

LAST MILE ACCESS STUDY



BUILDING
OFFLINE
ARCHITECTURES
TO ENABLE
BETTER
ACCESS
TO THE
STATE

Last Mile Access Study

*Building offline
architectures to enable
better access to the state*

Lakshmee Sharma
Sarayu Natarajan
Kanimozhi Udhayakumar

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Glossary

Public Grievance Redressal (PGR)

Mechanisms to identify and report public grievances to relevant authorities

Includes complaint interface, workflow, tracker/dashboard

Offline Architecture/Social Architecture

Social mechanisms or structures (not technological) that work around technology. These include, but are not limited to, networks, social capital, trained intermediaries who support access to technologies, training programmes, etc.

Intermediation

The process of mediating access between the citizen and the state. Intermediation may differ based on a given socio-political or cultural context. For example, in an informal settlement, an informally chosen leader may act as a bridge between residents and the government.

Questionnaires/guides/probes

A questionnaire is a research instrument consisting of a series of questions for the purpose of gathering information from respondents. It can be carried out face to face, or by telephone, computer or post.

Last-mile citizens

Citizens who have difficulty in accessing the state due to a set of socio-political and economic vulnerabilities. Citizens at the fringes of the state. Structural vulnerabilities (e.g. caste/religious minorities), identity (e.g. LGBTQ minorities), or disabilities.

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A note from our research partners

"We are on a mission to ensure ease of living for all citizens. We believe technology is an enabler; however, we understand that technology by itself is far from enough. The "digital divide" is a reflection of many deeper social and economic divides, and we will need a jugalbandi of online and offline initiatives to bridge it. This study is a promising start to understanding how online and offline architectures interact, and to better understanding how to reach and serve every citizen."

Viraj Tyagi, CEO

eGovernments Foundation

"Omidyar Network India is committed to ensuring that all Indians, especially the Next Half Billion, are able to access high-quality public services with ease. Technology-led initiatives such as the National Urban Innovation Stack (NUIS) have been able to do just that - they have enabled citizens to apply for services, get requisite municipal approvals, raise grievances and get them addressed more easily than ever before. However, more needs to be done to ensure that the benefits of such initiatives truly reach the most disadvantaged in our cities. The 'Last Mile Access Study' helps uncover some of the issues that prevent effective last mile delivery and the steps that can be taken to address these issues. It highlights the importance of partnering with existing offline intermediaries such as community leaders and political representatives that help ensure every Indian can reap the benefits of tech-enabled public service delivery"

Bharath Visweswariah, Director, Investments

Omidyar Network India

Introduction: Claiming the State

*How can we build to
ensure access to the state
through digital platforms
for the last mile?*

A growing body of evidence suggests that the urban poor are excluded from access to the municipality (Krishna, 2011). There is the opinion and some evidence (Deloitte Report, 2015) at the ecosystem level that digital pathways and channels to request services may improve such access to those in the last-mile.

However, despite growing access to data and availability of technology, citizens' access to the municipality to claim government services, especially when services are digitally mediated, is still low. Why and how can the societal ecosystem address this?

Through research, we have attempted to understand the breakdowns in digitally-mediated state access despite increasing internet availability. We found that the core limitations lay in a lack of awareness of the existence of such solutions, and the ability to navigate them. In addition to this, we also found significant gaps in awareness of entitlements and rights among last-mile citizens, and a breakdown of ability due to a general lack of trust in the state. To offset such barriers, we found that citizens rely on a layer of formal and informal, offline mechanisms or *intermediaries* that facilitate state access in various capacities. In short, they constitute human architecture that bridges the access gap between citizens and the state.

Using our exploration of such gaps as a starting point, we explore the relevance of offline intermediation architecture as a solution. In particular, given the finding that most technology use is intermediated, it may make sense for technologists and the wider ecosystem to engage with intermediaries to develop solutions for last-mile digital adoption.

This research uses a combined field and data perspective to enhance the visibility of the state for its citizens. We attempt to unpack the barriers to access experienced by the urban poor in reaching the municipality and in using digital services, and surface solution pathways. Specifically, we explore the viability and limitations of intermediation as a solution for enabling wider access and use.

Need for this research

For some last-mile urban communities, existing social, occupational, and legal barriers add a layer of inaccessibility (Corbridge, Williams, Srivastava and Veron, 2005) to the municipality that digital solutions may not currently be able to overcome. For instance, social determinants like class and caste might act as hurdles for citizens striving to access the municipality to address their grievances or civic complaints.

Moreover, urban informal settlements are poorly serviced by municipalities. Socio-economic conditions and political economies imply that the urban poor have to navigate through multiple complexities to reach the state. Besides, the language of bureaucratic formality is a significant hindrance.

Benefits of this research

We believe this research has benefits for states and urban local bodies (ULBs), as well as platforms that have societal aims. As these technologies are deployed at scale, it is worthwhile to engage with the social realities in which they operate. Research into ground realities can inform the design and development of offline architecture enhancing citizen access. States can use this as a way to reach underserved communities by adopting meaningful strategies. ULBs have deployed resources towards technology, but the insight into social factors will inform the strategic deployment of additional resources. For instance, existing architecture of support such as municipal workers, who are already a point of everyday contact, can bolster access to services through digital solutions. This research may also inform resource allocation in the sector by investors and philanthropists.

The general benefits are derived from a specific context. Our research is rooted in the work of eGovernments Foundation (eGov).¹ eGov has been working on taking urban governance digital for over 15 years. More than 600 cities across four states currently use eGov's digital platforms and solutions to carry out a number of functions, ranging from administration, revenue gathering, and expenditure management to delivering citizen-facing services such as building plan approvals, registration of births, deaths and marriages, and public grievance redressal. The use of such public digital platforms benefits both ULBs—simplifying and streamlining work processes, financial management, and data collection and reporting—and citizens, who can interact with their local government more quickly and easily.

1 We set the research context in eGovernments Foundation's DIGIT solution, India's largest open source platform for urban governance

Executive Summary



This section provides an overview of the general storyline surfaced by this research. The aim of this section is to lay out the subsequent sections that detail each node of the storyline.

Technology is empowering, especially for migrants and stigmatised communities

■
We (trans people) still aren't accepted by people in general, so what can we expect from the government?"

– *Anantapur citizen*

Our fieldwork corroborated our assumption that technology has significant benefits for last-mile communities, including groups that face significant vulnerabilities and stigma. For instance, members of the trans community vocalised their preference for a digital interface when interacting with the state, as they might otherwise face discrimination and consequent trauma if they visited municipal offices in person. This was echoed by individuals who live in informal settlements without any recognition from the state, particularly migrants. A digital interface—if effective and easily available to them—would provide a protective layer of invisibility between them and the state, thus enabling ready access to services and amenities. Additionally, digital interventions protect frontline municipal workers and ward officials by providing an accessible record of transactions and action taken, which enforces accountability by proving that action is taken. Digital interventions also protect workers by preventing unsavoury interactions with disgruntled citizens.

Key informants and civil society organisations suggest that a digital interface to mediate state services could be especially useful for daily wage labourers, whose occupational barriers mean that they experience opportunity costs in spending time accessing the state in person. In the absence of a digital interface (or lack of awareness of an existing one), people experiencing such vulnerabilities rely on offline and human architecture to access services of the state.

However, there are significant breakdowns in awareness and ability around tech use, and these are magnified for the marginalised

■
"If there's a sanitation issue or any issues in the neighbourhood, we go to this person named Suresh who lives here, he collects the complaints and solves the problems for us. We trust him."

– *Guntur citizen*

Citizens and ward officials experience breakdowns in access along an *awareness and ability* frame. However, the two features manifest differently for ward officials and last-mile citizens. For instance, last-mile citizens do not have awareness of entitlements from the state, and lack awareness of the existence of channels (such as IVRS number, web portal and mobile application). Ward officials do not have awareness of the existence of digital channels like apps, or how to use them.

In terms of ability among last-mile citizens, the incapacity to use the local variance of the DIGIT app resulted in a preference for WhatsApp and phone calls. This was mirrored by ward officials whose inability to use the app often led them to promote use of offline channels like phone calls and in-person check-ins or WhatsApp to deliver services to

citizens. There was also a breakdown in ability to approach the state for vulnerable citizens due to an erosion of trust in the state brought on by experiences with bureaucratic processes and corruption.

A combination of these breakdowns led last-mile citizens to rely on a *layer of intermediation* to reach the state. An intermediated approach meant that a layer of human, offline architecture lies between the citizens and the state that actively work on bridging the access gap brought on by breakdowns. We witnessed a range of intermediaries driven by a range of motives, and functions spanning capacity development, awareness dissemination, and rent-seeking.

To enhance service delivery and adoption, work with intermediaries and leverage use patterns

■
"We don't try to reach the government directly, we prefer to go through trusted channels that we personally know."

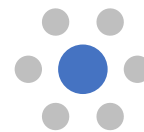
– Amritsar resident

We recommend a *two-pronged approach* of intermediary outreach and proactive adoption to support the uptake of technological interventions for state access at the last mile



INTERMEDIATION

Partnering with existing networks utilised by last-mile citizens to reach the state, and relying on their capacity to amplify awareness about entitlements and the existence of technological solutions may increase adoption. Further research on types of intermediation popular in each context and the natural incentives will enable differentiation strategies. Additional measures must be taken here to safeguard against this structure replicating or amplifying existing inequalities.



PROACTIVE ADOPTION

Using data insights which have identified areas with pre-existing dispensation towards digital capacities and proactive adoption strategies could help self-serve channel adoption considered in a state-specific context. Prior to proactive adoption, the media consumption habits and preferences should be understood in a disaggregated way (such as among youth, new urban areas, etc).

Literature Review



This section discusses the existing resources and literature on access to the municipality for last-mile and marginalised citizens.

The existing discourse on urban citizens and state services in India widely details the inequality in access for those in the last mile. Insights suggest breakdowns at the institutional level due to limited state capacity and budget management may be behind urban infrastructure deficit and difficulty in service delivery for citizens (Ahluwalia, 2017). However, specific breakdowns in access pathways exist for the urban poor, especially for those navigating informality in both labour and housing. Urban informality intersects with poverty and precarious work in informal settlements or slums. Citizens in the last mile experiencing this type of informality often face significant roadblocks in not only reaching the state, but even sighting the state for basic services and entitlements.

The urban poor often rely on informal channels to reach the state for municipal services due to a range of vulnerabilities (Berenschot and Bagchi, 2020). In certain cases, there exists a possibility for exploitative negative bottlenecks that provide services to disenfranchised citizens in exchange for votes. Exploitation of informal dwellers due to vote-bank politics in India is a widely documented phenomena (Breeding, 2011).

However, in the absence of easy access to the state, typically granted by social and economic capital, citizens in the last mile rely on building local networks of trust and pathways to access basic amenities and rights by leveraging local political capital and collectivisation (Auerbach, 2017). These 'institutions in the middle' (Krishna, 2011) act as a layer of trust between marginalised citizens and the state, playing a variety of roles from capacity building and increasing awareness of basic rights and entitlements to, most importantly, mediating between the state and citizens.

There is an argument for digital governance as a viable layer to offset exploitative situations brought on by corruption, and to improve municipal performance by using real-time data and user experience to dynamically bridge gaps (Javed, 2019). However, chequered public infrastructure, and lack of awareness and ability to utilise digital solutions stymie the full potential of digital governance and run the risk of leaving already marginalised users behind. In the Indian context, the digital divide adversely affects the urban poor, who already have a history of facing access barriers to the state. As a result, they become a crucial demographic that are left out of the fold of inclusive digital governance (Parsheera, 2019).

This research offers an empirical look into the existing access gaps to digital pathways, while the alternative mechanisms utilised by last-mile citizens may offer strategic insights to leverage existing channels to enhance adoption of digital solutions in the last mile.

Research Methodology



This section details the methodological approach adopted to explore municipal access to last-mile citizens across three states. The section also provides qualitative depth on the sites selected, and typology of the sample interviewed.

	Andhra Pradesh	Punjab	Chennai
ULBs	Guntur, Kakinada, Anantapur	Jalandhar, Amritsar	Chennai
Sample	21 F, 7 M, 1 Trans/ prefer not to say	10 F, 11 M, 1 prefer not to say	19 F, 13 M, 2 Trans
	Age: 24-50	Age: 19-52	Age: 24-60
	10 ward officials	10 ward officials	
Features	Citizens from informal settlements/slums	Citizens from informal settlements/slums	HIV +ve and persons with disabilities
	Fisherwomen	Migrant labourers	Caste and religious minorities
Experts	AIWC, CFAR, Fisherwomen's Assn., CDMA official	Sanjhi Sikhiya, SEWA Bharat, IVE Children, Ministry of Urban Devt., Mantra For Change	CFAR, Community based key informants

An exploratory study with fieldwork and data analysis

We undertook *qualitative fieldwork across selected ULBs in three states* to understand key access breakdowns on the ground. We buttress this with *data analysis across multiple ULBs in three states* to document the broad trends of last-mile citizens' municipal access, preferred channels of use, and vulnerability correlates in the context of digital solutions designed by eGovernments Foundation as well as offline solutions operating in the same ULBs.

In this research, we adopted an exploratory approach to:

- Understand breakdowns in digitally-mediated state access
- Surface and explore solution hypotheses
- Set up a foundation for further research

The combined approach of data and fieldwork ensures methodological robustness, by gleaning insights from broader trends and corroborating them through empirical evidence from the field.

The approach enables us to posit a set of hypotheses for solutioning for future research and testing through fieldwork.

What does this study do—and what does it not do?

While this study finds one approach to enhance adoption in the last mile (intermediation and proactive adoption), it does not attempt to negate the validity and effectiveness of other approaches, or establish its relative impact compared to other approaches such as design changes, or development of state capacity.

This study focuses on examining breakdowns in access in the context of digital solutions for last-mile citizens and ward officials. It does not focus on documenting user experience. Therefore, it does not account for functional breakdowns of use of the interface.

The study does not attempt to prove causal links between predictors and their impact, nor does it prove the quantum or direction of impact of a specific solution. The study does not conduct behavioural experiments in the field. Further, while state capacity may vary across the ULBs studied, the research does not attempt to control for this, nor does it incorporate possible variations in state capacity in its hypotheses.

Tele-fieldwork

In March 2020, due to the nationwide lockdown brought on by the COVID-19 pandemic, we realigned our approach to fieldwork to continue to access last-mile citizens for the field interviews. After an internal discussion and conferring with other research organisations on their approach and methodology, we determined that the *tele-fieldwork* approach allowed us significant advantages in reaching a wider set of participants.

Prior to piloting the tele-fieldwork methodology, we ensured that we were:

- Able *to successfully repurpose the instrument* in a meaningful way to elicit relevant insights around points of breakdown experienced by last-mile citizens in accessing municipal services
- Able to capture a diverse range of vulnerabilities and experienced access breakdowns for last-mile citizens
- Able *to identify potential solutioning strategies* and the *feasibility to soft-test principles* in future studies
- Able to maintain *ethical norms in field research* (and ensure informed consent) without adding to stressors of current sociopolitical climate
- Able to ensure availability and representativeness by adding more ULBs, and doubling the number of interviews per state.

Ethics of field research

Prior to undertaking the study, Aapti Institute conducted an internal review of the proposed methods and agreed to seek informed oral consent. Accordingly, all interviewees were asked for oral consent for interviews after the purpose of the research was clearly explained. If anyone refused, the interview was not conducted. In any case, all names have been changed to protect privacy. Photographs which show people have been taken with their consent.

In cases of extreme distress due to the pandemic, we shared a list of immediate resources respondents could utilise, including details on access to emergency rations, and phone numbers of hospitals and organisations aiding in COVID-19 relief.

Implications of shift to tele-fieldwork

We internally reviewed the benefits and disadvantages of tele-fieldwork

Pros

Captured a wider range of vulnerabilities even in remote fieldwork—e.g. trans persons, persons with disabilities, HIV +ve persons.

Connected with civil society organisations to understand their experience in mediating between citizens and state.

Cons

Set aside focus group discussions, but offset the structural effects by increasing the number of ULBs and total number of interviews per state.

We could not access Chennai ward officials as they were occupied with COVID-19 response efforts.

Site and sample selection

To build the sample remotely and ensure diversity and representation, we followed a combination of informant-led snowball sampling in each state, with a minimum of three different informants acting as key nodal points to facilitate snowballing.

The nodal points included government personnel, civil society organisations, community workers, and researchers.²

The wide set of nodal points for snowballing ensured robust key informant interviews, diversity of responses, and representation which allowed us to make effective structural linkages.

To access ward officials, we utilised publicly available information to cold-call officials in selected ULBs, and schedule interviews.

Sample typology of last-mile citizens: Mapping vulnerabilities

Tele-fieldwork enabled us to widen our reach to include respondents from categories of vulnerabilities that may not have been as evident to us in an in-person field engagement. To access truly last-mile citizens from marginalised groups, we approached civil society organisations that work on a range of issues including education for all, basic rights and services for slum residents, and public health. Some of the key categories of vulnerabilities across all three states are as follows:

² See Annexe 1

1 Informal settlements and houseless citizens

This category includes residents of slum settlements, who often occupy land illegally. Depending on the age of the slum, local leadership and political economy, they run the risk of demolition if noticed by the municipal corporation. This hinders their access to the state and state services.

2 Daily wage workers

Daily wage workers are in a precarious occupational position because they are paid by the hour or day. This barrier often keeps them from approaching the municipal offices to avail of a service, as they cannot afford to miss work and, consequently, wages.

- | | | | |
|---|---|--|--|
| 3 | Sexual minorities | Members of the LGBTQ community, especially those whose identity markers are visible, risk being subjected to discrimination by unscrupulous municipal officials. Trans people, in particular, are often subjected to sexual harassment and abuse, which may hinder them from accessing state services. | |
| 4 | Migrants | <p>Migrant communities, especially rural to urban labour migrants, form a part of the urban poor who reside in informal settlements. Migrants often find themselves at a loss for cohesive local networks that would have enabled them to reach the state, and avail of essential services.</p> <p>Migrants also run the risk of disrupting vote-banks created by politicians, thus further limiting their access to basic services.</p> | <p>"I tried to help some migrants in a settlement nearby to access rations here, but the local MLA didn't allow it because the rations were reserved for his constituents."</p> <p>– SEWA worker in Moga</p> |
| 5 | Disabilities and stigmatised illnesses | <p>Last-mile residents who may be differently abled or suffer from illnesses with attached social stigma (HIV/AIDS) have reported that in addition to structural barriers like socioeconomic background or caste, they've experienced further breakdowns in physically accessing the state, and faced discrimination if others came to know about their condition. The last-mile respondents in this study accounted for one or more of the vulnerabilities mentioned above. In general, we sampled respondents from a lower socioeconomic background.</p> | |

The last-mile respondents in this study accounted for one or more of the vulnerabilities mentioned above. In general, we sampled respondents from a lower socioeconomic background.

Sample typology of ward officials:

We accessed ward officials through publicly available databases of numbers. We approached more than 100 ward officials across the three states to obtain a total of 20 interviews. The difficulty in access was largely due to the unavailability of ward officials as they were engaged in COVID-19 relief measures. We attempted to capture experiences of ward officials from a wider number of ULBs in each state to enable us to build

structural linkages. Although we did not attempt to sample ward officials based on a set of demographic criteria, the key criteria that emerged were *age*, *gender*, and *ULB size*.

Expert interviews:³

We conducted 10-12 expert interviews with a network of local NGO workers, academicians, and administrators to ensure qualitative depth of the findings.

These interviews largely informed the solutioning as they showed the need for greater dissemination of information on digital solutions in geographies of exclusion, and posited the need to tap into existing civil society nodes with established community ties and networks to amplify information about digital solutions, and their use.

Qualitative Coding

Through the process of interpretative analysis and researcher subjectivity, the field data was coded into themes along breakdowns of access, knowledge, and infrastructure, and demographic variables.

The process of qualitative coding informed us of larger breakdown along awareness and ability, which formed the key metrics to understand barriers to access.

Data analysis

Data analysis has been used to derive insights from data at two levels.

- In the first level of analysis, we used the data to explore eGovernments' (eGov) reach to citizens. We explored two aspects of reach—usage trends across years and mode of access to the municipality (channel preference).
- In the second level of analysis, we explored the relationship between structural factors (urban informality, demographics, community characteristics) to understand the correlates of municipality access, especially channel preferences.

3 Full list in Annexe 1

For both analyses, we primarily used Andhra Pradesh data, made available through the CDMA dashboard,⁴ while Punjab and Chennai data have been used to supplement the findings. We relied on Andhra Pradesh data as the dashboard provides comprehensive and dynamic data. We used static tables for Punjab and Chennai analysis, made available on request from the states. Our partnership with eGov has been helpful in interpreting and comprehending the data from different states.

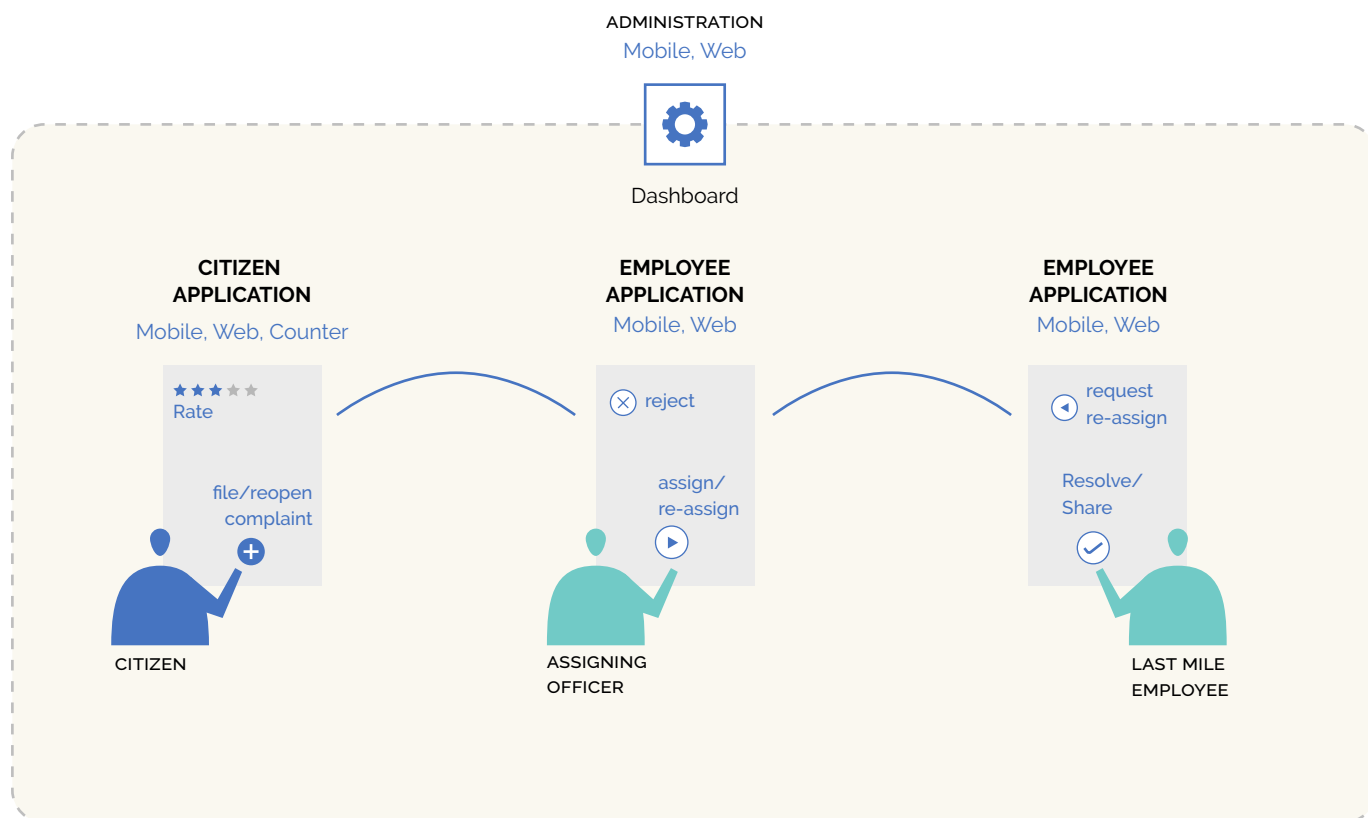
Limitations

The data captures only those who have used the system and does not account for or describe the experiences of those who do not/ have not used the system. For the second level of analysis, we have used social variables from the 2011 census data as this was the latest comprehensive data set available. Therefore, we need to be cautious in interpretation, and rely on fieldwork findings and literature.

Mapping the Gap: Navigating breakdowns towards access



In this section, we posit the findings of technological breakdowns in access along awareness and ability, and delve into the disaggregated breakdowns by state. We also expound the differentiated patterns of use of solutions.



To empirically understand municipal access for last-mile citizens and the role of technology in increasing this access, we chose three states where solutions designed by eGovernments Foundation were deployed. Within Punjab and Andhra Pradesh, we selected multiple ULBs where we conducted tele-fieldwork with last-mile citizens. We conducted interviews with ward officials from selected ULBs to understand the breakdowns they face in utilising technological solutions to deliver services, and specific breakdowns if any, in servicing residents from typically last-mile contexts.

The data from fieldwork was further qualitatively coded to form a set of metrics along which access breakdowns were analysed. For both citizens and ward officials, the crucial breakdowns were along the nexus of *awareness and ability*. In addition to this, we also explored demographic variables to further explore differentiators based on age and gender. The findings are further disaggregated across the three states.⁵

⁵ See Annexe 2

1

The Awareness and Ability Frame

We coded the 100+ interviews of citizens and ward officials to find that despite the benefits of technological access, there existed breakdowns along the nexus of *awareness and ability*. There exists a general lack of awareness, which is a primary access barrier to the state, and a lack of ability is seen among specific demographics among both citizens and ward officials that hinders access to and delivery of services, respectively.

They can be further listed as follows:



AWARENESS

Awareness of the existence of solutions, specifically digital solutions that aim to ease access to the state.

Awareness of basic rights and entitlements that citizens are owed by the state.



ABILITY

Ability to navigate self-serve, and digital solutions.

Ability to trust state mechanisms due to bureaucracy, or general fear of the state.

The breakdowns of awareness and ability are differentiated along state lines and also for different social categories. Migrants and women experience structural difficulties in navigating the state and technology, having a compound effect on their ability to access the state through digital means. States also displayed variation in the levels of awareness of entitlements and digital solutions. These can be linked to divergent trajectories of digitisation of governance at the state level, the nature of state politics and social movements, as well as general levels of digital literacy (Bhatnagar, 2008).

2

Plotting the variation in breakdowns, channel preference, and state access

■
“We prefer to go to Pearl madam (NGO) to get our civic issues solved.

– *Municipal worker and last-mile citizen in Amritsar*

■
“We just downloaded the app, we don't know how to use it, it's a hassle.”

– *Ward official in Jalandhar*

Across the states, there is a generally moderate level of awareness of entitlements and rights owed by the government, and a lower level of *awareness* of digital solutions to reach the state. The awareness of existing digital solutions varies across states and ULBs amongst citizens, but there is an overall lower familiarity with navigating the digital interface among ward officials.

■
“See, the government isn't there to serve people like us, we don't approach the government for anything.”

– *Migrant citizen from Jalandhar*

■
“It is really complicated to navigate the app, we don't bother with it, the citizens know our number and call us directly if there's any issue.”

– *Kakinada ward official*

Across the three states, there is a generally higher level of mistrust in the government and its mechanisms among last-mile citizens, and significant breakdown in *ability* and digital literacy among migrant labourers. Among ward officials, there is a generally lower digital literacy across the states, especially for older ward officials. There are also instances of inability to navigate the process that leads to breakdown, and results in rejection of request.

The observed variations can be linked to state-level characteristics including the proclivity for technological interventions in governance, greater sociopolitical consciousness among last-mile citizens, and longer runway of eGovernments Foundation's presence in the state.

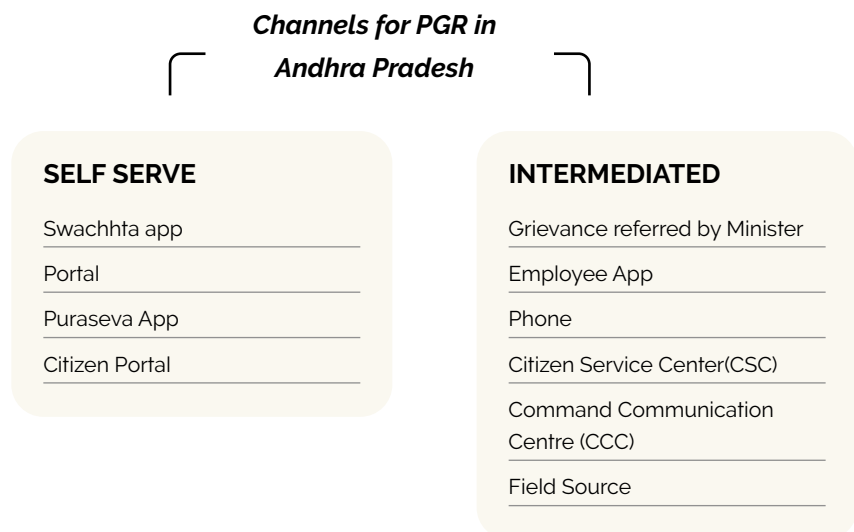
ANDHRA PRADESH (AP)

The government in Andhra Pradesh has a longer history of introducing technological interventions in governance. It also has a comparatively longer relationship with eGovernments Foundation—eGov has been present in AP since 2012. In Andhra Pradesh, we found a generally *high awareness of entitlements* among last-mile citizens in terms of services owed to them by the state. They also exhibited *high awareness of the existence of digital solutions* such as the PuraSeva app, and offline solutions such as the IVRS phone number. They had generally higher visibility of the state and access to the municipality.

AP from the data

There are 112 ULBs in Andhra Pradesh, which are classified into seven different types for ease of analysis. Based on the size of the ULBs and the municipal government budget, the ULBs are classified as follows—Corporation, Grade I, Grade II, Grade III, Nagar Panchayat, Special Grade, Unclassified.⁶ All district headquarters are Corporation ULBs, accounting for around 60% of the urban population.

Based on whether the citizens themselves have control over triaging of the complaints, the channels are classified into self-serve and intermediated channels. Out of the 10 channels mentioned on the AP CDMA dashboard, four are self-serve and the remaining six are intermediated (Figure 1).

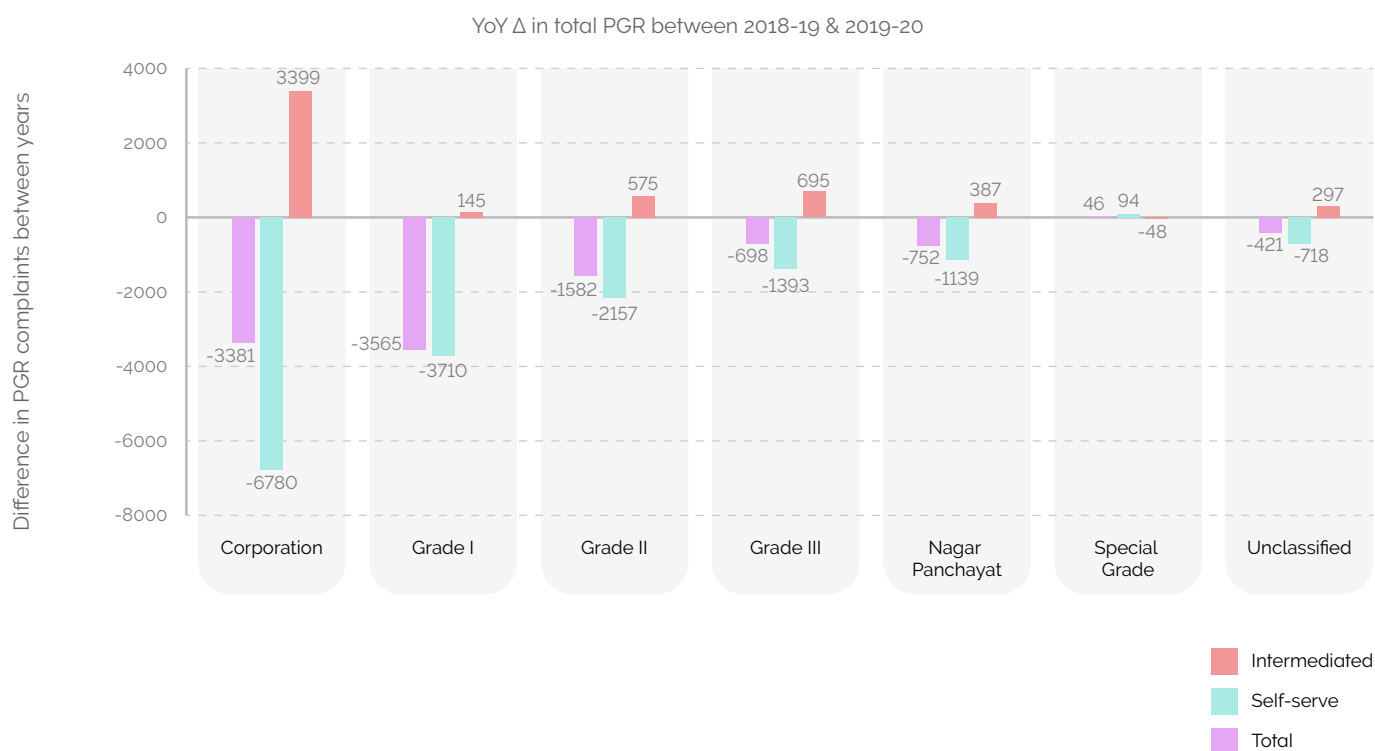


▲ **FIGURE 1**
Channel classification in Andhra Pradesh

The data reveals that at the ULB level, eGov's platform has not gained traction across ULBs between 2018-19 and 2019-20⁷ (Figure 2). Most ULB types, except for Special Grade ULBs, display drops in the aggregate numbers of PGR complaints, while the Special Grade ULBs register a small increase. It is possible the decrease may be the result of the state and parliamentary elections of 2019. It is known that politicians rely on increased service delivery in the weeks and months prior to polling in order to secure votes (Khemani, 2004). This spurt in service may have elevated the numbers in 2018-19, mainly in the months prior to the elections. The dip in the next year may reflect a normalisation post the spurt. Also, in 2018-19 eGov employed higher awareness building strategies to amplify the existence of the solution which resulted in higher engagement in 2018-19.

⁶ See Annexe 2

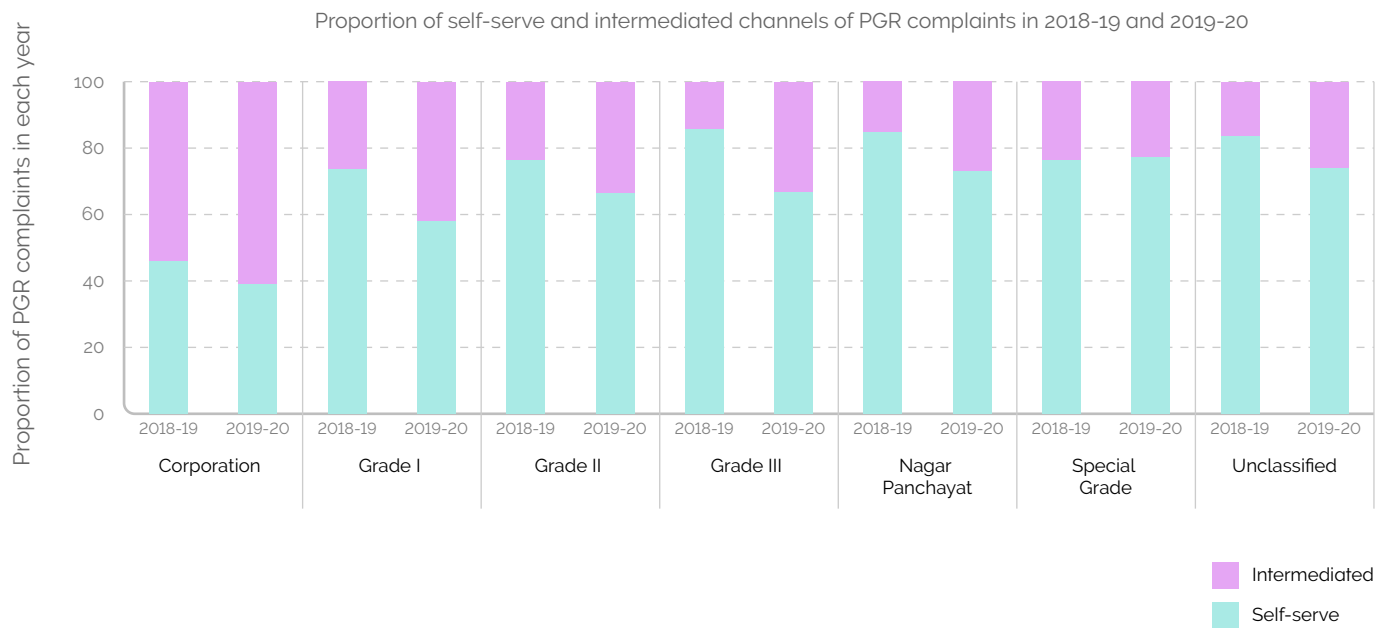
⁷ Financial year is considered. We consider only this two-year period, as data for 2017-18 is not available for any ULB.



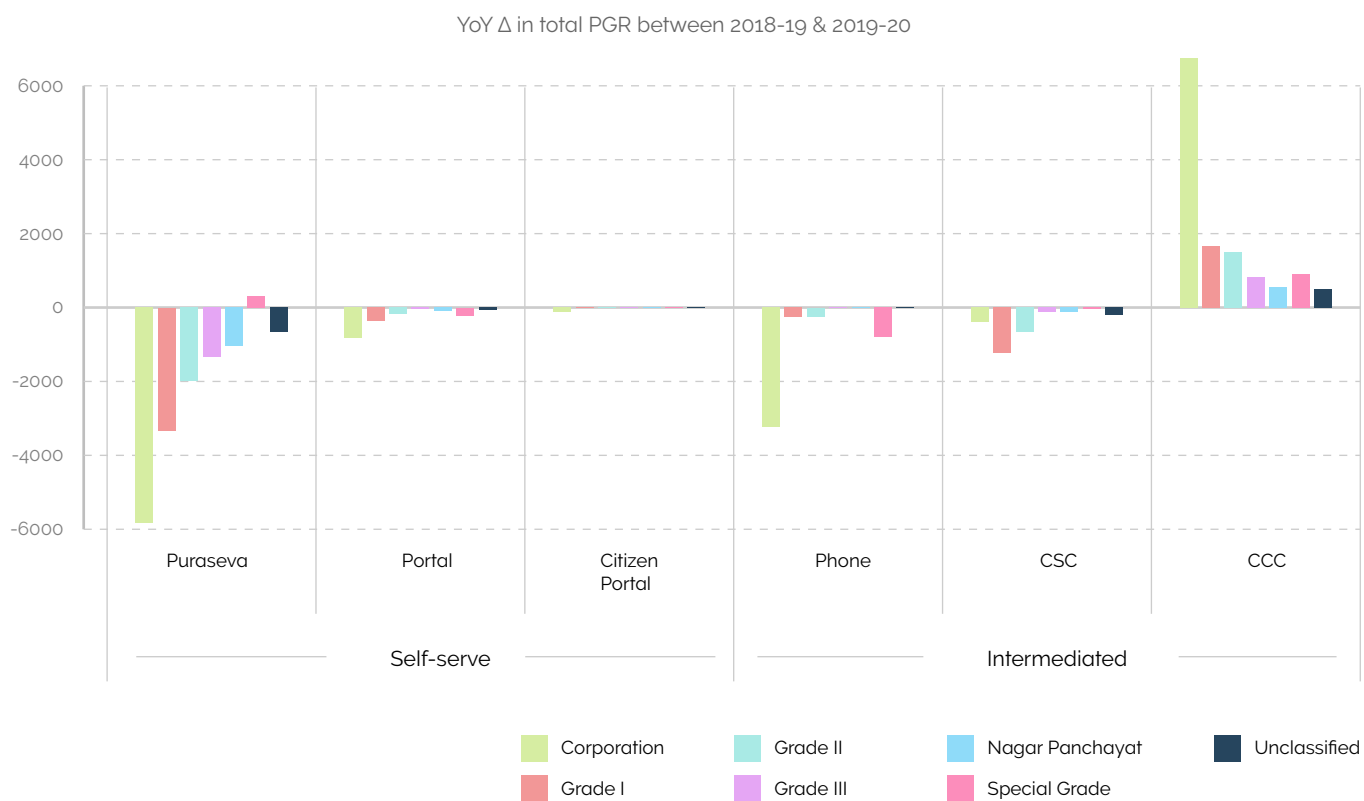
▲ **FIGURE 2**
PGR overview in Andhra Pradesh

We find that there is an increased preference for intermediated channels in 2019-20, compared to the previous year (Figure 3). Except for Special Grade ULBs, all other types of ULBs have registered a higher proportion of complaints by self-serve channels as compared to the intermediated channels in 2018-19. However, in 2019-20, the proportions have changed with a higher number of PGR complaints registered by the intermediate channels. But it should also be noted here that the maximum proportion of total PGR complaints from all ULBs (from all channels) come from Corporation ULBs (more than 65% complaints from Corporation ULBs) through 2018-20.

More prominently used self-serve channels are Puraseva, Portal, Citizen Portal while the major intermediated channels used are Phone, Citizen Service Center and Command Communication Center. Puraseva, Portal and Citizen Portal have registered a significant decrease in 2019-20 in most of the ULBs. Phone and Citizen Service Center show a dip in 2019-20, Command Communication Center sees an increase in PGR (Figure 4).



▲ **FIGURE 3**
Channel usage in Andhra Pradesh



▲ **FIGURE 4**
Specific channel usage in Andhra Pradesh

AP from the field

We interviewed last-mile citizens in Kakinada, Guntur and Anantapur and also ward officials of these three ULBs, in addition to Vijayawada.

Breakdowns in awareness and ability

CITIZENS

While Andhra Pradesh presented higher awareness compared to other states, there is a measure of breakdown in awareness of existence of digital solutions in the last mile. Among those who were aware of the existence of digital solutions, there was a breakdown in ability to navigate it due to a lack of infrastructure vis-a-vis a smartphone, lack of digital literacy, and the ease of using alternative solutions. Interestingly, there is a willingness to switch digital solutions among the youth, if a mechanism to increase awareness is put in place. In areas where last-mile residents were aware of digital solutions, it was largely due to the intervention and awareness campaigns conducted by NGOs and community-based organisations.

WARD OFFICIALS

Among ward officials, depending on the ULB size and the presence of motivated officials, as in the case of Guntur, there is awareness of digital solutions among last-mile citizens. Ward officials also exhibited a differentiated pattern of breakdown of ability based on age. Older ward officials preferred to rely on offline methods such as phone calls and in-person check-ins, or low-tech alternatives such as WhatsApp or text messages.

■
“We would prefer to use the digital solution because sometimes citizens behave badly and confront ward officials.”

—Kakinada ward official

A combination of awareness and ability breakdowns at both citizen and ward official level influenced channel preference in a given ULB. For instance, residents of Kakinada and Guntur preferred to directly contact their local ward officials on personal phone numbers or use WhatsApp as a means to register complaints because those were the channels where the response rate of ward officials was higher.

Reasons for rejection of complaints by ward officials could include that the specific complaint did not relate to their department, or the complaint came from a slum locality or an area on the periphery of the ULB, or there were infrastructural deficits.

■

"I learnt about the Puraseva app through an NGO named CFAR. We collect complaints in the neighbourhood and one person submits it on the app for all of us."

– *Guntur citizen*

Access to the state

In Andhra Pradesh, last-mile citizens who experienced awareness and ability breakdowns in the context of digital solutions reach the state in the following ways:

1. **Through NGO intermediaries:** Residents of informal settlements in Anantapur relied on NGOs who both spread awareness of the existence of government technology and bridged the gap between them and the state. We also found that last-mile citizens trained by intermediaries were assigned the role of collecting complaints in a given neighbourhood, and submitting them to the municipality digitally.
2. **Through publicly-available contact information of ward officials:** Residents of informal settlements in Anantapur relied on NGOs who both spread awareness of the existence of government technology and bridged the gap between them and the state. We also found that last-mile citizens trained by intermediaries were assigned the role of collecting complaints in a given neighbourhood, and submitting them to the municipality digitally.
3. **Through informal local leaders:** Residents across the three ULBs relied on local informal leaders and 'agents' to bridge basic ability gaps brought on by occupational barriers (e.g. shoe leather costs).
4. **Through caste-based associations:** In Kakinada, we found that residents belonging to a Scheduled Tribe in an informal settlement relied on a caste-based association to mediate services for them, as they ran the risk of demolition if they attempted to reach the municipality directly.



The insights from Andhra Pradesh suggest that the role of community intermediaries in bridging the awareness gaps for last-mile residents is significant.

CHENNAI

Chennai is the only ULB in Tamil Nadu where the digital solutions designed by eGovernments Foundation has been deployed. It also has the longest runway of the three states, with Punjab being the shortest.

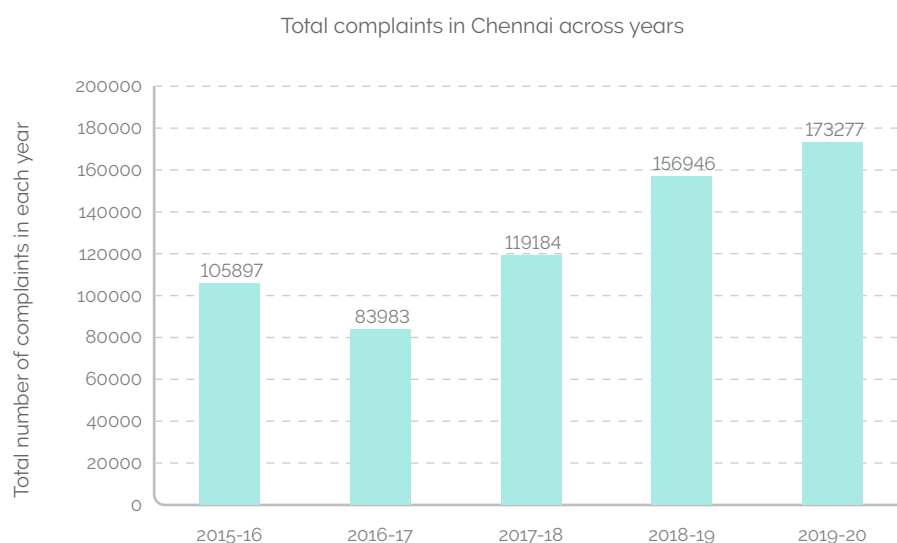
Chennai has a comparatively more unique sociopolitical history characterised by social movements of self-respect, independence, and identity.⁸ Perhaps due to this history, there is a *higher awareness of entitlements* among last-mile citizens in terms of services owed to them by the state, relative to all other sites. However, there is relatively *lower awareness of the existence of digital solutions* offered by the state, despite their longer presence. We also witnessed a generally *higher ability and willingness to shift to digital use* across all ages.

⁸ No source specified.

NB: It is important to note here that prior to the national lockdown, we had the opportunity to visit the Adyar and Periyasekkadu in Chennai, and conduct in-person interviews with last-mile citizens and local intermediaries.

From the data

In Chennai, eGov's long-term deployment of PGR modules has helped in increasing the complaints trend through the years.⁹ (The PGR data has been obtained from eGov on confidential terms.)

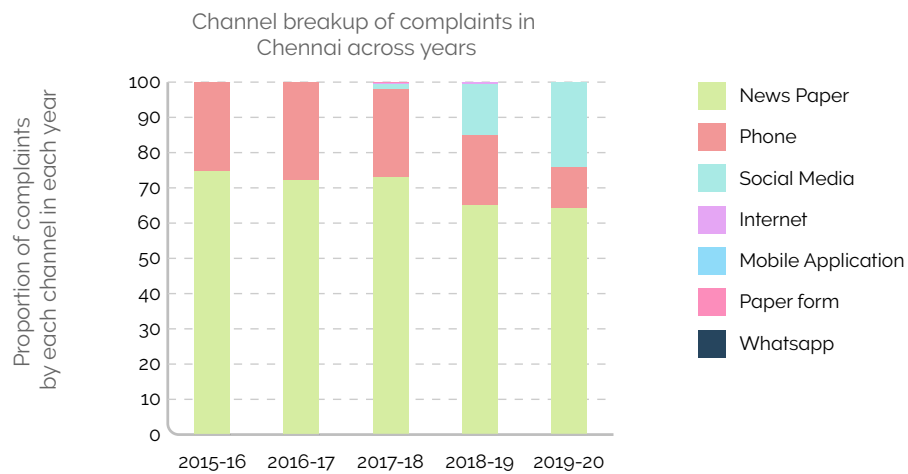


▲ **FIGURE 5**
PGR overview in Chennai

Compared to the other sites, Chennai shows the highest raw numbers of complaints. The Chennai PGR module was deployed in 2010. Complaints have increased steadily, barring a dip in 2016-17.

The data also shows that phone calls (>60% complaints) constitute the most preferred channel for registering complaints through the years. In the last two years, usage of the internet (web portal) is decreasing accompanied by a proportionate increase in usage of the mobile app (Namma Chennai). This suggests that internet users may have shifted to app use.

⁹ Financial year is considered.



▲ **FIGURE 6**
Channel usage in Chennai

From the field

In Chennai, there is a generally high level of awareness of entitlements among last-mile citizens, and a higher level of digital literacy and ability to navigate digital platforms such as social media applications. However, there is significant breakdown in awareness of the existence of the digital solutions deployed by eGovernments Foundation, while there seems to be awareness of other government technology solutions like the Kaavalan app, because of more recent advertisements and awareness campaigns.

We were unable to obtain interviews of ward officials due to the COVID-19 lockdown in Chennai and the fact that the municipal officers were occupied with implementing relief measures.

Breakdowns in awareness and ability

In Chennai, we interviewed trans women, those with HIV, and members of the Scheduled Caste and Scheduled Tribe communities.

There is high awareness of ways to navigate the municipal systems in person and by phone, and preference for these two channels. There is support for digital solutions as a viable layer between citizen and state for last-mile citizens, as it might be an effective solution to the multiple follow-ups that are needed after complaints are filed in person or over the phone. Neighbourhoods in affluent sections of the city had a higher response rate from ward officials once complaints were filed, compared to neighbourhoods on the city's periphery.¹⁰

Access to the state

■
"We collect the complaints in our neighbourhood as a group and submit it to the local party worker, he solves it for us."

– *Chennai citizen*

In the absence of pathways to the municipality discussed above, last-mile citizens of Chennai opted for the following intermediated channels to reach the state:

1. **Political party cadres:** A majority of residents without easy access to the state relied on political party cadres to avail of amenities and services from the state, and report grievances from the neighbourhood. Party cadres are often members of a community in the employ of a local political party who bridge the access gap between last-mile communities and the state. This model appears to be mutually beneficial for citizens and politicians, as it is a process of vote-bank creation and maintenance. The phenomenon of vote-bank creation and exchange of services between citizens in informal settlements and local political leaders is supported by literature.¹¹
2. **Through NGO intermediaries:** Local NGOs play a crucial part in spreading awareness of state-endorsed schemes, policies, and services to last-mile citizens, who in turn amplify awareness in their respective last-mile communities.
3. **Caste-based associations:** In Chennai, we witnessed a greater awareness of caste consciousness and pride due to the region's sociopolitical history and anti-caste movements.¹² We found a diverse set of caste-based associations operating on a granular level, providing communities a platform to voice grievances in their neighbourhoods. Some of the associations are also registered at the state level.
4. **Informal leader/thalaiva:**¹³ In low socioeconomic neighbourhoods and informal settlements, we see informally elected leaders or '*thalaivas*' who play a crucial role in mediating between citizens and the state. Such individuals usually exhibit charismatic leadership and harbour political ambitions. They may either utilise their own political networks to facilitate delivery of services by the state, or represent a group of people in demanding services from the state. Such leaders may be aligned to a specific political party, but do not operate in the capacity of a cadre.

10 From in-person fieldwork prior to the pandemic lockdown.

11 No source specified.

12 No source specified.

13 Colloquial Tamil for 'leader'.



Insights from Chennai suggest the need for amplified awareness strategies. Engaging with community-based organisations that have robust existing networks of trust in last-mile communities may enhance citizens' trust and adoption of digital solutions

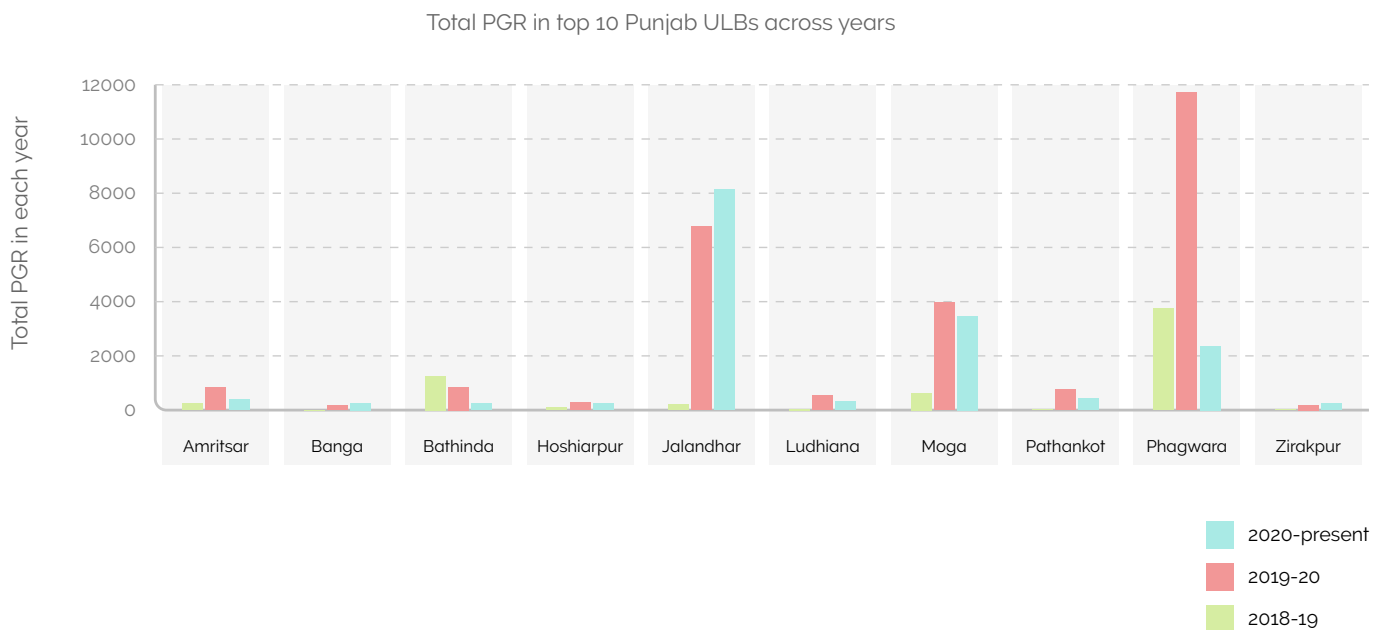
PUNJAB

Of the three states, Punjab has had the shortest time with the digital solutions deployed. The Punjab app has been launched in a staggered fashion¹⁴ since early 2018. In Punjab, we captured significant insights from labour migrant communities and the unique challenges they face in accessing the state in their highly mobile existence.

¹⁴ Initially, the app was launched with a few services in select ULBs and then it has been extended both in terms of services and ULBs in the successive iterations.

From the data

The static data on PGR for 2018-19, 2019-20¹⁵ was obtained from eGov upon request. Out of around 150+ ULBs in Punjab, very few have significant PGR registrations (around 80% ULBs have less than 50 complaints in 2019-20)—highlighting the recent deployment of the eGov platform. Overall, from 2019, the platform has gained traction in many ULBs—indicated by the increasing PGR complaints (Figure 7). For this analysis, top 10 ULBs in terms of PGR complaints were considered.¹⁶



▲ **FIGURE 7**
PGR overview in Punjab

Phone calls are the most preferred channel for citizens to make complaints across the 10 cities analysed in Punjab over the years (Figure 8). In the last two years, usage of mobile apps has decreased and the proportionate usage of web portals and phone calls has increased.

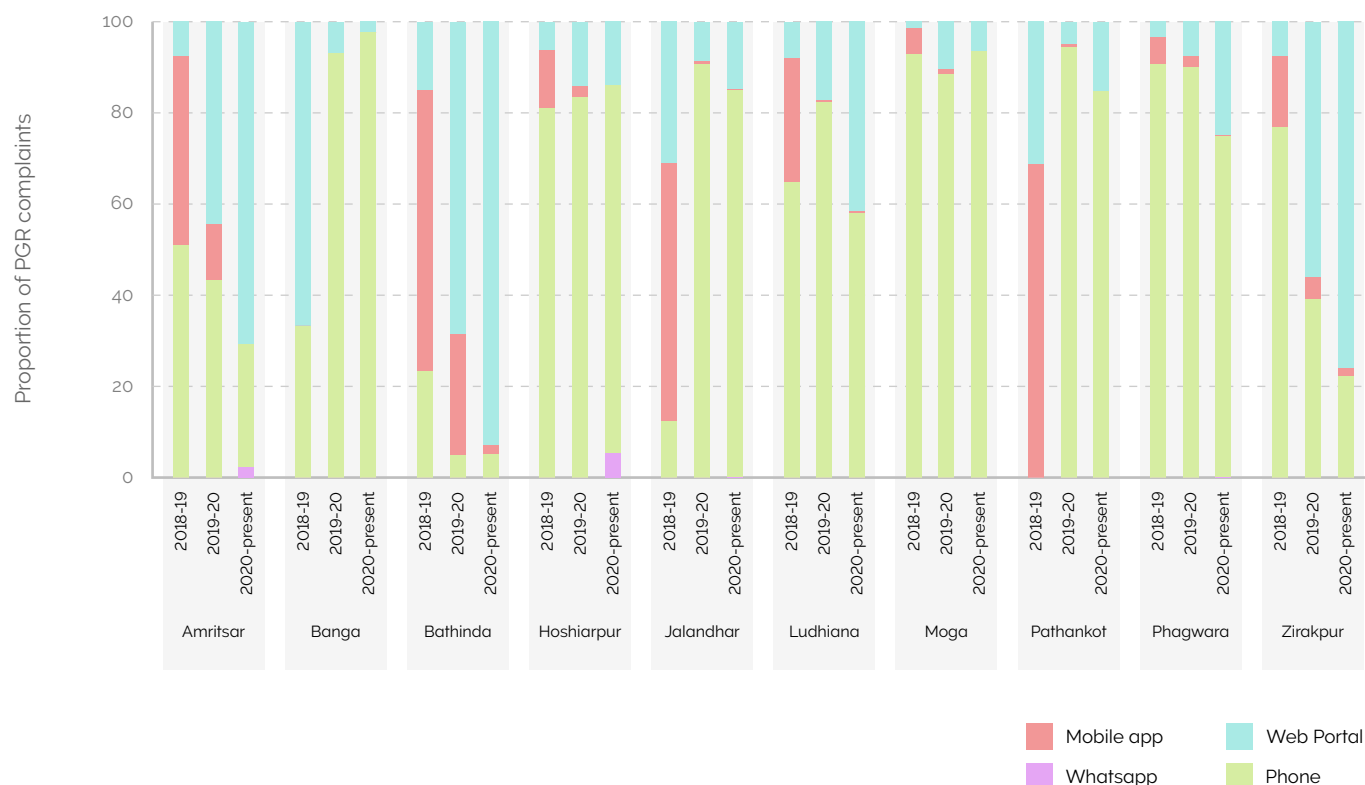
From the field

In Punjab, there is a generally *lower awareness of entitlements and existence of digital solutions*, and in areas where awareness is higher, there is *lower ability to navigate municipal systems and digital solutions*. There is significant data that shows a generally *lower ability in reaching the state due to deep mistrust in governance mechanisms* brought on by unsavoury experiences with bureaucracy, and specific traumatic

¹⁵ Calendar year is considered.

¹⁶ Some data points are not available for all ULBs.

Channel breakup of top 10 Punjab ULBs across years



▲ **FIGURE 8**
Channel usage in Punjab

experiences faced by religious minorities, migrants, and urban poor. Due to a combination of these factors, we saw a higher reliance on intermediated channels to reach the state.

We interviewed last-mile citizens in Jalandhar, Amritsar and Moga (key informant interviews). We interviewed ward officials in Jalandhar, Amritsar, Phagwara and Ludhiana.

Breakdowns in awareness and ability

CITIZENS

In Jalandhar, the respondents from our sample pool were migrant labourers from Bihar, Chhattisgarh, Odisha, Jharkhand and Uttar Pradesh, most of whom were relatively recent migrants, that is, two to five years earlier. In Amritsar, we interviewed the residents of Ekta Nagar slum, a section of whom were migrants who moved to Punjab from Kashmir and Uttar Pradesh over 15 years ago. This allowed us to capture the relative impact the duration and history of migration has on citizens' access to the state.

Migrant citizens in Jalandhar exhibited a significant breakdown in both awareness and ability in accessing the state. Migrant labour living in Jalandhar come from rural poverty, and exhibit limited knowledge of municipal services and offices in their native villages as well. In Jalandhar there is significant breakdown in ability to reach the state due to deep mistrust of the government. Most residents navigated daily existence perils in accessing basic necessities like food. Even amidst such precariousness, there was a preference for utilising their energy in solving their own immediate problems rather than approaching the state for solutions. There is also low awareness of municipal offices, and lower inclination to approach the state by telephone or in person.

There is also a significant breakdown of ability due to lack of digital literacy and access to digital infrastructure. Residents in Jalandhar banked on reliable intermediary channels such as local NGOs to avail of essential services, and on the goodwill of local MLAs. In Amritsar, there is higher awareness of entitlements but low awareness of existence of digital solutions. Despite having higher ability to navigate the municipal system in person and by telephone, citizens relied on a local NGO to mediate access to services.

The preference for an NGO channel was largely due to a perception of efficiency and trust associated with that specific intermediary, which would offset bureaucracy and shoe leather costs. Selected members in last-mile communities were also trained by local NGOs to help facilitate municipal access for last-mile residents.

WARD OFFICIALS

Among ward officials, there is a general trend of breakdown of ability to navigate the digital solutions, which results in a push for low-tech alternatives like WhatsApp and direct phone calls to the ward officials.

Ward officials preferred low-tech interactions with citizens as this was far easier to navigate than the digital solutions deployed. Several ward officials admitted to downloading the application, but rarely using it.

In Amritsar, motivated councillors ensured that citizens' complaints were addressed in a timely way without relying on technological interfaces. Here, the perception was that the offline trust networks built with their constituents was a matter of pride and goodwill for both ward-level officials and citizens. In smaller ULBs like Phagwara, there was a lack of awareness of certain digital solutions (PGR/MSeva) among ward officials despite higher usage recorded in that area.

■

"Even though we know where the nearest municipal office is, we prefer to go through Pearl madam, it is just easier that way because going to the municipal office in person takes time away from work."

—Amritsar citizen

Access to the state:

In the absence of pathways to the municipality discussed, last-mile citizens of Punjab use the following intermediated channels to reach the state:

1. **NGOs:** Local NGOs play a crucial part in spreading awareness of state-endorsed schemes, policies and services to last-mile citizens, who in turn amplify awareness in their respective last-mile communities.
2. **Local MLA/political leaders:** A widely documented scenario involves local political leaders who trade services for votes. This type of intermediation runs the risk of negatively affecting last-mile communities by creating exploitative bottlenecks.
3. **Community-based organisations:** Community-based organisations function similarly to NGOs, with a specific social mandate (e.g. education, hunger, public health) but often specific to certain localities and communities. Example: IVE CHILDREN in Amritsar.

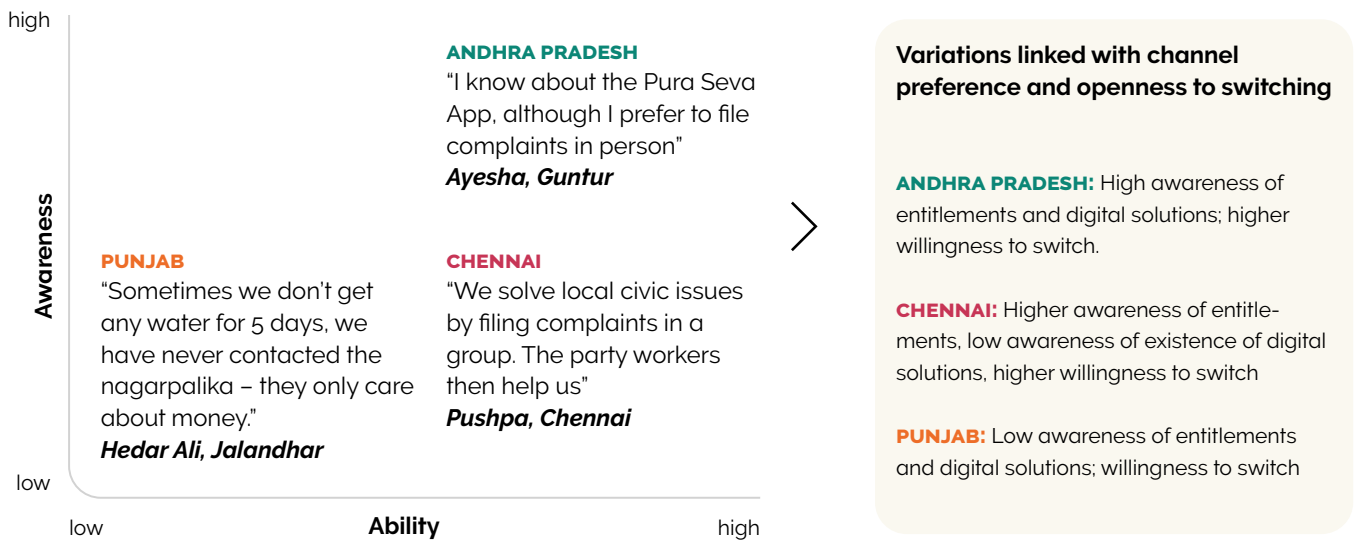


Insights from Punjab indicate that a combined approach to increase awareness of entitlements among last-mile citizens, and of municipal processes and channels, is required. They also show that alternatives to existing channels that are already popular could also be incorporated in digital solution design to reach last-mile citizens.

3

Mapping breakdowns

The breakdowns in awareness and ability can be mapped on a 2x2 graph to represent the need for a state-wise differentiated solutioning strategy. The graph captures the differentiated findings regarding willingness to switch, which is critical in informing proactive adoption strategy:



- ▲ *This 2x2 graph depicts the differential insights into the existing level of awareness and ability across the three states, and suggests a varied strategy by state to enhance last-mile adoption.*

4

Differentiated use patterns based on demographic variables

In this segment, we explore the relationship between structural variables and their impact on channel preferences to supplement the findings from the field. The limitation, however, is that data analysis helps us understand only aggregates.

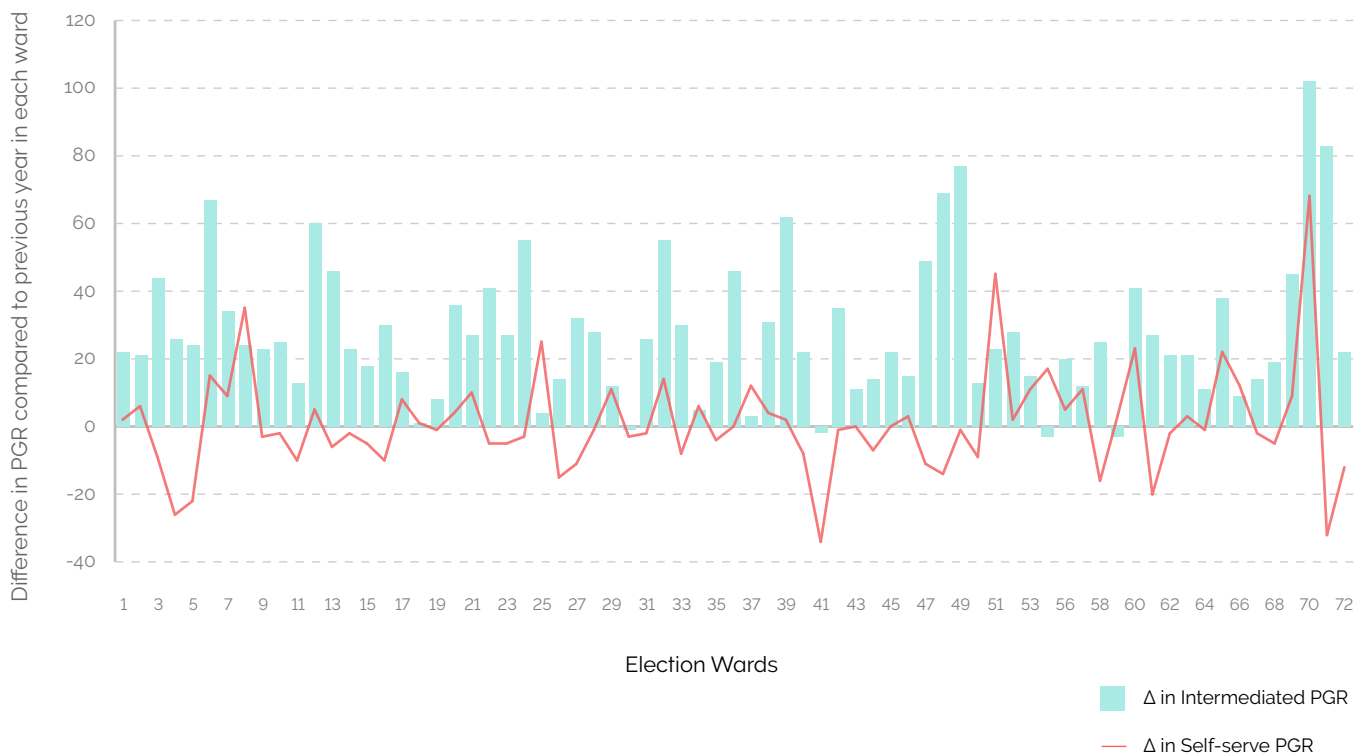
For this analysis, we relied on Andhra Pradesh data due to the availability of an exhaustive data set from the publicly available CDMA dashboard. We use the specific data points for 2019-20 since it is the most recent data available. The 2011 census data allows us to explore correlates' questions at an aggregate level. The predictors were selected based on the fieldwork, and supported by existing literature.

These analyses are helpful in identifying the aggregates of breakdown along specific themes. They are suggestive in identifying directions for solutioning and require further research. For quantitative confidence, we require deeper exploration of the inter-relationships of the variables.

1. Community characteristics

Fieldwork suggests a higher willingness to use self-serve (non-intermediary) based on the industrialised nature of the ULB. To analyse the impact of community characteristics, we compared the ward-level distribution of complaints in Visakhapatnam¹⁷ to its population distribution. The Greater Visakhapatnam Municipal Corporation (GVMC) has been considered due to the availability of comparable open source ward data for this.

Δ in self-serve and intermediated PGR in each ward between 2018-19 and 2019-20

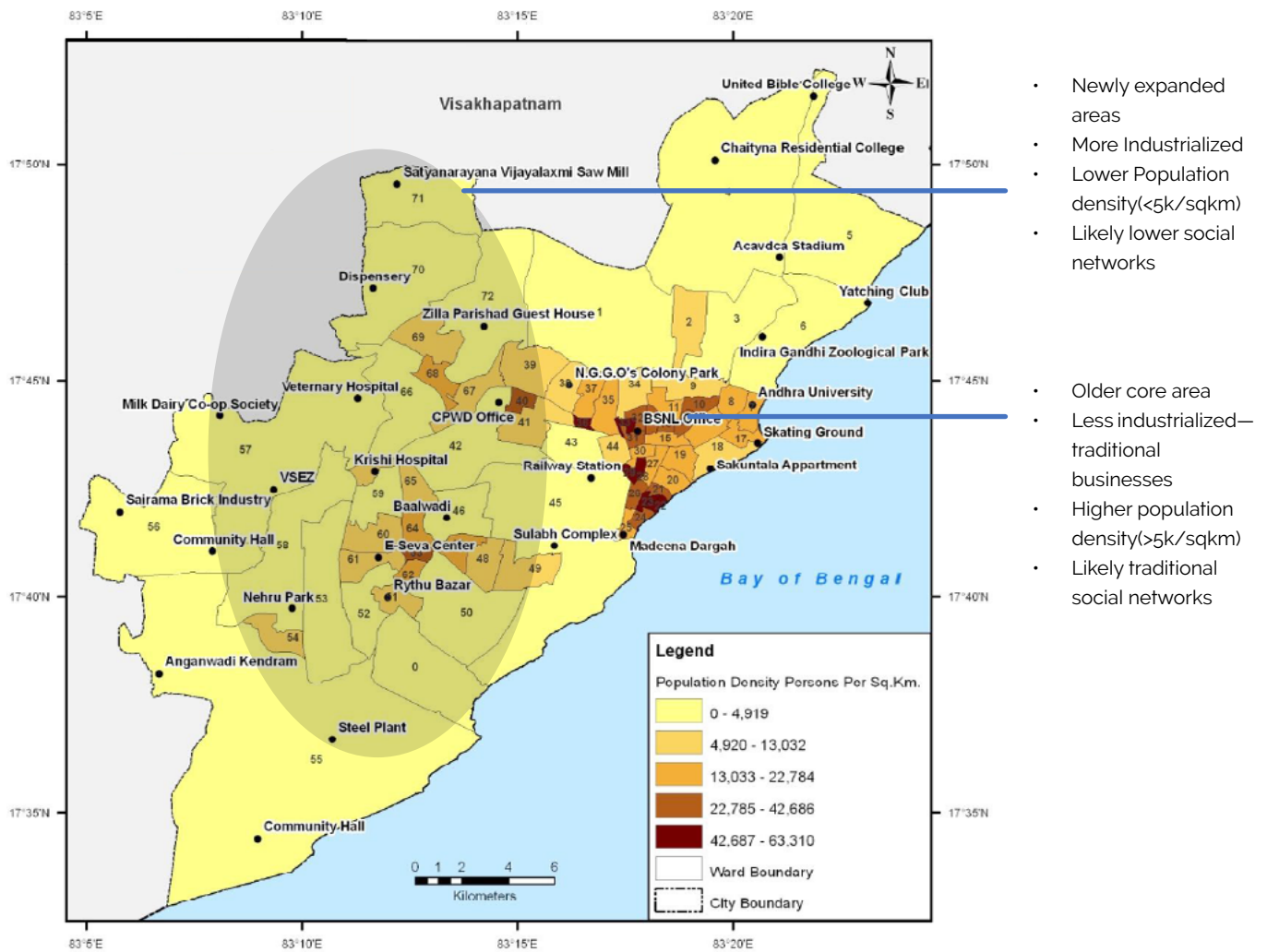


▲ **FIGURE 9**
Overview of PGR ward-wise in Visakhapatnam

In election wards 1 to 50, most of the increase in PGR complaints in 2019-20 comes from intermediated channels. In election wards from 51 to 72, increase in PGR complaints appear to come from self-serve channels. These wards are in the southern and south-western part of the GVMC area¹⁸ with population densities of less than 5,000 persons per sq. km. These areas are the newly expanded areas of the GVMC, which are more industrialised and likely characterised by lower social networks. The northern parts of the city, which are the core area and older areas of the city with higher traditional social networks, show preference for intermediated channels.

¹⁷ Source : AP CDMA Dashboard

¹⁸ Source: Visakhapatnam - CRS report, p-11.



▲ **FIGURE 10**
Map of Visakhapatnam ULB by population distribution

2. Age

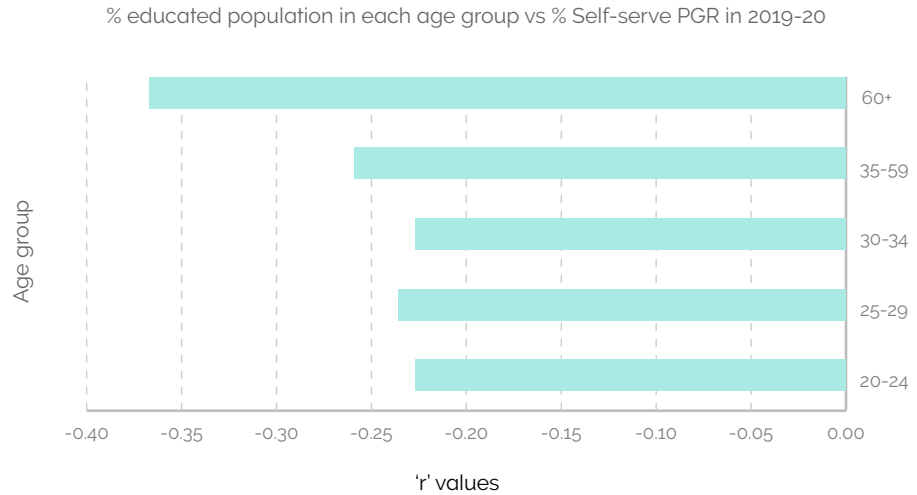
Fieldwork insights showed us that there was more awareness and ability to use self-serve channels among the younger, educated population. So we analysed the impact of age and literacy on channel usage by segmenting the population of ULBs of Andhra Pradesh into sequential age brackets.¹⁹ We further included the percentage of educated²⁰ in each age bracket which is correlated with the proportion of self-serve usage in 2019-20.

¹⁹ Only 31 ULBs under consideration which are AMRUT towns; age groups classification used from Census 2011.

²⁰ Here educated refers to the population attending/has attended educational institutions.

We observe that the correlation coefficient ('r'), used to measure the strength and the direction of the relationship, is negative across various age brackets. Across age groups, we see the proportion of educated

population being negatively correlated with self-serve channel usage, with the correlation showing increased strength in age groups greater than 35.



▲ **FIGURE 11**
Age vs Self-serve channel usage (2019-20)

3. Housing Informality

It was also observed that residents of informal housing preferred the security of intermediated channel usage in our fieldwork. To explore that, we constructed a model using Visakhapatnam data for analysing the uptake of intermediated channel usage in areas with vulnerable dwellings with poor infrastructural qualities. This was performed using the statistical tools of Multiple OLS Regression and PCA (Principal Component Analysis) in STATA to make meaningful inferences that inform our research directionally. The value of this analysis²¹ lies primarily in the directions that it offers in terms of associations or relationships between variables. Of course, in interpretation, one must be attentive to the distinction between 'association' and 'proof' and avoid conflation of the former with the latter!

We used three predictor variables—housing informality, housing infrastructure, and demographics—in OLS regression²² for predicting the output variable of intermediated channel usage in 2019. Principal component analysis (PCA),²³ used for reducing the dimensionality of large data sets, has been used to arrive at single dimensional 'housing informality' and 'housing infrastructure' indexes. Details of the modelling process and model-wise inferences are available in the Statistical Appendix.

21 Regression summary in Annexe 2.

22 Estimates the relationship between one or more independent variables and a dependent variable.

23 Increases interpretability while minimising information loss.

Predictor variables ($X_1 - X_n$)

Housing Informality PCA

DESCRIPTION: Measures dwelling conditions and the HH quality

REASON FOR INCLUSION: in Punjab and AP, residents of informal housing preferred intermediated channels

Housing infrastructure PCA

DESCRIPTION: Measures HH infrastructure conditions

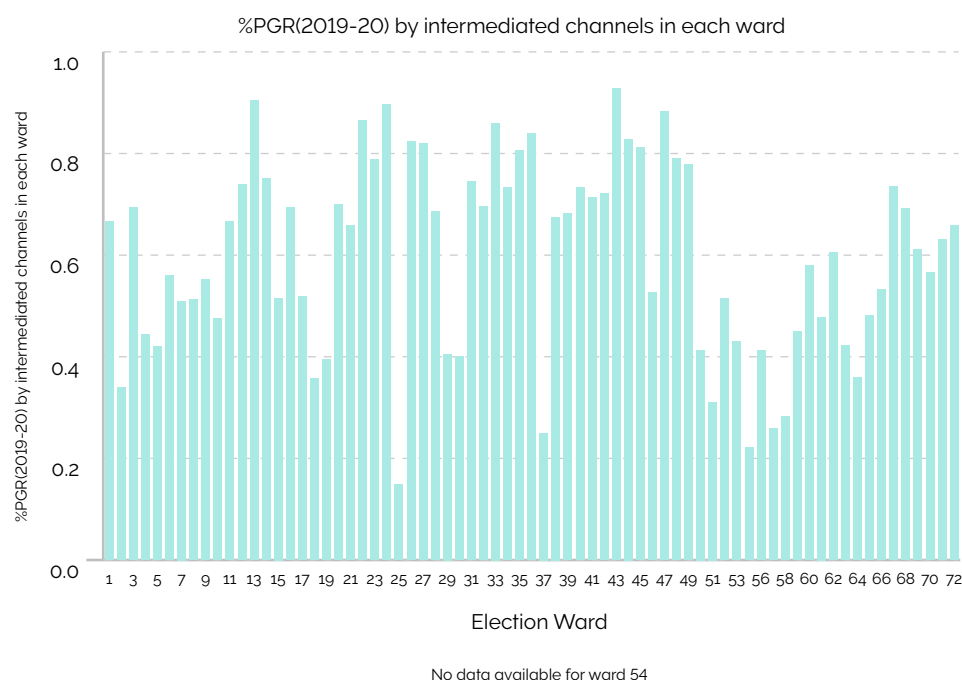
REASON FOR INCLUSION: Chennai fieldwork showed that residents in low infrastructure quality preferred intermediation

Demographics

DESCRIPTION: Population characteristics (caste etc.)

REASON FOR INCLUSION: In AP, marginalised population preferred less of self-serve channels

Y = %PGR by intermediated channels in 2019-20



▲ **FIGURE 12**
Regression and PCA process

'Housing informality' index indicates the dwelling conditions and the quality of the households. 'Housing infrastructure' index indicates the infrastructural conditions of the households. To understand and control for demographic variations (which fieldwork highlights as significant), population characteristics (caste, literacy etc) are also used as predictor variables individually.

It is seen that housing informality is positively correlated with intermediated channel usage at statistically significant 95% confidence levels ($p\text{-value} < 0.05$). This implies that increases in housing informality (as measured by our index) at the ward level are associated with increases in the percentage of complaints through intermediated channels, keeping other predictors constant. This aligns with the theoretical and field findings. Residents in informal housing prefer intermediated channels.

Literacy rates are also observed to be positively correlated with intermediated channel levels at statistically significant 95% confidence levels ($p\text{-value} < 0.05$). This reveals that even people with higher levels of education rely on intermediation to access the state. Even the elite communities prefer intermediation for other reasons.

5

Other findings and observations

Human point of contact

Across all three states, we saw a greater sense of trust attached to a human point of contact both at the ward official level and at the citizens' level. For instance, in the case of Punjab, we found that the presence of a Grievance Redressal Officer meant that complaints about sanitation were addressed faster as the GRO assumed responsibility for rerouting them to the concerned department, compared to the automated system in Andhra Pradesh.

Preference for WhatsApp

There is a high reliance and trust in WhatsApp as a channel to reach municipal officials, especially in Punjab, and smaller ULBs in Andhra Pradesh. The ease of use and wide penetration of the app were some of the reasons for this preference.

Limited trust in the state due to past experiences

We found that citizens who had experienced past trauma and disappointment in the state due to structural limitations owing to vulnerabilities exhibited extremely low trust in the state, and preferred to solve their immediate issues on their own.

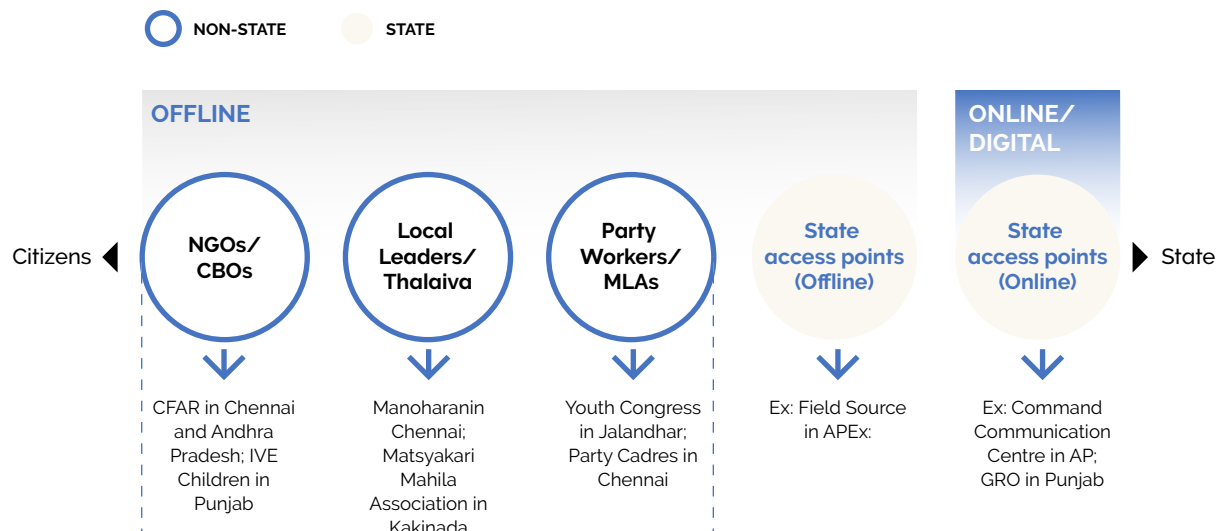
Solutioning Strategy: Intermediation and proactive adoption

Upon analysing the findings from the field and data and the key gaps in access seen across three states, we suggest a two-pronged approach of intermediation and proactively driving adoption to enhance adoption of digital solutions in the last mile.

Leveraging existing offline architecture or intermediaries that lie between citizen and state can help amplify awareness through information dissemination via networks citizens trust, and increase ability through capacity building efforts intermediaries make at the granular level.

Following a strategic promotion approach to citizen pools that are more likely to rely on self-serve as suggested by the PCA analysis would enhance uptake of digital solutions in the last mile.

A combination of the two approaches could enhance adoption of digital solutions in the last mile.



- ▲ *This figure depicts the layers of offline and online intermediaries that lie between citizens and state, and provides a brief typology of non-state offline intermediaries.*

1

Intermediation

Our core strategy is informed by the significant field data that suggests the importance of local intermediaries in bridging the access gap for last-mile citizens. Intermediation is fundamental to access in conditions of marginality, especially in the context of informal housing, for labour migrants, and citizens with vulnerabilities. Voices from the field suggested a potential need for a *digital interface for intermediaries*.

Additionally, engaging with intermediaries at the information dissemination and awareness building process may enhance trust in solution among citizens. They play the role of building awareness about government mechanisms in marginalised communities, building capacity among last-mile communities to navigate state mechanism, and being the layer of trust between citizens and the state.

From our field data and coding, we attempted to arrive at a typology of intermediaries, with differential incentives, that could be engaged to better serve last-mile citizens in a given state or social context.

Typology of intermediaries and driving incentives

From our fieldwork, we built a typology of intermediaries that can broadly classify intermediaries in the following categories:

- 1 Non-Governmental Organisation (NGO)**

NGOs typically function with a set mandate determined by the organisation's founder and guiding principles, and funder expectations. NGOs may be found nationally, with local chapters. They are usually issue-based organisations, that play the role of intermediaries in additional capacity.

They are typically driven by an incentive for social change, or to positively change metrics for given social issues.

Examples: CFAR, SEWA
- 2 Community-Based Organisation (CBO)**

CBOs are largely similar to NGOs in that they are driven by a set mandate and are issue-based. However, they are often present in a single community context, working for the amelioration of that specific community.

They too are driven by an incentive for social change, and may also be funder-driven.

Example: IVE CHILDREN
- 3 Caste-Based Associations (CBA)**

CBAs typically serve the agenda of a specific caste group. They may or may not be national, registered and recognised. They are typically apolitical, but leaders within a CBA may be driven by political aspirations.

Their incentive is usually the upliftment of a specific caste group that has faced historical and systemic oppression. Individuals within the organisation may also be incentivised by political aspirations.

Example: Dalitha Samrakshana Samithi
- 4 Local politicians/MLAs**

MLAs are typically negative bottlenecks present in marginalised communities who offer basic services owed to citizens by right, in exchange for votes. Of the intermediaries, they may be the least likely to engage with solutions to ease access to the state for last-mile communities. Caution must be taken before engaging with local political partners. However, this may not always be the case. Further research and exploration are suggested before engaging.

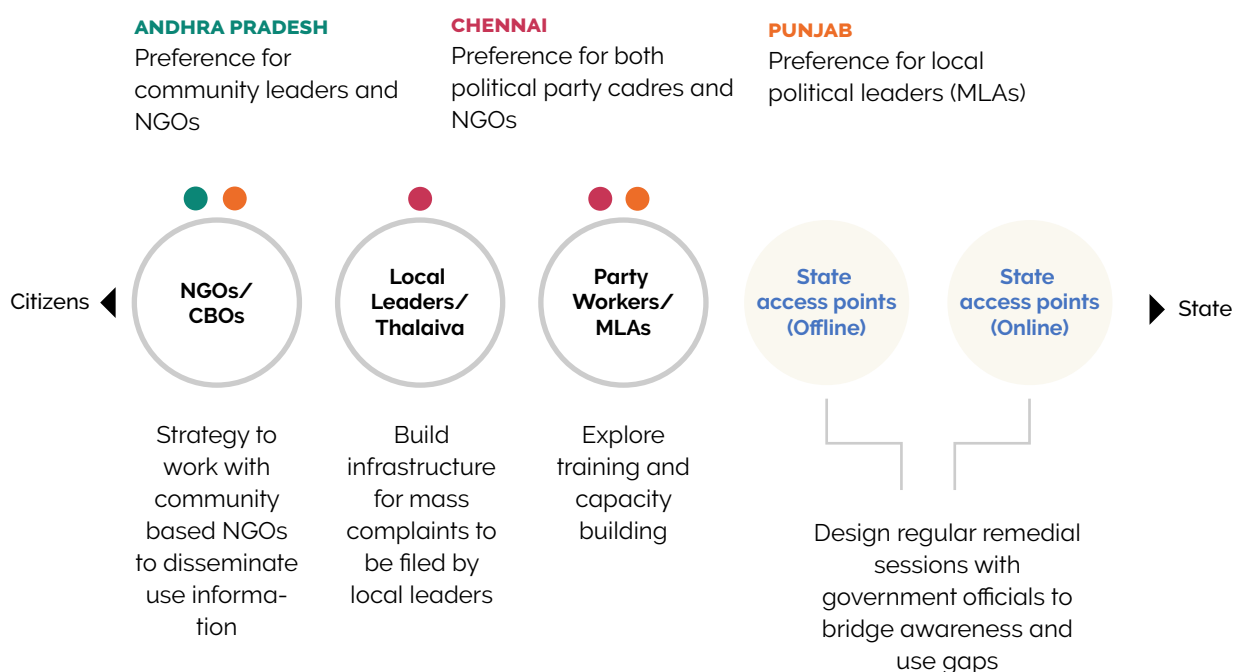
They are usually driven by an incentive to gain votes, and create and maintain viable vote banks.

5 Informal local leaders and party cadres (thalaivar)

Informal local leaders are usually present in lower socioeconomic settlements, or settlements where legal claim is tenuous. It is a form of collectivisation where leaders may slowly build political clout and form a bridge between a specific community in a specific location and the local municipality.

Example: Manoharan in Periyasekkadu

They could be led by an incentive for social good, and personal political clout.

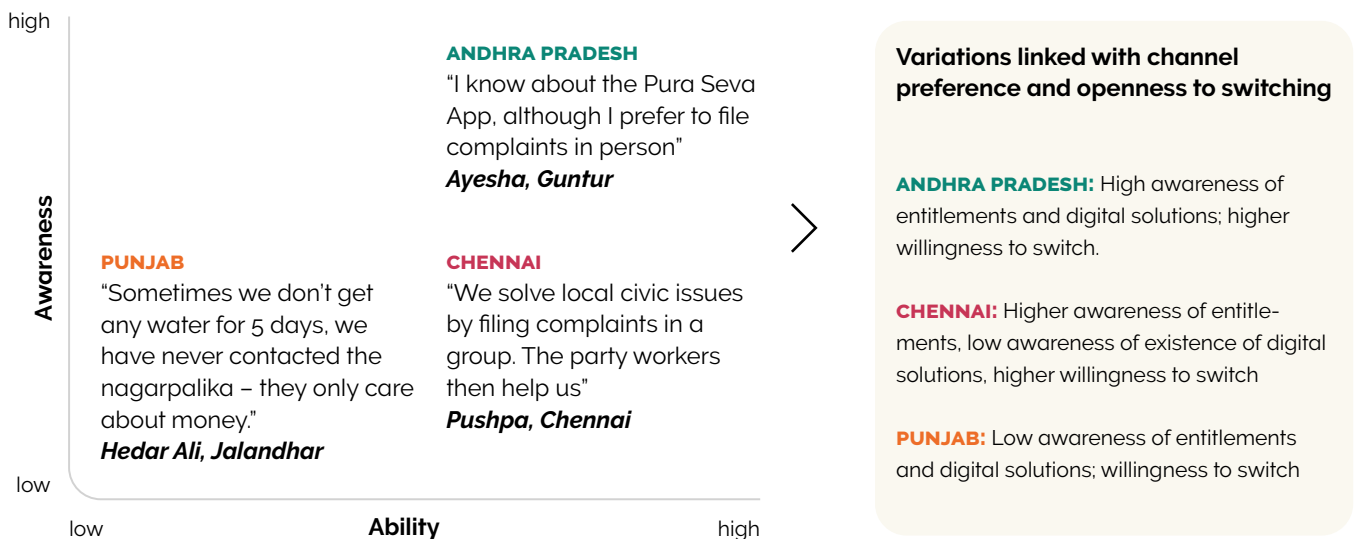


▲ *This figure depicts the differential preferences for intermediary type across the three states.*

State-wise intermediary channels of preference:

Insights into differential preferences for intermediary type allow for state-wise strategic approach to intermediary partnerships, and may inform effective adoption in the last mile.

The analysis of key access barriers per state, coupled with the preferred choice of intermediation in that state, allowed us to infer potential partnership strategies with local intermediaries, and specific awareness and ability gaps to address in that state.



▲ This figure depicts differential partnership strategies with intermediaries across the three states.

2

Proactive Adoption Strategy

Leveraging the data insights, self-serve channel usage could be promoted by proactive adoption strategies. However, prior to proactive adoption, media consumption habits and preferences of the population with pre-existing dispensation towards tech should be understood in a disaggregated way (youth, new urban areas, etc).

1. Community characteristics

Self-serve channel usage could be prioritised by reaching out to industrial areas with lower population densities. Conducting promotional activities in these newer urban areas could be prioritised. Residents in this area may not have the robust social networks that older neighbourhoods have built, and rely on to reach the state. This could nudge the residents to use more of self-serve channels. After building a map of community-level intermediaries, supporting and enabling these intermediaries/civil society organisations to access tech could provide a way for reaching out to last-mile citizens.

2. Age

Approaching younger populations, who show willingness to switch to digital methods, could also aid the expansion of self-serve channel usage. Supporting and enabling youth leaders to act for their communities could improve self-serve channel usage among the

already digitally connected populace. Exploring partnerships with youth empowerment organisations (e.g. Indus Action) for outreach and for improving the capacity to access self-serve channels could bring in new segments of the populace into the digital world.

3. Housing Informality

The strategies to access the residents of informal housing with poor infrastructural conditions needed to be differentiated according to different housing and infrastructural characteristics. Pre-existing intermediary networks could be utilised to engage the vulnerable and the marginalised sections of society. The capacity of the street-level bureaucracy to support service delivery could also be considered.

Conclusion

How can we leverage existing offline architecture to build inclusive gov-tech?

Our work has attempted to study access barriers that last-mile citizens experience in reaching the state for basic rights and amenities. Digital governance and technology-enabled municipal service delivery offers the potential to overcome these barriers. However, our research shows the need for mindful deliberation and engagement with last-mile architecture to make digitally enabled state access more inclusive and equitable.

We hope our research is the starting point for developing and deploying robust offline architecture for, keeping humans at the centre of solution design.²⁴ We have learnt that while technology can be empowering, power structures, infrastructural inequality, occupational barriers and mistrust of the state play a role in alienating the most vulnerable citizens from the protections and services of the state. Overlaying tech on prevailing asymmetric structures can only exacerbate inequalities. Engaging with the offline layer of intermediaries at the stage of design and dissemination could cater to the need for last-mile citizens' access to the state.

A significant contribution of this study is the surfacing of existing gaps in access, and alternative pathways adopted by marginalised citizens to reach the state. While the study highlights the relevance of the community layer as the crucial node in unlocking last-mile access, it is imperative to conduct further research around specific solutions.

We suggest the need for further testing of the solutions on the ground, to strengthen causal links and to ensure scalability of solutioning to larger citizen pools, prior to proceeding with overall strategic shifts. An area that could benefit from further research relates to intermediary incentives, and the nature of engagement with last-mile citizens.

²⁴ We also hope to build on this to kickstart a global conversation on communities and ecosystems around societal platforms, through an Offline Architecture Lab at Aapti

Annexe 1

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Expert interviews list

- Akhila Shivdas* – Centre for Research and Advocacy
- Ankit Chhabra* – Sanjhi Sikhiya
- Bhanumathi* – All India Women's Conference
- Sharat Gidda* – Grameen Vikas Kendra
- Pearl Jasra* – IVE CHILDREN
- Smit Singh* – Punjab Ministry of Urban Development
- Simranpreet Singh Oberoi (Manu)* – Sanjhi Sikhiya
- Ravie Kiran* – Centre for Research and Advocacy
- Upendra Nath* – Centre for Research and Advocacy
- Daniel* – Centre for Research and Advocacy
- Santosh More* – Mantra
- Harsharan Kaur* – Self Employed Women's Association
- Gautam Seth* – Indian Youth Congress, Ludhiana

Annexe 2

Classification of ULBs

According to the Andhra Pradesh Municipalities (Gradation of Municipal Councils and Nagar Panchayats) Rules, 1994, urban local bodies (ULBs) are graded on the basis of annual income as:

Type of ULB	Criteria	Number of ULBs (n)
Nagar Panchayat	Annual income of one crore or less than one crore	19
Grade I	Annual income between one crore and two crore	16
Grade II	Annual income between two crore and four crore	30
Grade III	Annual income between four crore and six crore	16
Special Grade	Annual income between six crore and eight crore	7

- All those District Headquarters are classified as Municipal Corporations (n=18)
- 6 ULBs are not classified as under any type of ULB in the AP dashboard – we call them Unclassified

ULB-Level Insights from the Field

1. Andhra Pradesh

	Data Overview	Field insights	Key insights/codes
Guntur	<ul style="list-style-type: none"> • PGR (2019-20) - 60% Phone, ~ 30% Portal + Puraseva app • Pop (2011) - 670073 • Slum pop % - 39.77 • PT (2019) - ₹ 591.52 lakhs 	<ul style="list-style-type: none"> • Ward level differences in push to use digital solutions • Accountability driven by senior ward officials • Higher citizen awareness of digital solutions 	<ul style="list-style-type: none"> • Lower reliance on intermediation • Higher awareness of pathways to municipality
Kakinada	<ul style="list-style-type: none"> • PGR (2019-20) - 60% Phone, ~30% Portal + Puraseva • Pop (2011) - 384182 • Slum pop % -29.16 • PT (2019) - ₹ 128.56 lakhs 	<ul style="list-style-type: none"> • Ward level preference for WhatsApp • Geographies of exclusion exist • Very low citizen awareness of entitlements and digital solutions 	<ul style="list-style-type: none"> • Higher reliance on intermediation • Structural breakdown of access to municipality (Caste/class) • Capacity breakdown at ward level
Anantapur	<ul style="list-style-type: none"> • PGR (2019-20) - 60% Puraseva, 30% CCC • Pop (2011) - 267161 • Slum pop % - 31.97% • PT (2019) - ₹ 2,140.32 lakhs 	<ul style="list-style-type: none"> • Awareness of digital solutions due to information dissemination by intermediaries • Rely on alternate paths to municipality (ward sachivalayam) 	<ul style="list-style-type: none"> • Intermediation bridges awareness gap • Capacity breakdown addressed by NGO intermediaries

2. Punjab

	Data Overview	Field insights	Key insights/codes
Amritsar	<ul style="list-style-type: none">• PGR (2020) - >80% Web• Pop (2011) - 1,132,383• Slum pop % - 28.45%	<ul style="list-style-type: none">• Limited awareness of digital solutions even at the ward level• Extremely low awareness of digital solutions at last-mile level	<ul style="list-style-type: none">• Generally higher awareness of entitlements• Extremely high reliance on intermediation
Jalandhar	<ul style="list-style-type: none">• PGR (2020) - 85% IVRS• Pop (2011) - 862,886• Slum pop % - 16.70%	<ul style="list-style-type: none">• Moderate awareness of digital solutions at the ward level• Low push for use at ward level• Extremely low awareness of entitlements and solutions at last-mile level	<ul style="list-style-type: none">• Extremely low awareness of entitlements and access to municipality• High reliance on NGO intermediation and self

3. Chennai

Data Overview	Field insights	Key insights/codes
<ul style="list-style-type: none">• PGR (2019-20) - >60% by phone• Population (2011) - 4,646,732• Slum population % - 28.89%	<ul style="list-style-type: none">• Limited awareness of existence of digital solutions• High awareness of entitlements owed to them by the State likely due to unique political history in Chennai	<ul style="list-style-type: none">• Generally higher awareness of entitlements• Reliance on local political cadres and informal leaders

Regression summary

This segment contains output summaries from the statistical modelling process that was conducted to explore the implications of housing informality on intermediary channel uptake for PGR resolution at the ward level in Visakhapatnam.

Methodology

The analysis employs the statistical tools of Multiple OLS Regression and PCA (Principal Component Analysis) in STATA to draw meaningful inferences that inform our research directionally. Fourteen predictor variables were chosen based on insights from robust qualitative fieldwork to explore their relationship with the outcome variable (intermediated_perc_201920).

A variable measuring housing informality (housinginformalityindex) and another measuring housing infrastructure (housinginfra) were constructed and used in a series of five regression models to explore their implications for intermediary channel uptake while holding constant other predictors that were indicative of demographics (literacy rates, SC & ST populations), nature of work (nonwork_perc) and total levels of redressal uptake (percapitahh). All variables used in this analysis are listed in Table 1 below.

Modelling limitations

1. The source data set for our predictor variables is the 2011 Census data while data for intermediary channel levels is extracted from the CDMA Dashboard for 2019-20. Despite this discrepancy, we believe patterns of use to have remained consistent and therefore relevant.
2. The outcome variable (y), indicating levels of intermediary channel usage, only includes those people who are within the system already. The lived experiences of people within/outside the system are not accounted for in the modelling process.
3. We use the PCA as an observational tool to construct variables that are aggregate representations of an indicator that is relevant to the outcome variable. This tool emphasises orthogonal projections of the data that contains the highest variance to underscore linear correlations between variables. Given that it was applied to a range of similar variables that were indicative of housing informality and low-quality housing infrastructure, the PCA enabled statistical compression of highly correlated variables to remove the noise from our models.

Interpretation guidance

1. The value of this analysis lies primarily in the directional perceptions that it offers in terms of associations or relationships between specific variables.
2. In interpreting the results of our analysis, it is important to be cognisant of the distinction between 'association' and 'proof' and avoid conflation of the former with the latter.

Variable	Type	Representation	Source Dataset
Intermediated_perc_201920	Outcome Variable (y)	Percentage of complaints received via intermediary channels in 2019-2020	CDMA Dashboard
dilapidated_res	Predictor	Number of 'dilapidated' houses	Census Data (2011)
no_exclusive_room	Predictor	Number of households with no exclusive room	Census Data (2011)
oneroom	Predictor	Number of households with one room only	Census Data (2011)
literacyrate	Predictor	Percentage of the population that is literate	Census Data (2011)
nonwork_perc	Predictor	Percentage of the population that is not working	Census Data (2011)
wall	Predictor	Number of households with walls made of Grass/Thatch/Bamboo, Plastic/Polythene, Mud, Stone, GI/Metal/Asbestos or Other (all indicators of low levels of housing infrastructure)	Census Data (2011)
roof	Predictor	Number of households with roofs made of Grass/Thatch/Bamboo/Wood/Mud, Plastic/polythene or Other (all indicators of low levels of housing infrastructure)	Census Data (2011)
floor	Predictor	Number of households with floors made of mud, stone or Other. (all indicators of low levels of housing infrastructure)	Census Data (2011)
water_source	Predictor	Number of households that use water from an uncovered well, handpump, spring, river/canal, tank/lake/pond or Other (all indicators of low levels of housing infrastructure)	Census Data (2011)
lighting_source	Predictor	Number of households that receive light from kerosene, other oil, Other or have no lighting (all indicators of low levels of housing infrastructure)	Census Data (2011)
fuel	Predictor	Number of households that use firewood, crop residue, cow dung cake, coal/lignite, kerosene, biogas or Other for fuel, including households that do not cook (all indicators of low levels of housing infrastructure)	Census Data (2011)
percapita	Predictor	Total number of complaints (2018-2019) / Total number of households	Census Data (2011)
Inpop	Predictor	Log values of total population levels	Census Data (2011)
scstperc	Predictor	Linear combination of SC & ST populations	Census Data (2011)

housinginformalityindex	Predictor	dilapidated_res, no_exclusive_room and oneroom were combined in this variable using PCA	Census Data (2011)
housinginfra	Predictor	wall, roof, floor, water_source, lighting_source and fuel were combined in this variable using PCA	Census Data (2011)

MODEL 1

Preliminary Analysis

$$y = \text{beta0} + \text{beta1} \cdot \text{dilapidated_res} + \text{beta2} \cdot \text{no_exclusive_room} + \text{beta3} \cdot \text{oneroom} + \text{beta4} \cdot \text{literacyrate} + \text{beta5} \cdot \text{nonwork_perc} + \text{beta6} \cdot \text{wall} + \text{beta7} \cdot \text{roof} + \text{beta8} \cdot \text{floor} + \text{beta9} \cdot \text{water_source} + \text{beta10} \cdot \text{lighting_source} + \text{beta11} \cdot \text{fuel} + \text{beta12} \cdot \text{percapita} + \text{beta13} \cdot \text{lnpop} + \text{beta14} \cdot \text{scstperc}$$

Description:

All fourteen predictor variables are used in this model to gain a preliminary understanding of their relationship with the outcome variable.

Inferences

There exists a positive correlation between the variables wall, floor, oneroom and intermediary channel usage. These associations align with our fieldwork findings that showed residents of informal housing experience difficulty in accessing the state, and prefer the use of intermediaries.

```
. regress intermediated_perc_201920 dilapidated_resno_exclusive_
roomoneroomliteracyratenonwork_perc wall roof floor water_sourcelighting_source fuel
percapitalnpopscstperc
```

Source	SS	df	MS	Number of obs = 71		
Model	1.34868959	14	.096334971	F(14, 56) = 4.45		
Residual	1.21156155	56	.021635028	Prob> F = 0.0000		
Total	2.56025114	70	.036575016	R-squared = 0.5268		
				Adj R-squared = 0.4085		
				Root MSE = .14709		
intermed~201920	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
dilapidated_res	.0202198	.0251244	0.80	0.424	-.0301104	.0705499
no_exclusive~m	-.0058351	.0127243	-0.46	0.648	-.0313248	.0196547
oneroom	.0090873	.0021993	4.13	0.000	.0046816	.0134931
literacyrate	.2966481	.5418556	0.55	0.586	-.7888191	1.382115
nonwork_perc	1.71323	1.173387	1.46	0.150	-.6373461	4.063805
wall	1.899854	.6484205	2.93	0.005	.6009117	3.198796
roof	-.8399241	.726759	-1.16	0.253	-2.295797	.6159492
floor	.9416357	.437564	2.15	0.036	.0650898	1.818182
water_source	.1074996	.1382516	0.78	0.440	-.1694516	.3844507
lighting_source	.4791947	1.25879	0.38	0.705	-2.042464	3.000854
fuel	-1.328219	.332636	-3.99	0.000	-1.994569	-.6618688
percapita	9.422171	15.92818	0.59	0.557	-22.48581	41.33015
lnpop	-.0709902	.1091707	-0.65	0.518	-.2896854	.1477049
scstperc	.0814178	.422173	0.19	0.848	-.7642963	.927132
_cons	-.3094836	1.665989	-0.19	0.853	-3.64686	3.027892

MODEL 2

Construction of a housing informality indicator variable

$$y = \text{beta0} + \text{beta1} \cdot \text{housinginformalityindex} + \text{beta2} \cdot \text{literacyrate} + \text{beta3} \cdot \text{nonwork_perc} + \text{beta4} \cdot \text{wall} + \text{beta5} \cdot \text{roof} + \text{beta6} \cdot \text{floor} + \text{beta7} \cdot \text{water_source} + \text{beta8} \cdot \text{lighting_source} + \text{beta9} \cdot \text{fuel} + \text{beta10} \cdot \text{percapita} + \text{beta11} \cdot \text{lnpop} + \text{beta12} \cdot \text{scstperc}$$

Description:

This model employs PCA to aggregate three predictors (dilapidated_res, no_exclusive_room and oneroom) into an indicator variable for housing informality. This helps reduce the compounding effect that the correlation between each of these predictors has on the output and is a step towards minimising the effects of multicollinearity

Inferences

The housing informality indicator (housinginformalityindex) shows a statistically significant positive correlation with the outcome variable at the 95% confidence level ($p < 0.05$) such that intermediation increases by 1% for every increase in the number of informal households by 0.06 households. The PCA weighted this variable across dilapidated_res (0.55), oneroom (0.59) and no_exclusive_room (0.58). Thus, increases in housing informality (as measured by the index) at the ward level are associated with increases in the percentage of complaints through intermediated channels, keeping other predictors constant. This aligns with our field findings at all three sites in Andhra Pradesh – residents in informal housing experience breakdowns in access to the state.

.pca dilapidated_resoneroomno_exclusive_room

```
Principal components/correlation          Number of obs   =      71
                                           Number of comp. =       3
                                           Trace           =       3
                                           Rho             =     1.0000
```

Rotation: (unrotated = principal)				
Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.76855	1.10232	0.5895	0.5895
Comp2	.666238	.101029	0.2221	0.8116
Comp3	.565209	.	0.1884	1.0000

```
. predict housinginformalityindex
(score assumed)
(2 components skipped)
Scoring coefficients
sum of squares (column-loading) = 1
```

Variable	Comp1	Comp2	Comp3
dilapidate~s	0.5528	0.8151	0.1735
oneroom	0.5970	-0.2421	-0.7649
no_exclusi~m	0.5814	-0.5263	0.6204

Source	SS	df	MS
Model	1.11897997	12	.093248331
Residual	1.44127117	58	.024849503

```
Number of obs =      71
F( 12, 58) =    3.75
Prob> F       = 0.0003
R-squared     = 0.4371
Adj R-squared = 0.3206
```


Total		2.56025114	70	.036575016	Root MSE		=	.15764
intermed~201920		Coef.	Std. Err.	t	P> t	[95% Conf. Intervall		
housinginform~x		.0616255	.021082	2.92	0.005	.0194252	.1038258	
literacyrate		.1167219	.574889	0.20	0.840	-1.034044	1.267487	
nonwork_perc		1.47504	1.255004	1.18	0.245	-1.037123	3.987203	
wall		1.669117	.6551132	2.55	0.014	.3577657	2.980469	
roof		-.9361942	.7609805	-1.23	0.224	-2.459462	.5870738	
floor		.6908212	.4616202	1.50	0.140	-.233212	1.614854	
water_source		.0491683	.1460622	0.34	0.738	-.2432071	.3415436	
lighting_source		-.4106061	1.316384	-0.31	0.756	-3.045635	2.224423	
fuel		-.8988445	.3269283	-2.75	0.008	-1.553263	-.2444264	
percapita		-8.330409	16.0347	-0.52	0.605	-40.42735	23.76653	
lnpop		-.0329739	.1162985	-0.28	0.778	-.2657706	.1998227	
scstperc		.3191056	.4456348	0.72	0.477	-.5729293	1.211141	
cons		-.065243	1.765065	-0.04	0.971	-3.598404	3.467918	

MODEL 3

Construction of a low-quality housing infrastructure indicator variable

$$y = \text{beta0} + \text{beta1} \cdot \text{dilapidated_res} + \text{beta2} \cdot \text{no_exclusive_room} + \text{beta3} \cdot \text{oneroom} + \text{beta4} \cdot \text{literacyrate} + \text{beta5} \cdot \text{nonwork_perc} + \text{beta6} \cdot \text{housinginfra} + \text{beta7} \cdot \text{percapita} + \text{beta8} \cdot \text{lnpop} + \text{beta9} \cdot \text{scstperc}$$

Description:

This model employs PCA to aggregate six predictors (wall, roof, floor, water_source, lighting_source and fuel) that are most typically associated with low quality housing infrastructure into a single indicator variable (housinginfra). This helps reduce the compounding effect that the correlation between each of these predictors has on the output and is a step towards minimising the effects of multicollinearity in the model.

Inferences

The coefficient for the low-quality housing infrastructure variable (housinginfra) is not statistically significant and shows a negative association with intermediary uptake. Although this result could be a representation of the true statistical association between these variables, it is likely that the variable housinginfra captures people that are not in the system to begin with. The variable is thus a statistical present but has no theoretical or fieldwork resonance. For instance, our fieldwork findings show that people who live in spaces with low-quality infrastructure are often under the control of slum lords, making the possibility of their inclusion in the outcome variable (intermediary channel uptake) narrow.

There exist statistically significant positive correlations between literacy rates and non-working populations with intermediary channel usage. The model shows that for every increase in literacy rates by 1.52% there is a 1% increase in intermediary channel usage. The implications of this result, given that such a relationship accurately captures pattern of use, are noteworthy as they suggest that even people with higher levels of education rely on intermediation to access the state. Additionally, with every 2.26% increase in non-working populations there is a 1% increase in intermediary channel usage.

It is important to note that these inferences are relevant when all remaining predictors in the model are held constant.

```
. pca wall roof floor water_source lighting_source fuel
```

```
Principal components/correlation      Number of obs   =      71
                                      Number of comp.  =       6
                                      Trace              =       6
Rotation: (unrotated = principal)    Rho              =    1.0000
```

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.46239	2.25729	0.5771	0.5771
Comp2	1.2051	.661687	0.2009	0.7779
Comp3	.543417	.152547	0.0906	0.8685
Comp4	.390869	.152588	0.0651	0.9336
Comp5	.238282	.0783466	0.0397	0.9733
Comp6	.159935	.	0.0267	1.0000

```
. predict housinginfra
(score assumed)
(5 components skipped)
```

```
Scoring coefficients
```

```
sum of squares(column-loading) = 1
```

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6
wall	0.4751	-0.1122	0.0133	-0.5104	0.5207	0.4795
roof	0.4806	-0.0396	-0.0045	-0.5140	-0.4336	-0.5615
floor	0.2021	0.7250	0.6337	0.0675	-0.0997	0.1319
water_source	0.3093	0.5546	-0.6992	0.2275	0.1978	-0.1298
lighting_sve	0.4352	-0.3100	0.3115	0.5231	0.4188	-0.4104
fuel	0.4663	-0.2376	-0.1105	0.3813	-0.5625	0.5021

```
. regress intermediated_perc_201920 dilapidated_resno_exclusive_
roomoneroomliteracyratenonwork_perchoosinginfra percapitalnpop scstperc
```

Source	SS	df	MS	Number of obs =	71
Model	.827857112	9	.091984124	F(9, 61) =	3.24
Residual	1.73239403	61	.028399902	Prob> F =	0.0028
Total	2.56025114	70	.036575016	R-squared =	0.3233
				Adj R-squared =	0.2235
				Root MSE =	.16852

intermed~201920	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
dilapidated_res	.0429523	.0257819	1.67	0.101	-.0086019 .0945064
no_exclusive_~m	.0012995	.0135523	0.10	0.924	-.0258001 .028399
oneroom	.0048376	.0022455	2.15	0.035	.0003475 .0093278
literacyrate	1.517221	.5027584	3.02	0.004	.511893 2.522548
nonwork_perc	2.255466	1.314069	1.72	0.091	-.3721774 4.88311
housinginfra	-.0137689	.0135562	-1.02	0.314	-.0408762 .0133384
percapita	-20.32299	16.4871	-1.23	0.222	-53.29099 12.645
lnpop	.1675909	.101282	1.65	0.103	-.0349351 .3701168
scstperc	.0356582	.4437385	0.08	0.936	-.8516518 .9229682
_cons	-3.792006	1.581618	-2.40	0.020	-6.954648 -.6293648

MODEL 4

Inclusion of both constructed indicator variables

$$y = \beta_0 + \beta_1 \text{housinginformalityindex} + \beta_2 \text{literacyrate} + \beta_3 \text{nonwork_perc} + \beta_4 \text{housinginfra} + \beta_5 \text{percapita} + \beta_6 \text{lnpop} + \beta_7 \text{scstperc}$$

Description:

Both the constructed variables (housinginformalityindex and housinginfra) are included in this model with the remaining five predictors. Having reduced the number of predictors, the effect of multicollinearity has been minimised in this model.

Inferences

There continues to exist a statistically significant positive association between the housing informality indicator (housinginformalityindex) with the outcome variable such that there is a 1% increase in intermediation for every increase in the number of informal households by 0.057 households. The positive association between literacy rates and intermediation also continues to remain statistically significant such that an increase in literacy rates by 1.3% will lead to a 1% increase in intermediary channel levels. Interestingly, as the number of total PGR complaints increase, there is a decrease in intermediary channel usage such that for every 26.39 increase in complaints there is a 1% decrease in intermediary channel levels. This result implies that with an increase in the total number of complaints, people tend to gravitate away from intermediary channel usage.

```
. regress intermediated_perc_201920 housinginformalityindex literacyrate nonwork_
```

```
> perc housinginfra percapita lnpop scstperc
```

Source	SS	df	MS	Number of obs =	71
Model	.761830233	7	.10883289	F(7, 63) =	3.81
Residual	1.79842091	63	.028546364	Prob> F	= 0.0016
				R-squared	= 0.2976
				Adj R-squared	= 0.2195
Total	2.56025114	70	.036575016	Root MSE	= .16896

intermed~201920	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
housinginform~x	.0568099	.0188833	3.01	0.004	.0190746 .0945452
literacyrate	1.295884	.4414642	2.94	0.005	.413688 2.17808
nonwork_perc	2.018869	1.304869	1.55	0.127	-.588704 4.626442
housinginfra	-.01425	.0132225	-1.08	0.285	-.040673 .012173
percapita	-26.39212	15.97631	-1.65	0.104	-58.31823 5.533991
lnpop	.1725467	.0997325	1.73	0.089	-.0267527 .3718461
scstperc	.1180992	.4375405	0.27	0.788	-.7562558 .9924542
_cons	-3.310927	1.488562	-2.22	0.030	-6.28558 -.3362734

MODEL 5

Inclusion of both constructed indicator variables

$$y = \text{beta0} + \text{beta1} \cdot \text{housinginformalityindex} + \text{beta2} \cdot \text{housinginfra} + \text{beta3} \cdot \text{housinginformalityindex} \cdot \text{housinginfra} + \text{beta4} \cdot \text{literacyrate} + \text{beta5} \cdot \text{nonwork_perc} + \text{beta6} \cdot \text{percapita} + \text{beta7} \cdot \text{lnpop} + \text{beta8} \cdot \text{scstperc}$$

Description:

This model includes an interaction term to account for the effect that the relationship between low-quality housing infrastructure and housing informality has on the outputs of the regression model.

Inferences

There continues to remain a statistically significant positive correlation between the housing informality indicator and literacy rates with intermediary channel uptake, indicating the robustness of these variables under differentiated models. The low-quality housing indicator also continues to remain statistically insignificant.

```
. regress intermediated_perc_201920 c.housinginformalityindex##c.housinginfra li
```

```
>teracyratenonwork_percpercapitalnpop scstperc
```

Source	SS	df	MS	Number of obs = 71		
Model	.76275733	8	.095344666	F(8, 62) = 3.29		
Residual	1.79749381	62	.028991836	Prob> F = 0.0034		
Total	2.56025114	70	.036575016	R-squared = 0.2979		
				Adj R-squared = 0.2073		
				Root MSE = .17027		

intermed~201920	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
housinginform~x	.0562863	.019254	2.92	0.005	.017798	.0947745
housinginfra	-.0151466	.0142374	-1.06	0.292	-.0436067	.0133135
c.						
housinginform~x#						
c.housinginfra	.0017867	.0099914	0.18	0.859	-.0181858	.0217592
literacyrate	1.265324	.4765882	2.65	0.010	.312638	2.21801
nonwork_perc	2.012787	1.315451	1.53	0.131	-.6167622	4.642336
percapita	-26.12072	16.17186	-1.62	0.111	-58.44781	6.206361
lnpop	.1718562	.1005818	1.71	0.093	-.0292038	.3729163
scstperc	.1176274	.4409492	0.27	0.791	-.7638175	.9990722
_cons	-3.278617	1.510973	-2.17	0.034	-6.299009	-.2582257

Key Inferences & Takeaways

1. **Housing Informality:** We find that housing informality is positively correlated with intermediary channel levels in Models 2, 4 & 5 at statistically significant 95% confidence levels (p-value < 0.05).

This implies that increases in housing informality (as measured by our index), at the ward level, are associated with increases in the percentage of complaints through intermediated channels, keeping other predictors constant. This result aligns with our field findings at all three sites in Andhra Pradesh – residents in informal housing experience breakdowns in access to the state.

2. **Literacy Rates:** We find that literacy rates are positively correlated with intermediary channel levels in Models 3, 4 & 5 at statistically significant 95% confidence levels (p-value < 0.05).

The implications of this result, given that such a relationship accurately captures pattern of use, are noteworthy as they suggest that even people with higher levels of education rely on intermediation to access the state.

3. **Low-quality Housing Infrastructure:** We find that the housing infrastructure indicator is statistically insignificant (p-value > 0.05) with respect to intermediary channel levels in Models 3, 4 & 5.

Although this result could be a representation of the true statistical association between these variables, it is likely that the variable captures people that are not in the system to begin with. The variable is thus a statistical present but has no theoretical or fieldwork resonance. For instance, our fieldwork findings show

that people who live in spaces with low-quality infrastructure are often under the control of slum lords, making the possibility of their inclusion in the outcome variable (intermediary channel uptake) narrow.

The following caveats apply to these findings:

- a. This data analysis was conducted using 2011 Census data.
- b. Even with the use of more contemporary data sets, it is indeterminate that our findings reflect the behaviour of informal households. However, robust qualitative research from the field supports our key findings in this analysis.
- c. Applicability of our findings to elite sections of society is limited not only in terms of the explanatory power of our statistical results but also in terms of insights from fieldwork about this section of society.

