhaar's software; the rest is built on open source. Members created an API-based system[59] to use three proprietary algorithms for de-duplication with 'a management layer that can orchestrate across the multiple solution providers'.[60] Instead of a one-to-one relationship between components and their functions, the team implemented a many-to-one relationship between proprietary algorithms (as components) and de-duplication (their function). The three vendors chosen were mandated to provide only their algorithms and ensure compatibility with Aadhaar's open scale-out hardware architecture.

This API-based software design was not only instrumentalised to distribute de-duplication to proprietary algorithms, but also to scale Aadhaar's infrastructural processes. Pramod Varma—Aadhaar's chief architect and technology advisor (2009–present)—recalled that members were not building the material infrastructure for Aadhaar as most other government projects would: 'Let's use the ecosystem. We control the software and the entire digital spine, as we call it. We designed the digital spine, we designed the software, [and] we designed the certification'.[61] The core principle here was to map Aadhaar's implementation onto a set of software components to

53. Kairav, personal communication.
54. UIDAI, 'Aadhaar Technology and Architecture', p. 79.
55. TAGUP, 'Report of the Technology Advisory Group'.
56. Kairav, personal communication.
57. TAGUP, 'Report of the Technology Advisory Group', p. 42.
58. *Ibid*.
59. In software programming, application programming interfaces (APIs) are a set of clearly-defined methods of communication between different software components.
60. UIDAI, 'Aadhaar Product Document'.
61. ThoughtWorks, 'Pramod Varma: Building Country Scale Systems', YouTube (13 Dec. 2016) [https://www.youtube.com/watch?v=lvZSXjB_04s, accessed 26 Dec. 2018].

standardise the process workflows irrespective of the public/private agency carrying them out.

Varma further explained how ecosystems thinking is deeply intertwined with treating Aadhaar as a start-up product and the UIDAI as a start-up within government:

> From a government perspective, you don't build a product the way start-ups build a product. But, when we started in 2009, we wanted to treat [Aadhaar] as a product. That is, we should understand the incentive structures for our customer, our partners who use it, understand the whole ecosystem, activate the ecosystem to really adopt it, and it has to be what we call pull-based and not push-based products.[62]

Aadhaar is a peculiar start-up product, in part because the support from government reduced the risk of launching it. An identification infrastructure for more than a billion people was also a major incentive for any private company to participate in its implementation. With the government using Aadhaar in welfare schemes such as the Public Distribution System (PDS) for subsidised food grains,[63] it also manifested as a push-based product.

The organisational hour-glass of Aadhaar

Dakshin, involved in designing Aadhaar's infrastructural processes, spoke at length about ecosystems thinking in implementing Aadhaar: 'An Aadhaar number didn't have a particular bureaucratic purpose *per se*, it was simply intended to uniquely identify a person. The rest of the uses of Aadhaar is an extension of the ecosystem that leverages the number'.[64] Members reconfigured the work of the Indian bureaucracy (through seeding and authentication) by re-specifying identification as an end (a government service) rather than a means (a resource to accomplish other services). They conceptualised 'open and distributed' front-end and back-end for Aadhaar.[65] The front-end (resident-facing) side of Aadhaar allows residents to authenticate their identity and provide verified information about themselves to public/private agencies. On the back-end, the standards and specifications for biometric devices and de-duplication software have streamlined the market of biometric technologies. The front-end and back-end, *together* with the Aadhaar number and the authentication services linked to it as the waist, constitute the technical hour-glass architecture of Aadhaar.

Simultaneously, 'Aadhaar is a new ecosystem of new and old companies, private organisations and public institutions, connected together by the standards that the UIDAI has created on both ends'.[66] In organisational terms, the waist of the hour-glass consists of the UIDAI creating standards, best practices and memorandums of understanding (MOUs) for a state-managed identification infrastructure project.[67] Below the waist lies a networked hierarchy of enrolment and authentication agencies enabling the

62. *Ibid*.
63. Ministry of Consumer Affairs, Food & Public Distribution, Government of India, 'Linking of Aadhaar with PDS', Press Information Bureau (28 July 2017) [http://pib.nic.in/newsite/PrintRelease.aspx?relid=169225, accessed 26 Dec. 2018].
64. Fieldnotes on conversation with Dakshin.
65. *Ibid*.
66. *Ibid*.
67. UIDAI, 'UIDAI Documents' [https://uidai.gov.in/resources/, accessed 26 Dec. 2018].

UIDAI to provide enrollees with identity verification services. Above the waist lies any public/private organisation using the UIDAI's services to conduct their own work. Aadhaar's implementation was designed as an interplay between two hour-glass architectures: first, a technical hour-glass of software and hardware services with the Aadhaar number; and second, an organisational hour-glass of public and private services with the UIDAI at the waist.

The design team, however, did not initially know that they were implementing an hour-glass architecture, as Pranay—involved in marketing Aadhaar—told me:

> We did not know what this way of thinking in ecosystems was really called. It was only later when discussing our work with some professor, he mentioned that this is hour-glass architecture and it's a well-known strategy in the design of information systems.[68]

> If you look at the waist, you quickly realise that because its function is controlled by a single entity, [the] UIDAI in our case, it looks like a naturalised monopoly. It is easier to implement this if you are a government body but imagine if you are trying to do this as a private company, it becomes a marketing nightmare.[69]

Indeed, the UIDAI is increasingly securing a naturalised monopoly over identity verification services in India which began with efforts to enrol India's population on Aadhaar.

Members enthusiastically brought up Aadhaar's success in enrolling more than a billion residents: 'Aadhaar's user appropriation rate is the same as WhatsApp!'[70] Enrolment presented critical challenges in creating standardised data-collection processes within the ecosystem of public/private agencies. Praful, involved in creating documents to standardise these processes, explained: 'Normally, when the government creates a tender, it is a single tender that covers everything. We didn't believe that would meet our needs'.[71] As the processes were broken down into pieces, every piece had to be defined and documented[72] 'so that the system behaviour could be captured and be more predictable'.[73] These documents (MOUs and RFPs), along with data analytics used to evaluate and visualise the performance of agencies, putatively made interactions within Aadhaar's enrolment ecosystem predictable. They enabled the UIDAI to outsource the problem of procuring the human resources required for enrolment to public–private partnerships while maintaining control over them. On the one hand, these documents were bureaucratic resources for allocating roles in and accountability for enrolment. On the other hand, data analytics was a technical resource for

68. One of Nilekani's talks on Aadhaar's architecture reminded an attendee of the 'hour-glass model' of innovation. See Nilekani and Shah, *Rebooting India*, p. 224. Here, the reference to a well-known strategy is based on research on the internet protocol stack, which shows how it has evolved into an hour-glass over time. See Saamer Akhshabi and Constantine Dovrolis, 'The Evolution of Layered Protocol Stacks Leads to an Hourglass-Shaped Architecture', in *Proceedings of the ACM SIGCOMM 2011 Conference* (New York: ACM, 2011).
69. Fieldnotes on conversation with Pranay, 25 Aug. 2015, Bengaluru.
70. Sanjeev, personal communication, 2 Sept. 2015, Bengaluru. Sanjeev was involved in Aadhaar's proof of concept studies. He drew a comparison between the time taken by WhatsApp to secure one billion active users in 2016 from its inception in 2009, and by Aadhaar to secure one billion enrolments in 2016 from the first enrolment in 2010.
71. Praful, personal communication.
72. UIDAI, 'Aadhaar Product Document'.
73. Praful, personal communication.

automatically auditing the performance of enrolment agencies. Managing enrolment at scale required *both* these resources.

Data analytics allowed UIDAI officials to monitor and evaluate the enrolment of every resident. Of course, the data analysed did not represent the street-level complexities of enrolment,[74] but it offered quantitative measures to evaluate the performance of every enrolment operator *in situ*. Praful further specified:

> The operators were in a three level [organisational] structure. They were part of an enrolment agency contracted by the state government that had a relationship with [the] UIDAI. We had very little control in the field. We had to make sure that the enrolment client was self-sufficient. Even though we had this very long-distance relationship with this operator, they couldn't mess up, the data was safe and secure, and they couldn't tamper with it. We specified the mechanics of data capture by the client—both user data and process data. When the user (operator) logs into the system, starts a new enrolment, moves [from] screen to screen, moves back, corrects data, and so on. Every one of those events is logged. All this data is sent back to the server and processed, so now we have a clear view of what the operator is doing that allows us to even correlate behaviour with quality of enrolment .... We interestingly found that when operators behave badly in one aspect, they behave badly in others also. For operators doing badly, there was sort of a shaming process, where you send back a report highlighting the best and the worst .... If they consistently didn't get their act up, some people were no longer part of the system.[75]

Praful described how every action on the enrolment client's interface was an object of information, an event to be logged, and a resource to map operators' efficiency. The UIDAI officials controlled every enrolment in the field, and by extension, controlled the enrolment ecosystem with these data analytics reports. Ideal conditions for collecting data were enacted by comparing an operator's performance with a statistically-averaged ideal user of the enrolment client.[76]

From pipes to platforms

Thinking through the success of one billion Aadhaar enrolments, members ultimately argue for a shift from *pipes* to *platforms* in designing government services.[77] In the pipe model, control is embedded in designing end-to-end vertically integrated solutions carried out by various government departments in co-ordination with each other. In the platform model, the government only controls a critical part of a service—akin to the waist of an hour-glass—and opens up space for innovation by horizontally integrating the rest of the parts—above and below the waist—to a market created and regulated for delivering the service.

The traditional Public Distribution System (PDS) of food grains exemplifies the pipe model.[78] It requires end-to-end vertical integration of central and state government

74. Ursula Rao, 'Biometric Marginality', in *Economic & Political Weekly*, Vol. 48, no. 13 (2013), pp. 72–7, provides illustrative stories of challenges in enrolling the homeless into Aadhaar. Also see papers by Ursula Rao and Parul Baxi in this special section.
75. Praful, personal communication.
76. The time spent by a statistically-averaged ideal operator on every screen of the enrolment client is the statistical mean of time spent on every screen over all enrolment attempts.
77. See, for example, ThoughtWorks, 'Pramod Varma'; and Nilekani and Shah, *Rebooting India*.
78. Varma uses PDS to instantiate the pipe model in ThoughtWorks, 'Pramod Varma'.

services to provide food security to the Indian poor: 'The central government procures, stocks and supplies grain and absorbs the costs of these operations. Once the grain is allocated to the states, it is the job of the state government to "lift" the grain and distribute it to the retail PDS outlets across the state'.[79] The central government controls PDS implementation by integrating the logistical supply chain with distribution channels, but it spends more resources to address inefficiencies and leakages in delivering food grains. Arguments for improving the PDS ranged from streamlining logistics and distribution through private traders and decentralising the storage of food grains to ensuring portability such that beneficiaries could draw their entitlement from any ration shop rather than being tied to the specific shop at which they were registered.[80] Collectively, these arguments suggest opening the closed pipes of PDS. The pipe model affords consistency in the use of government resources to provide food security, but limits openness.

Members use Aadhaar-enabled services to envision governance-through-platforms. Cash-based subsidies for the PDS piloted in Chandigarh in 2015 showed how the platform model would work in practice.[81] Like cash subsidies for liquid petroleum gas (LPG) cylinders, the PDS can be 'transformed thanks to a thin layer of technology';[82] PDS beneficiaries pay the market price for food grains and the subsidy amount is transferred directly into the Aadhaar-enabled bank account of the oldest woman in a household (per PDS distribution policy). Data on cash distribution can be used to target below poverty line beneficiaries—such as determining eligibility based on income tax—and to evaluate local consumption patterns. In a cash-based PDS, the food-grain supply chain from farmers to PDS beneficiaries will be outsourced to the market for agricultural produce. The platform model of the PDS treats distribution of the cash subsidy as the waist of the hour-glass, with food-grain retail shops above (front-end) and the market for agricultural produce below (back-end) the waist. The platform model affords openness, but limits consistency in how cash subsidies are used to ensure food security.

Members 'believe that the fundamental nature of government is a platform'.[83] This platformised government will collect real-time data on its services to evaluate and supplement their efficiency: 'By correctly structuring incentives, leveraging the power of markets, and designing robust technology solutions generating real-time data, entire bureaucracies can be accommodated on a central dashboard'.[84] The government functions as the waist of an hour-glass 'to create a strong regulatory regime and operate effective social safety nets'.[85] Members address every aspect of governance—ranging from education and health care to taxation and welfare distribution—by creating

79. Bhaskar Dutta and Bharat Ramaswami, 'Targeting and Efficiency in the Public Distribution System: Case of Andhra Pradesh and Maharashtra', in *Economic & Political Weekly*, Vol. 36, no. 18 (2001), p. 1524.
80. Shikha Jha and P.V. Srinivasan, 'Taking the PDS to the Poor', in *Economic & Political Weekly*, Vol. 36, no. 39 (2001), pp. 3779–86; and Anuradha Joshi, Dipa Sinha and Biraj Patnaik, 'Credibility and Portability?', in *Economic & Political Weekly*, Vol. 51, no. 37 (2016), pp. 51–9.
81. Shikha Nehra, 'Ration to Cash, a Harsh Transition', in *India Together* (1 Feb. 2016) [http://indiatogether.org/ration-to-cash-a-harsh-transition-poverty, accessed 12 Dec. 2018].
82. Members used LPG subsidies to exemplify the platform model and instantiate 'governing with data'. See Nilekani and Shah, *Rebooting India*, p. 280.
83. *Ibid*., p. 279.
84. *Ibid*., p. 281.
85. *Ibid*., p. 287.

platforms to regulate and control the ecosystem around them. Such platforms will be implemented by start-ups within the government (like the UIDAI) that later integrate 'into the main body of the government'.[86] Citizens will 'enter [such government services] freely with data and technology [is] used to detect fraud'.[87] The future of data-rich India is a platformised state leveraging real-time collection of citizen data to support personalised state–citizen interactions.

Challenges in transitioning from pipes to platforms

The momentum for these plans and futures, however, has been hard to sustain. It requires extensive investment in infrastructure (electricity, bandwidth, connectivity, etc.), consistency in digital literacy and user competence to leverage the platformised state, and robust socio-technical support networks. Organisational challenges for Aadhaar enrolment range from incorrect data entry,[88] discrimination faced by marginal groups,[89] and the proliferation of informal payments for enrolment (which is supposedly free),[90] to a lack of specificity in the guidelines and protocols for the ecosystem[91] and ineffective control over how much data enrolment agencies can collect.[92] While the UIDAI has been consistent in securing Aadhaar data,[93] the ecosystem of government departments using Aadhaar has had a troubling record in maintaining the security of their respective databases;[94] anyone with the right keywords can use Google to find and download them.[95] Even the enrolment client software has had its own history of misuse,[96] security

86. *Ibid*., p. 292.
87. *Ibid*.
88. Data entry is a primary challenge for any form of data collection. For Aadhaar-specific challenges, see Ashish Rajadhyaksha (ed.), *In the Wake of Aadhaar* (Bengaluru: CSCS, 2013) [https://pad.ma/documents/PI, accessed 26 Dec. 2018].
89. The transgendered and the homeless have encountered more troubles during enrolment. See, for example, Rao, 'Biometric Marginality'; and Ashpreet Sethi, 'Getting Aadhaar Card Big Challenge for Transgenders', *Deccan Herald* (17 May 2012) [https://www.deccanherald.com/content/250353/getting-aadhaar-card-big-challenge.html, accessed 9 May 2019].
90. Operators can charge up to Rs500 (∼US$7.50) for enrolment. See Neha Lalchandani, 'Aadhaar is Free, but Enrolment Centres Fleece Applicants', *The Times of India* (11 Sept. 2017) [https://timesofindia.indiatimes.com/city/delhi/aadhaar-is-free-but-enrolment-centres-fleece-applicants/articleshow/60454881.cms, accessed 9 May 2019].
91. Vidushi Marda, 'Data Flow in the Unique Identification Scheme of India', *Centre for Internet & Society* (3 Sept. 2015) [https://cis-india.org/internet-governance/blog/data-flow-in-unique-identification-scheme-of-india, accessed 9 May 2019].
92. Vivek, personal communication, 4 Sept. 2015, Bengaluru. Vivek was involved in proof of concept studies and pointed out that letting registrars—organisations at the state level (such as banks) entrusted with enrolment—collect more information during enrolment did not work in practice because UIDAI had no control over the data collected by registrars. Initially, registrars could collect enrolment data while collecting other data for their own services (such as opening a bank account). The team ultimately separated enrolment from registrars' other services.
93. UIDAI has consistently denied the possibility of data leaks from the Aadhaar database. Ministry of Electronics & IT, Government of India, 'Aadhaar Data is Never Breached or Leaked: UIDAI', Press Information Bureau (20 Nov. 2017) [http://pib.nic.in/newsite/PrintRelease.aspx?relid=173667, accessed 26 Dec. 2018].
94. Nikhil Pahwa, '#AadhaarLeaks: A List of Aadhaar Data Leaks', MediaNama (24 April 2017) [https://www.medianama.com/2017/04/223-aadhaar-leaks-database/, accessed 9 May 209].
95. Amber Sinha and Srinivas Kodali, '(Updated) Information Security Practices of Aadhaar (or Lack Thereof)', Centre for Internet & Society (1 May 2017) [https://cis-india.org/internet-governance/information-security-practices-of-aadhaar-or-lack-thereof-a-documentation-of-public-availability-of-aadhaar-numbers-with-sensitive-personal-financial-information-1, accessed 10 May 2019].
96. Anand Venkatanarayanan, 'The "Relative Print" Feature in the Aadhaar Enrolment Client', *Kaarana* (23 Jan. 2018) [https://medium.com/karana/the-relative-print-feature-in-the-aadhaar-enrolment-client-7c916954eb54, accessed 9 May 2019].

troubles[97] and 'jailbreak' versions.[98] In response, the UIDAI has blacklisted a number of enrolment agencies,[99] shifted enrolment centres from external sites to government premises,[100] continuously updated the enrolment client and MOUs for data collection,[101] and taken action (albeit contested) to improve the ecosystem's data security practices.[102] Government has many moving parts and all of them do not align at the same time.[103]

Furthermore, authentication remains an ongoing challenge for the Indian bureaucracy, especially within elderly and manual-labourer populations. Right to Food activists have consistently talked about failures in Aadhaar authentications resulting in denial of government services.[104] These failures range from lack of digital infrastructure or distinctive bodily features for biometric authentication to bureaucratic incompetence in implementing Aadhaar-enabled services. They have publicised incidents ranging from a girl dying of starvation in Jharkhand because her family did not have an Aadhaar-enabled ration card,[105] to thousands of elderly people in Rajasthan being incorrectly declared dead on their Aadhaar-enabled pension records,[106] to point to the failures of Aadhaar in scaling real-time collection of citizen data. Such failures have only complicated state–citizen interactions rather than personalising them. Marginal populations facing authentication problems must constantly undertake socio-political and material work (organising public hearings, filing complaints, standing in queues, and so on) to reclaim and maintain their standing as unique citizens. Platformisation may address problems of leakage in the last-mile delivery of

97. See Anand Venkatanarayanan, 'Aadhaar—A Self Certified ID', *Kaarana* (2 May 2018) [https://medium.com/karana/aadhaar-a-self-certified-id-a63e299b36f5, accessed 9 May 2019], for a chronology of security checks on the enrolment client and their exploits.
98. Messages to sell the 'Jailbreak' version of the client have proliferated on WhatsApp. See Saikat Datta, 'India's Ambitious Digital ID Project Faces New Security Nightmare', *Asia Times* (1 May 2018) [https://www.asiatimes.com/2018/05/article/indias-ambitious-digital-id-project-faces-new-security-nightmare/, accessed 9 May 2019].
99. TNN, '49,000 Fraudulent Operators Blacklisted, says UIDAI', *The Times of India* (12 Sept. 2017) [https://timesofindia.indiatimes.com/city/delhi/49000-fraudulent-operators-blacklisted-says-uidai/articleshow/60470131.cms, accessed 26 Dec. 2018].
100. Press Trust of India, 'Aadhaar Centres Only at Government Premises from September', *The Economic Times* (2 July 2017) [https://economictimes.indiatimes.com/news/economy/policy/aadhaar-centres-only-at-government-premises-from-september/articleshow/59408554.cms, accessed 9 May 2019].
101. Venkatanarayanan also lists updates to the enrolment client in 'Aadhaar—A Self Certified ID'. Vivek talked about changes in MOUs to deal with the unintended consequences of letting registrars collect more than enrolment data. Vivek, personal communication, 4 Sept. 2015.
102. There is an ongoing contest between independent data security researchers and the UIDAI on whether it is doing enough to address Aadhaar data leaks. See, for example, Anivar Aravind, '#AadhaarLeaks: Why UIDAI and PwC are Responsible', *Kaarana* (4 May 2017) [https://medium.com/karana/aadhaarleaks-why-uidai-and-pwc-are-responsible-ac5adc49b4f2, accessed 10 May 2019]; and Srinivas Kodali, 'A Billion Users, but No Bug Reporting Policy', *Kaarana* (4 Dec. 2017) [https://medium.com/karana/a-billion-users-but-no-bug-reporting-policy-20ce35122795, accessed 10 May 2019]. See also K.J. Shashidhar, 'The UIDAI has Filed 30 FIRs for Violations of the Aadhaar Act', MediaNama (22 Dec. 2017) [https://www.medianama.com/2017/12/223-uidai-filed-30-firs-violations-aadhaar-act/, accessed 10 May 2019].
103. Ranjit Singh and Steven Jackson, 'From Margins to Seams: Imbrication, Inclusion, and Torque in the Aadhaar Identification Project', in *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (Denver, CO: ACM, 2017), pp. 4776–824.
104. My fieldwork with Right to Food activists involved participating in their quantitative surveys on PDS implementation, attending their all-hands meetings and meetings with PDS beneficiaries, reading their letters to bureaucrats, and interviewing them.
105. Aarefa Johari, 'Denied Food Because She Did Not Have Aadhaar-Linked Ration Card, Jharkhand Girl Dies of Starvation', Scroll.in (16 Oct. 2017) [https://scroll.in/article/854225/denied-food-because-she-did-not-have-aadhaar-linked-ration-card-jharkhand-girl-dies-of-starvation, accessed 9 May 2019].
106. Anumeha Yadav, 'Rajasthan's Living Dead: Thousands of Pensioners without Aadhaar or Bank Accounts Struck Off Lists', Scroll.in (6 Aug. 2016) [https://scroll.in/article/813132/rajasthans-living-dead-thousands-of-pensioners-without-aadhaar-or-bank-accounts-struck-off-lists, accessed 9 May 2019].

government services, but it also creates the conditions for new kinds of leakages in securing datasets. The problems of governance manifest differently, but they persist.

Conclusion: Citizens as data records

India's population inevitably raises challenges of managing scale for any project that spans its diverse geography. Managing scale not only requires translating real-world things into abstract entities, but also translating the manipulation of abstract entities into real consequences. Members accomplished both these translations by blending the cultures of IT start-ups and the Indian bureaucracy. Aadhaar is a state-managed identification infrastructure designed to provide identity verification services to all Indian residents. It is also a digital platform creating new distributive regimes of control for public–private partnerships in government services. It exemplifies the emergence of platformised infrastructure projects in India. This paper follows members' work of translating a resident into a unique data record, and then using this data record to change government services. It examines the emergence of governance-through-platforms as the future of India's development. Members envision bureaucracies as centralised dashboards, and government as the arbiter of the circulation of real-time citizen data in such future(s). Ultimately, they conceptualise the Indian state as a database of citizen records and Indian citizens as unique data records transacting with dashboards of public/private services. Such services rely on the proliferation of data analytics to provide personalised services to Indian residents as both citizens and customers.

In describing how scientists maintain laboratories as a locus of power, Latour ultimately argues that 'No one has ever seen a laboratory fact move outside unless the lab is first brought to bear on an "outside" situation and that situation is transformed so that it fits laboratory prescriptions .... Since scientific facts are made inside laboratories, in order to make them circulate you need to build costly networks inside which they can maintain their fragile efficacy. *If this means transforming society into a vast laboratory, then do it*'.[107] In this paper, I have described how members maintained Aadhaar as a locus of power. Between the mundane work of managing enrolment at scale, and the everyday struggles of marginal residents in authenticating their identity, Aadhaar's infrastructural processes will ultimately be 'black-boxed', that is rendered invisible in order to practically establish the bureaucratic authority of Aadhaar numbers as stable markers of residents' identities. The 'thick' personhood of a resident is standardised along 'thin' and reductive data categories to create conditions for the circulation of Aadhaar numbers. Residents are not only expected to express their identity in these data categories, they are also expected to competently manage them in order to claim their rights as citizens and to participate in India's formal market. It is only under conditions of its infrastructural set-up that Aadhaar can maintain its fragile efficacy in ensuring one-to-one correspondence between a number and an enrollee: *if this means transforming a nation-state into a vast database, then do it*.

Approaching the state as a database inevitably produces a situated translation and fragile account of what the state is. Most databases do not span the entire

107. Latour, 'Give Me a Laboratory', p. 166, emphasis in original.

population of a nation-state, they only represent the population enrolled. Moreover, being on a database does not necessarily mean success in effectively using it. Databases as accounts of populations are situated translations; what makes these accounts fragile is the instability of the networks of trust needed to not only create, but also maintain these databases as resources for governing a population. The construction and use of databases often represent a function of the state—a government service—rather than the state itself. As a database without a bureaucratic purpose, Aadhaar allegedly becomes an ongoing real-time census of the basic know-your-resident information (name, age, gender and residential address) of India's people. While it has successfully enrolled most of the resident population, rendering it the best effort at representing India's population, failures in its authentication services and legal disputes over its use indicate the fragility of the networks of trust within its ecosystem. Aadhaar is a situated translation; it is a fragile account of the Indian state.

As 'ecosystem-builders',[108] members achieved control by breaking down the problem of unique identification into programmable and interconnected smaller problems. Each smaller problem was an occasion to explore the technological imperatives and legal frameworks maintaining the balance between public and corporate interests. For example, members created competition in the market of unique identification by using commodity hardware and multiple de-duplication algorithms. However, implementing a similar model for organising human resources for Aadhaar's key processes has engendered problems of managing performance at scale and of consistency in legitimate use. *The technical properties of platforms do not seamlessly map onto the organisational processes that sustain them.*

Finally, the platformisation of the infrastructure for Indian government services will continue. Aadhaar is only one among the many platformised infrastructure projects being built in the country.[109] This leaves us with the problem of how to map and analyse the ongoing transformation of India towards a platformised state over time and across places. This paper has shown that each hour-glass comes with its own challenges in negotiating modularity and power between the waist and the components above and below it. Hour-glasses do not resolve the problem of control, they redistribute it. Its redistribution diffuses accountability. Different bureaucracies curate their own Aadhaar-enabled citizen records. Thus, the accountability of maintaining citizen records gets diffused across bureaucracies. Recent controversies over leakages of Aadhaar data demonstrate this diffusion of accountability. Thus, mapping a platformised nation-state requires analytic attention to contests and consensus over how its hour-glasses maintain openness, competition and consistency in legitimate use within their ecosystems. After all, platforms need pipes too.

108. Plantin *et al.*, 'Infrastructure Studies Meet Platform Studies', p. 307.
109. The TAGUP report is an excellent starting point to identify platformised infrastructure emerging as National Information Utilities (NIUs) in India such as the Goods and Services Tax Network (GSTN) launched in 2017. TAGUP, 'Report of the Technology Advisory Group'.

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ORCID

Ranjit Singh http://orcid.org/0000-0001-6453-8676