USER INNOVATION AND EGOVERNANCE DESIGN

Jessica Wallack & **Srikanth Nadhamuni**[1]

August 9, 2009

Abstract

This paper provides an analytical case study of an Indian NGO's efforts to engage city government officials in developing and refining an e-governance system for tracking public grievances and city performance in redressing these. The eGovernments Foundation (www.egovernments.org) developed the first version of its Public Grievance and Redressal Module (PGRM) based on careful study of city government and citizen needs. Not all of the needs were obvious, however, nor were users (governments and citizens) necessarily able to predict and express what attributes of a then-unfamiliar system would be most helpful. The foundation is now seeking to harness user insight and innovations to refine the system. Users' suggestions and observed efforts to customize and adapt the program, the practices they employ to encourage others (colleagues and constituents) to use the system, and even their efforts to evade adoption of the technology are a potentially rich set of design inputs to refine the products, particularly as city officials become more adept with technology. This paper documents our efforts to learn from city officials' actions and ideas and identify city government users who might be particularly worth following up with over time. The activities described here are the first part of an ongoing initiative to involve more stakeholders, including citizens and politicians, in refining the PGRM.

[1] The authors' affiliations are *Director, Centre for Development Finance, Chennai, India; and Managing Trustee, Egovernments Foundation, Bangalore, respectively.* *We would like to thank Sudha Yadav for helpful research assistance, Mr. Zia Ullah for his support of this initiative, and all of the Karnataka city officials who responded to our survey for their time*

Local Governments and "Customer Service"

Local governments are the natural customer service organizations of the public sector. Whether they are acting as intermediaries for funds transferred from higher levels of government, implementing state programs, or simply carrying out their own responsibilities and policies, local governments are crucial links in delivery of government services to citizens. Many of people's everyday needs relating to water and sewerage, electricity, and roads are linked to local governments or closely linked parastatal agencies. Local governments are also the point at which citizens interact most with the government. Paying fees and taxes (e.g. property tax, water tax/fee), obtaining certificates (for birth, death, or registrations, for example), getting approval for constructing of buildings are all important transactions that local governments around the world are often responsible for.

City Governance in India

A city is geographically broken up into wards, each of which has an elected councilor. The councilors of the various wards jointly constitute the city council and elect a mayor (in the case of a corporation of over 300,000 people) or a president (in the case of a smaller city municipal council). The council comes up with the city budget and the program of works that will be taken up in a given year. The implementation of these works rests on the executive branch of the city government headed by the commissioner. The commissioner, depending on the size of the city, might appoint zonal Deputy Commissioners (DCs) and Department Heads such as Deputy Commissioner Revenue, Chief Engineer, Chief Health Officer, etc. Each of these officials manages a team of service providers and/or any private service providers

The challenge is how to create and enable a customer-service mentality in local governments, and especially in newly empowered local governments such as India's.[2] The literature on decentralization extols the informational advantage that local governments have in discerning and responding to local needs, but glosses over exactly how local governments measure customer satisfaction and identify causes of customer

[2] The history of urban local governments (ULGs) in India with independent powers of decision making and revenue collections is relatively short. The 74th constitutional amendment enacted in 1992 gave these bodies constitutional status and prescribed a set of responsibilities for them. States were left to oversee the actual implementation of devolution, however, since "local governance" is constitutionally a state subject. Their enthusiasm for transferring "funds, functionaries, and functions" varied. Many justified their haphazard and grudging devolution by pointing to local governments' "lack of capacity," but the uncertainty and the lack of autonomy only perpetuated in the problem in developing any kind of administrative and service deliver capacity.

dissatisfaction.[3] "Local" still means hundreds of thousands of citizens to work with in India's cities. Elections are a crude way to convey information: just an opportunity to take a binary up or down vote on officials' overall performance on a multi-year, multi-aspect job.

Everyday citizen interactions with local officials – elected and bureaucrats - provide more fine-grained information on citizen priorities, and feedback on performance, but it can be difficult for the organization to absorb this information to use it to shape its actions. Technology can be used to bridge some informational gaps, but writing software, creating a website, or building a database no more guarantee effective performance in the public sector than they do in the private sector. System design is matters: How does a citizen's complaint get registered and passed on to the department or person who can respond? When several citizens complain, how do these complaints get tracked to better understand whether it is a resource or an effort problem that is causing the breakdown in services? When a multitude complains, how are the legitimate complaints separated from the cacophony? The organizational changes accompanying IT and encouraging its integration into work flows and interactions are equally if not more important than the technology itself in translating the information into improved performance.

Designing effective infrastructures for citizen-state interaction requires bringing together technology knowledge, governance experience, political savvy, and the will to use all of these skills to effect change. The challenge is that these diverse skills are rarely found in the same organization, much less in a single person or small design team.

This paper documents "innovation squared" in seeking to bring together governance and technology knowledge in e-governance design. We first describe an innovative way to manage citizen feedback about public services, and second, our initial efforts to incorporate user innovations – above and beyond user perspectives - to improve this e-governance system.

[3] Local governments' information advantage in identifying local needs and tailoring policy these was one of the earliest arguments for decentralization: see, for example, Tiebout (1956), Oates (1972, 1977). More recently, see Bardhan (2002) and Faguet (2004).

The first section describes the eGovernments Foundation's Public Grievance and Redressal Module (PGRM). Public grievance systems are being implemented across the country at various levels of government in various departments, but the eGovernments Foundation's software is one of the most widely implemented systems.[4] The PGRM is currently running in Chennai (Tamil Nadu), more than 97 cities in the state of Karnataka, and as a customer service management tool for Delhi Transco Limited and the Haryana Transmission Corporation. We discuss its features and evaluate the extent and nature of usage as one indicator of the system's performance.

The next section discusses one of the main design challenges in developing and refining a system to effectively use IT to drive better governance. Information on both user needs and solutions is "sticky," or difficult to transfer between users and IT providers.[5] The classic definition of "sticky" information in the business context [Von Hippel (1994)] focuses on the costs of sharing information, but the incentives to share information are at least as important. Information is sticky in both senses. Important details about informal institutions, city worker ability, citizens' access to IT, citizens' time and location constraints, and other factors that the system has to respond to are not always readily available or collectible on an ongoing basis for developing and refining the system. City officials may also have incentives to obfuscate. Those who can see ways that the system could constrain their discretion or help their managers or voters identify failings, for example, are unlikely to volunteer this information to system designers. Users cannot be relied upon to answer questions truthfully, much less to spontaneously post their ideas in chat rooms or other fora that designers can monitor at low cost.

[4] Other examples include: "Lokvani" (Voice of the People) was implemented in rural Sitapur, Uttar Pradesh. PRAJA, a local NGO, has implemented an online complaints management system in the Mumbai Municipal Corporation. An increasing number of local governments have an email address and/or a simple form that citizens can use to provide feedback.

[5] Von Hippel (1994) defines the "stickiness" of information as essentially the cost of sharing it. In the egovernance context, the incentive to share information also matters. City officials who can see ways that the system could constrain their discretion or help their managers or voters identify failings, for example, are unlikely to volunteer this information to the egovernance system designers.

The third section explores potential ways to overcome this sticky information in designing the next generation of egovernance systems. The typical approach to e-governance design – and the eGovernment Foundation's initial approach – brings information about governance to the technologists so that they can design solutions. The technologists become more familiar with governance in the process, but this melding of knowledge about the (governance) problems and (technology) solutions is bounded by the fact that engineers are unlikely to ever become public servants or actually experience the governance process. We focus on the potential role of technology users as innovators. City officials are becoming increasingly experienced over time as e-governance systems become more widely used for managing everything from public works to finances to citizen complaints. Their insights are a potentially rich source of design inputs.

eGovernments Foundation

www.egovernments.org

The eGovernments Foundation is a new breed of IT Social Startup (a registered not-for-profit trust) whose mission is to provide an eGovernance Software System for use in Corporations and Municipalities all across India - for Free. The goal of the eGovernance system is to improve Governance in India, and bring about accountability and transparency through the effective use of IT and Government Process Reengineering. eGov was started by Nandan Nilekani and Srikanth Nadhamuni in 2003.

Currently the eGovernments Foundation is working in more than 130 cities across India in Karnataka, Delhi, Andhra Pradesh and Haryana. The Nirmala Nagara project in Karnataka taken up by eGovernments Foundation is one of the largest implementations of municipal eGovernance in the world, including implementation of 6 municipal applications, accrual accounting, works management, property taxation, birth/death registration, public grievance & redressal (PGR), cadastral level GIS mapping and city websites to facilitate online transactions, disclosure of data and online payment of taxes and fees.

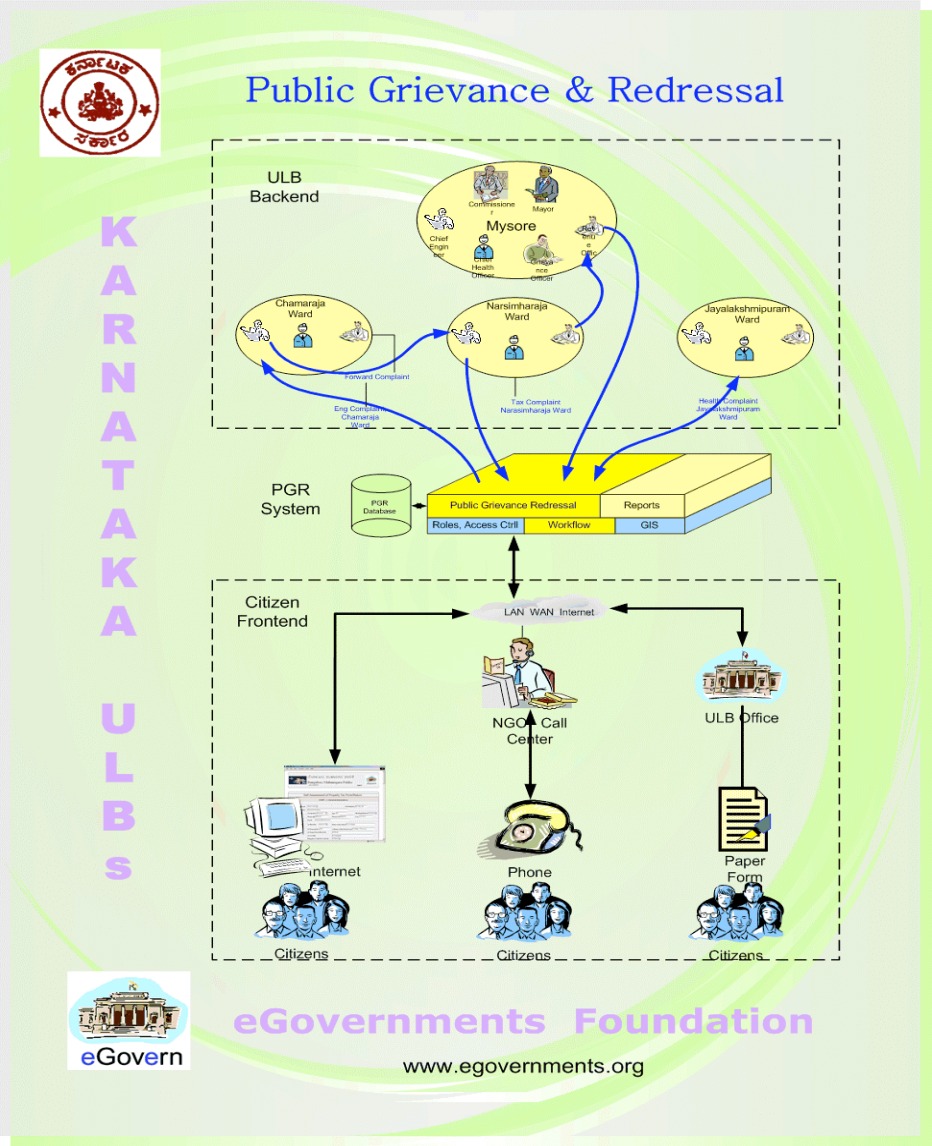
The foundation also works in the area of education, focusing on improving learning and retention in government schools in the states of Karnataka and Andhra Pradesh.

Harnessing this knowledge, however, is the challenge. Similar strategies of "user innovation" are already used in the corporate world to harness user ideas in fields from scientific instruments to sporting goods[6], but the fact that "information stickiness" includes

[6] See, among other cases: Herstatt and von Hippel (1992), Luthje, et al (2005), Morrison, et al (2000), Riggs and von Hippel (1994).

both costs of sharing and incentives to share means that harnessing user insight in governance poses unique obstacles relative to those outlined in the user innovation literature. The user innovation literature focuses on screening for innovative users and tracking their ideas in a cost-effective way, but assumes that users will be relatively forthcoming about their ideas. We face the additional challenge of motivating users to share their ideas. We outline some potential strategies for harnessing user innovation in this context and discuss our ongoing efforts to identify innovations and innovators among the users of the PGR system.

Section Four concludes. Technologists and technology-focused organizations will probably always play a central role in e-governance design, as this is where experience with technology, knowledge about governance, and the incentives to exploit these two kinds of expertise for better public sector performance come together. However, there does appear to be unexploited potential to learn more from users in e-governance design and we urge technologists to be more systematic in learning from user insight.



The Nirmala Nagara Public Grievance and Redressal Module

The initial version of the PGRM was part of a larger Municipal e-governance

project "Nirmala Nagara" (beautiful city) implemented in 57 cities of Karnataka. The goal was to develop and implement e-governance systems that would improve the city's delivery of services to citizens throughout the state by improving the municipality's internal efficiency, supporting record keeping, and enable disclosure of all public information. These municipal e-governance modules included eGov Property to manage property tax collection; eGov Financials, an accrual-based financial accounting system; eGov Payroll to streamline salary payments; eGov Inventory for inventory control; and eGov Birth/Death, a civil registration system; in addition to the eGov PGRM for managing public grievance and redressal. The PGRM was designed to facilitate the registration of complaints to the city government and support backend workflows needed to improve redressal of these complaints. Information from the system can also help state officials, city managers, and citizens track urban governments' performance in providing services that inspire few complaints and responding quickly to complaints that do arise.

The PGRM is a relatively rare example of an interactive e-governance tool implemented in a developing country context. These types of tools are generally considered to represent more "advanced" stages of egovernance than the more common use of IT to enable publishing of government information.[7] Citizens can register their complaints via the internet, phone, or by simply filling out a paper form and submitting it at one of the municipal offices. Many choose to bring their complaint to a local leader of a community group or to an elected councilor from their ward who then registers the complaint in their (the leader's) name.[8] A local NGO, chosen by the city among NGOs with a demonstrated strong presence in the city, was appointed to manage the front end in order to make the PGRM more accessible and user friendly to citizens. The goal in having the city choose an NGO from among those with a demonstrated local presence was to ensure that the intermediary was trusted by both citizens (as demonstrated by longer existence) and government (as demonstrated by choice), but the

[7] See Balutis (2001), Howard (2001), and Lau et al (2008), for example.

[8] Nearly all of the "frequent complainants" with more than 20 registered grievances over July 2005 – May 2007 identified themselves as councilors or spokespersons for public welfare societies. Wallack (2007)

Foundation has not verified whether the selected NGOs are in fact perceived as neutral players.[9]

All complaints get recorded in to the PGRM database in the same standard format and a complaint tracking number is issued to the citizen. The status of the grievance can be checked 24x7 via the internet, phone or by physically coming over to a municipal grievance office/desk. The citizen can resubmit the complaint or protest if it is recorded as "redressed" while the work has not been completed on the ground. From city's perspective, this simplifies the complaint management task – the same system offers full disclosure to the citizen as to who is working on the complaint, regardless of the channel that the complaint came in through.

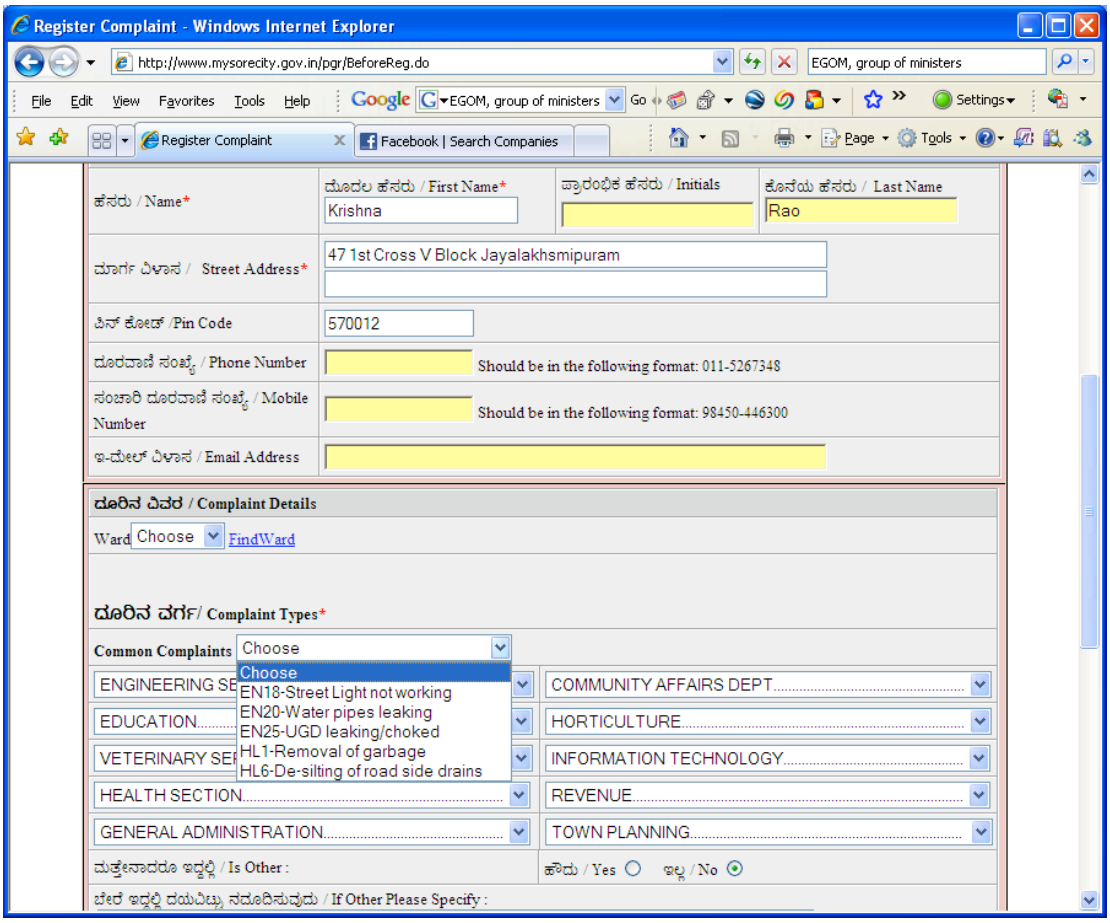


Figure 2: Citizen's complaint registration form

[9] One possibility is to have the NGO rotate over time, based on some selection mechanism that involved both citizen and city influence.

The lifecycle of a complaint through its state-transitions are recorded in the system, which helps manage the large number of complaints that a city gets. Complaints are recorded as "registered" as soon as they are entered into the electronic system. They are automatically routed to the system's inbox for the appropriate city official based on the complaint type and location of the complaint.[10] Figure 3 below shows a redressal officer's view of the system where s/he can run various queries to list complaints of a certain type. The officer can then assign the responsibility for redressal to another official (in which case the complaint status becomes "Assigned") or start to address it himself, at which time the status becomes "Processing." Finally, when the complaint has been fixed then the complaint goes to the "Completed" state. The feature simplifies urban management, as it embeds the organization chart of the government agency and auto-route complaints to the appropriate redressal officer through a configurable rule-drive engine that helps manage the distribution and load-balancing of complaints amongst redressal-officers.

The administrator and the complainant can also communicate through the PGRM system itself over the internet or via the phone. The NGO keeps online written records of all phone conversations. This has proven to be a very important channel of communication between the two to clarify details of the complaint as well as the redressal. The PGRM module also uses SMS over mobile phones to communicate 'emergency/urgent complaints' to the redressal officers through the rule driven auto-routing sub-module. The citizen is also contacted by SMS is s/he has filled out a mobile number during complaint registration.

[10] All relevant officers are given "redressal officer" accounts.

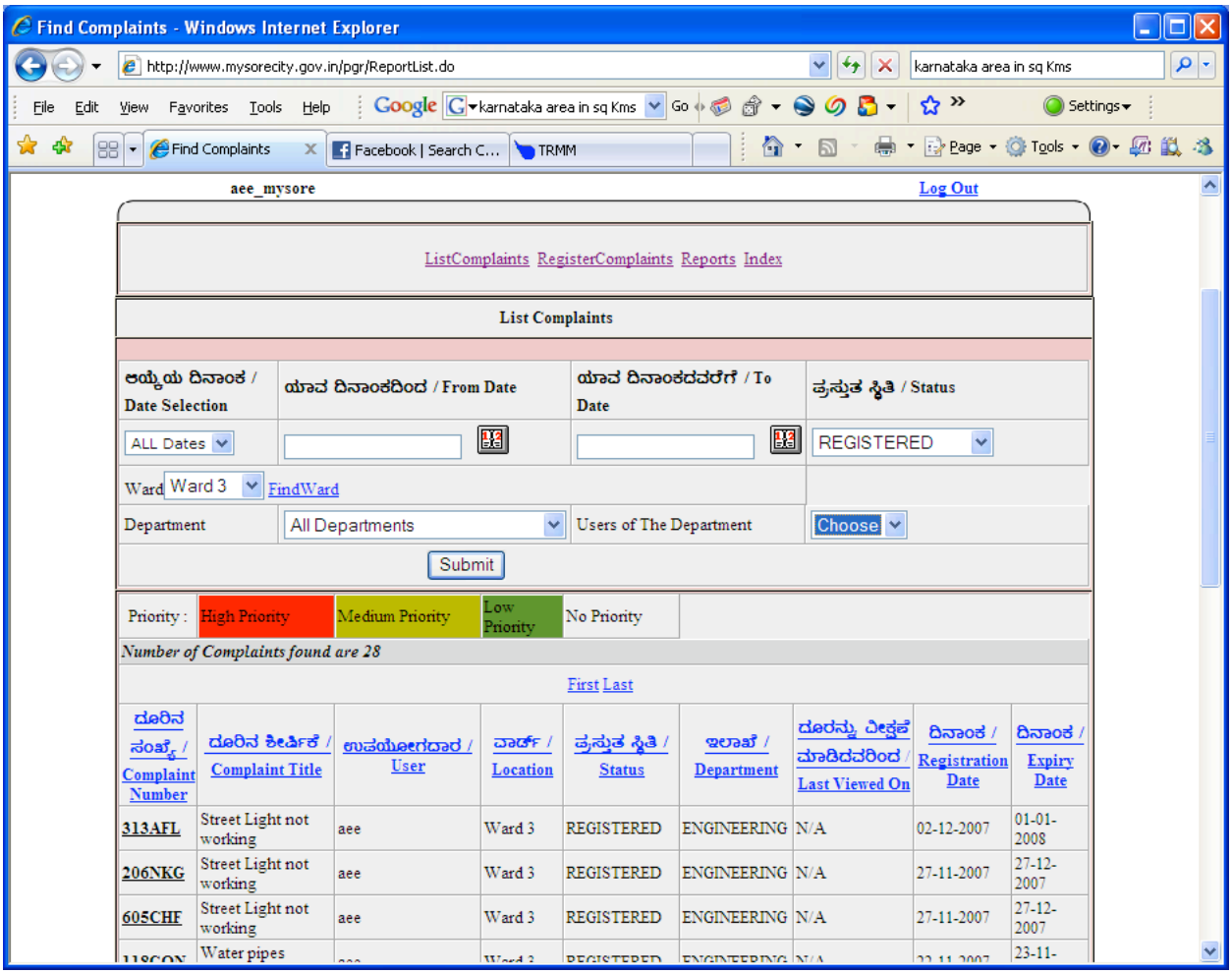


Figure 3: Redressal Officer's View of Grievances

The PGRM documents and publishes tallies of grievances and redressal in easy-to-digest visual reports such as graphs, pie-charts and GIS maps to help both citizen groups and city administrators see larger trends and patterns in the problems faced by the city. Citizens can generate real-time customized reports of complaints by area or type online. (Figure 4) The analytics built into the visual reporting system also help detect patterns and trends about the common problems afflicting the city, which is meant to help administrators focus resources on the most pressing problems at the specific locations pointed out by the GIS maps built into the PGRM system.

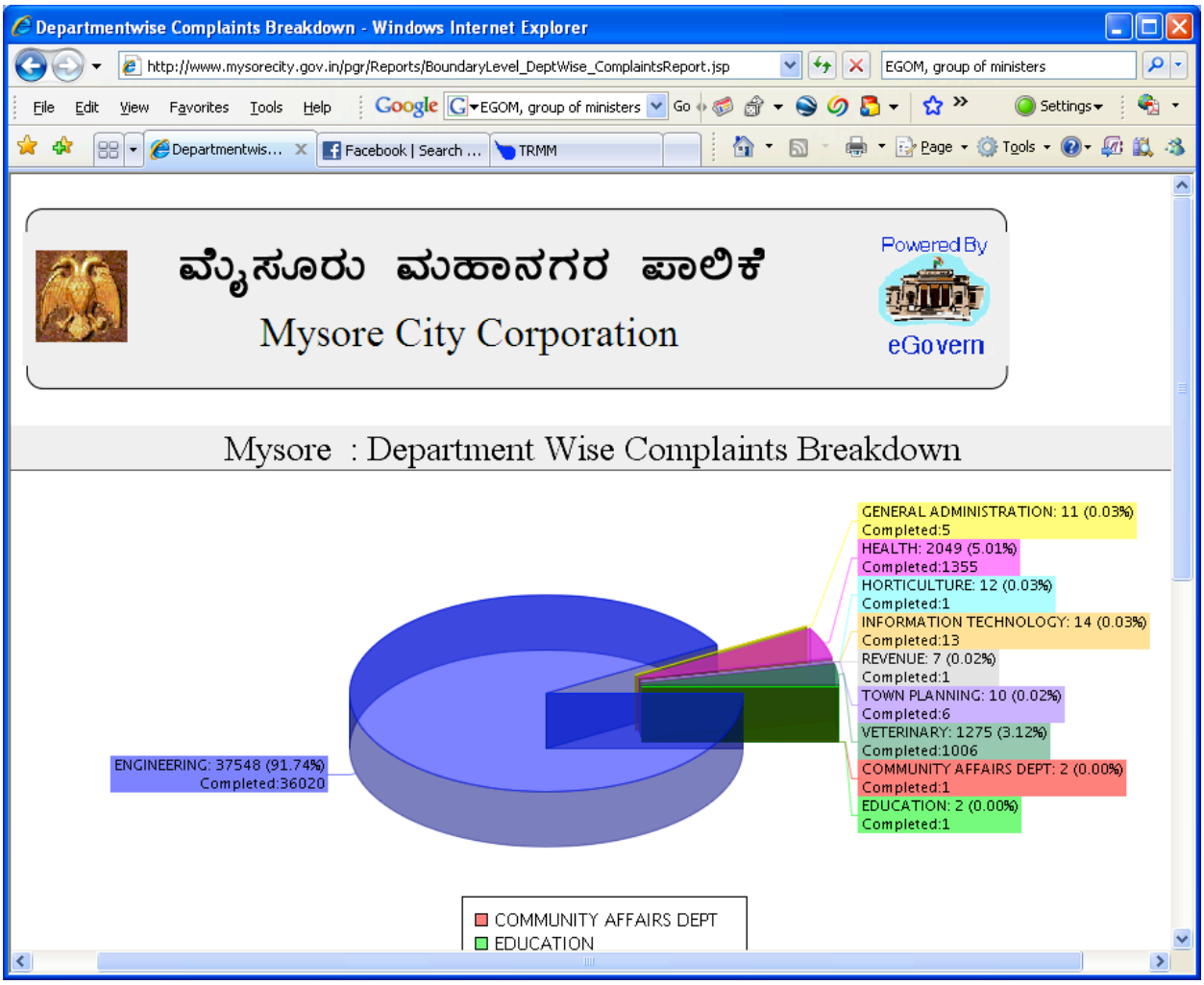


Figure 4: Distribution of complaints by department in the Mysore City Corporation as of Dec 12th 2007

The PGRM is unique among eGovernments' applications in that it collects information directly from the people and measures the responsiveness of the urban government in responding to these grievances. Internal systems (such as taxation, accounting, works etc) support efficient city management; the PGRM provides new information on effectiveness. The accuracy of this information, however, depends on cities and citizens actually using the system to facilitate a conversation about their grievances.

Does the PGRM Work?

The first and feasible step to assess whether or not the system "works" is to check whether cities and citizens are using the system to report and track complaints.[11] Ideally, we would be able to show that the system contributed to better service outcomes, but this kind of impact assessment is beyond the scope of the paper.[12]

Public sector usage of the PGRM has increased over time, but some important exceptions indicate city officials' resistance to using the module to track citizen feedback on their work. On the one hand, the state of Karnataka has fully adopted it as a means of managing citizen complaints for its cities. As discussed above, the module was initially used in the 57 larger cities, but is now being used in nearly a hundred cities of varying sizes statewide. The state uses the aggregate reports to supplement official statistics on city priorities, and the complaints reports have affected both city budgets and state transfers to cities.

Our small survey in Karnataka found that the cities are taking advantage of the information for work planning and short-term allocation of resources as well as for monitoring departments' performance. Table 1 summarizes the answers to the question "Does your city use information on Public Grievances to plan for departments' annual/monthly/weekly/daily work programmes?".[13]

Table 1

Answer Options	**Yes**	**No**	**Sometimes**	**Response Count**
Annual work programme or priorities?	13	10	13	36

[11] Tracking usage seems to be a fairly common shortcut for evaluating egovernance effectiveness. See, for example, Gupta et al (2008) and references therein.

[12] We do not know of any credible impact evaluations of such systems for managing citizen complaints. The problem with simply looking at whether outcomes changed after system implementation is that the governments that invite and implement public grievance management systems are likely to be different than those that avoid them in some way that is correlated with their ability and incentives to deliver quality infrastructure and services.

[13] The question format required officials to respond yes/no/sometimes for each time period mentioned on a separate row.

Monthly work programme or priorities?	18	3	11	32
Weekly work programme or priorities?	27	4	2	33
Daily assignments?	25	4	4	33
			answered question	**45**
			skipped question	**29**

Weekly planning seemed to be the most common use of the grievance information. More than half (26) of the 45 cities who answered the question used the PGR system to determine their annual work plans at least sometime, while only ten explicitly said that they did not use the PGR for annual planning. Monthly, weekly, and daily planning all had the same number of "yes" and "sometimes" (29), and fewer explicit statements that grievance information was NOT used for planning.

The system has also attracted new customers outside of the urban milieu. The Delhi Transmission Corporation, for example, monitors the performance of the (private sector) distribution companies using the PGRM; the Haryana transmission corporation is also using it for a similar purpose. Members of Parliament have also expressed interest in using it to track constituents' concerns.

On the other hand, Karnataka's most prominent city, Bangalore, does not use the system and one of the large early adopters, Delhi, has stopped using the system. The city did not provide any reason for discontinuing usage, and the current disuse is surprising because the city was one of the early innovators in adapting features of the system for internal communication among city officials. Informal interaction with officials suggested that the system had been highlighting many more complaints than the city could actually handle.

Several cities also use parallel processes for managing grievances. Some department officials, for example, told us in various informal interactions that that they continued to receive complaints directly from citizens or specifically went out to worksites to check for potential complaints. Others mentioned using phone calls or direct communication to route complaints to the appropriate departments in emergencies. Survey responses support these anecdotes: Even city officials who reported using the public grievance system 100% of the time received and routed complaints using features that were not part of the system. Modifying the system to motivate more complete usage is a high priority: the performance reports generated for citizens and city managers will be inaccurate and potentially biased if these parallel flows of information are not being captured in the PGRM.

Citizen usage of the system is also varied. Wallack (2007)' s study of the grievance profiles generated by the system found that the types of concerns generated by the system were generally in line with media reports, anecdotal perceptions of city service priorities, and available data on infrastructure quality. Nevertheless, there is room for improvement to ensure that the PGR system is presenting an accurate picture of citizen concerns and city performance. Cumulative complaints over July 2005 – May 2007, the period considered in that study ranged from 0.004 (Bidar) to 0.09 (Ranebennur) per capita in Karnataka's cities.[14] (Figure 4) This is an upper bound on the number of individuals participating and incidents reported since the records might double-count incidents or be repeat respondents.

[14] The analysis uses population figures from 2001. Source: Census 2001, reported on http://www.citypopulation.de/India-Karnataka.html, accessed July 2, 2007). Rajarajeshwari Nagar CMC did not have separate population data Bangalore in Census 2001, its population figure is from the CMC website, accessed same day. Soraba was also not on the website, as it was listed as a Town Panchayat rather than a city. Obtained data from a list of Nirmala Nagara towns on KUIDFC websited, which cited 2001 census.

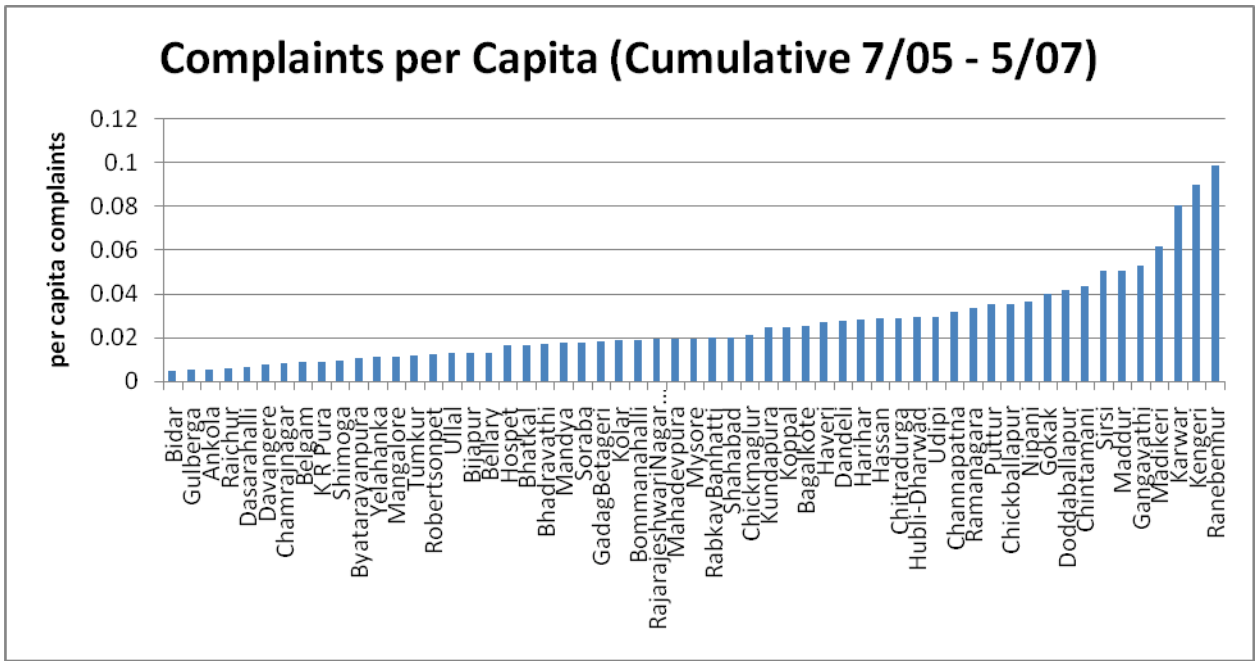


Figure 4: Per Capita Usage

Many of these complaints were also coming from a few wards in the city rather than from a broader sample. Almost all cities in Karnataka had at least 20% of their complaints coming from a few wards, and many have 40% plus coming from the top three wards.[15]

PGRM Design Challenges

The PGRM is functionally similar to bug-tracking tools that have long been used in the software industry to track and fix programming defects. The process of recording and routing problems in software and city services involve somewhat similar workflows, automation, state-transitions (registered, assigned, processing, completed, rejected etc), and reports. The similarity ends quickly, though. Reporting citizen complaints, recording, and routing these concerns to officials, and monitoring city government's solutions involves complex social dynamics between citizens, administrators, and elected councilors that need to be facilitated by

[15] These figures do not account for the many complaints that did not have a ward boundary noted in the record. These complaints had address information embedded in the correspondence – which enabled city officials to respond to grievances – but these were not readily able to be matched to wards for computing overall ward statistics.

or incorporated into the PGR Module by software designers. The design challenge is that the experts on social dynamics and the experts on technical solutions may not be readily able or willing to communicate to match problems with solutions to design effective egovernance software.

Developing the PGRM required substantial information about how governments function, which may not match the formal organizational chart even if one exists. Designers have to model the workflow of government agencies, for example, in order to automatically route complaints. These may or may not be entirely uniform across cities, so the challenge is to come up with an approximation that works for most. The designers also have to understand roles and jurisdictions in order to program access control as well. The system has to fit it into the workflow of well-intentioned city employees (e.g. not interrupting 'emergency" responses where the complaint comes in and then the recipient immediately refers it to somebody who fixes it) as well as prevent manipulation by ill-intentioned people.

Designers also have to factor in limited access to and familiarity with computers in urban local bodies. It has to function in "hybrid mode" - electronic mode for the redressal officers who are connected and a manual file based mode for the junior field employees who are not connected - without compromising key aspects of the workflow, complaint tracking, auto routing of complaints, and production of performance reports.

The PGRM also requires substantial knowledge about citizens and community based organizations to design an effective citizen-city communication platform. Designers have to understand citizen schedules and capabilities, for example, to design a feasible and convenient ways for people to submit grievances. They have to understand how citizens experience infrastructure and services, and what citizens can conceivable know about the problems underlying poor service – citizens can, after all, only complain about what they see and this "grievance" has to be mapped to information that is relevant for a department to know what is wrong and what it can fix. The designer has to anticipate citizen psychology in creating a system that gives enough assurance to the individual that a complaint, once submitted, is "heard" even if it is not immediately redressed. It has to provide performance reports that citizens and

community organizations can access and immediately understand if it is to fulfill its goal of "arming" citizens to hold city governments accountable.

Finally, designing the PGRM requires understanding socio-political nuances. The PGRM is also attempting to capture information about transactions that had been managed through a "legacy" system of personalized interactions between citizens, city officials, and elected councilors, without destroying positive parts of personalized contact.[16] Direct interaction can convey substantial information about the importance and underlying causes of a grievance, for example. Responding to grievances expressed by individuals, and receiving the gratitude personally, plausibly gives city workers more pride in their work than checking a box on an electronic list of complaints.

Most of these facts are either not readily observable or difficult to uncover due to city officials or citizens' incentives to withhold information. eGovernments Foundation found that working with city commissioners was useful for getting answers to questions such as who reports to whom in general, but not as helpful as site visits for understanding exceptions to the rules, informal conventions, or deviations that may happen due to personality conflicts or other factors. Many of the details of the complex workflows are stored in city workers' heads and require in-depth interviews to uncover.

eGovernments implementing staff has found that city officials' willingness to divulge details is mixed. Some are eager to provide detailed information about their work environment. One of the points made by the enthusiastic then-Commissioner of Hubli-Dharwad, for example, was that "every citizen who has a problem thinks they need to call me directly to resolve their problem, this is not an efficient use of my time." Others are more reluctant to part with details quickly. One city, for example, approved the formal statements of work flow when they were in

[16] This is in contrast to other e-governance process innovations where the object is to fully replace the legacy system. Egovernance software for accounting in India explicitly seeks to end ledger and pen records of public finance and replace these with electronically recorded accrual accounting, while property tax or land record registries seek to end the informal system of forged, non-existent, or difficult-to-access paper records.

tabular format, but then insisted on seeing and reviewing them again in chart format, a step that delayed the overall software customization. Officials elsewhere would not let Foundation employees see original records for understanding database requirements, but instead took extra time to transcribe sections for the review. These cases did not seem to be based on any particular financial motive, but rather a general reluctance to open themselves and their work up for closer scrutiny through an IT-based system.

Similarly, learning about citizen needs for the communications platform requires in-depth discussions with as many individuals as possible and certainly with respected community-based groups who would have to be identified on a city-by-city basis. The logistics of these in-depth interviews are costly: Karnakata is a fairly large state with its cities spread over almost 200,000 km^2. It would take about 14 hours to go from southern-most city to the northern-most city, never mind covering the many dots in the middle of the map.

Existing codification of government processes or marketing/lifestyle surveys of citizens, which might defray software development costs, are limited. The Indian Comptroller and Auditor General publishes a manual for municipal public expenditure management, but there is no analogous guidebook for local government organization. State governments prescribe some aspects of the organization either directly or through the rules for disbursing funds to particular functional units, but Commissioners have substantial latitude to work out their own arrangements. The census and National Sample Surveys are the primary sources of available information about citizens, but neither contains enough information about work and commuting patterns to assess what is “convenient” for registering complaints or about computer access. There are no equivalents of marketing research reports on internet and SMS usage to assess how deeply electronic collection of grievances could penetrate.

Citizens and city officials may also have incentives to conceal at least part of the relevant information. Cities in India are effectively under the thumbs of state governments that often prescribe rules and processes. City officials who have figured out alternate ways to manage the workflow may be reticent to publicize their departure from the procedures laid down by the state. This reluctance may also stem from risk aversion: procedures can also be comforting to

revert to (or at least claim to have followed) when something goes wrong. Similarly, citizens may be unwilling to criticize the existing way that city officials respond to their grievances or push too hard for ability to strictly monitor performance.

Neither city officials nor citizens may be willing to reveal the existing relationships they have with each other to communicate about services. Corruption is not something people just admit, nor are "connections." Cities with higher corruption levels may prefer the *status quo* that involves rent-seeking to deliver citizen services, PGRM brings about a high level of transparency at a transaction level that may eliminate the possibility of rent-seeking.

Finally, city officials and citizens may not be consciously aware and able to describe how grievances are expressed and redressed or how city workflows get managed. Sometimes people just do things because that's the way that they are done, and are not really self-conscious enough to fully describe the process even if they are asked. Knowledge might be tacit, therefore hard to verbalize even when people want to convey it. (Polanyi, 1958) This presumes that the software designers know enough about social processes to ask the right questions, which is itself not guaranteed.

At the same time, the IT solutions are also "sticky" information that experts – not city government officials – hold. Writing the software requires technical knowledge and experience. The organization of data in a structured form that helps recombine and aggregate information to generate city wide reports (and help in decision making) is something a good technical architect does but does not come naturally to a municipal administrator. A seasoned software professional brings the experience of implementing IT solutions in several sectors to the problem at hand, this is vital in envisioning IT solutions to urban governance problems. While the urban planner or administrator understands in detail the problems of urban governance, it takes good IT professionals to arrive at useful IT solution.

Success requires "unsticking" the information that users and software developers have so that the problems can be matched with solutions to improve the PGRM's contribution to urban governance. This could mean either eGovernments investing in collecting information

about city processes or working to convey enough technical knowledge to city officials with an incentive to improve urban function so that they can develop their own solutions. The first approach is far more common, and is what the Foundation has followed for the most part. The information is combined at the foundation level, and innovation has taken place there for the most part. The second approach has increasing potential, however, as users have become more familiar with the technology and its possibilities. Realizing this potential, however, requires creative mechanisms to not only identify prospective user-innovators, but to motivate them to reveal their ideas for improving the PGRM's ability to hold city officials accountable for high-quality services. Many of the officials with the highest capacity to identify useful innovations to limit evasion of oversight or improve PGR's ability to shed light on performance are the very people whose work environment would become more demanding if these changes were incorporated.

The PGR Design Process: Approaches to "Unsticking" Information

The eGovernments Foundation's initial design approach focused on "unsticking" as much information about governance processes as possible so that software designers (who already had the technical knowledge) could create an effective PGRM. The outcome, described above, has been reasonably successful. Casual interaction and chance encounters with city officials, however, have uncovered a new source of innovation for refining the system further: the users. The second part of the section discusses the Foundation's evolving strategy for harvesting user innovations efficiently.

Initial Development Process

The development process started with the creation of a 'System Requirements Study' (SRS) document. The Foundation studied several PGRM-like systems that were already operational in various cities in India. It also interacted with the Urban Development Dept Govt. of Karnataka, some City Commissioners, and elected Councilors. The team used this information to develop some of the key parts of the PGRM system described above.

Communication between the government officials and eGovernments in the first phase of development was not always easy, however. Many city workers (as in many departments in India) are first time users of computer technology and it seemed to be quite intimidating for them to transition to this new way of working. Computers and IT experts were not widespread in Karnataka's cities before the project: about 70 IT personnel had to be hired and deputed to the 57 cities in the project and computers were purchased and networked specifically for the new egovernance applications.

eGovernments found that the governments were not able to immediately communicate their requirements because they could not relate to an IT solution to their problems, processes and workflows at first. The Foundation had to prototype solutions (web pages with all the fields and interactions) before it could get good inputs on what their specific needs were.

The meetings with stakeholders helped gain buy-in as well as information about governance. The detailed explanations and interactions also helped users become more comfortable with the system. On security of the data, for example, the Foundation explained at the outset how IT systems authenticated users with a user ID/password, and told them repeatedly about not sharing their user ID/password since the system could be misused in their absence. The initial communication did always not sink in, however: an elderly gentleman at one of the training workshops said that he would rather not use this system since he was going to retire in 6 more months and he did not want anyone else misusing the system in his name. The meetings helped the Foundation identify and address these misunderstandings.

The Foundation found that city officials had more and more useful insights as they started to use the system and become familiar with its potential. Cities were using the product in unique ways: Delhi, for example, used the comment fields to track delegation of complaint redressal within departments.[17] One Mr. Manivannan, earlier Commissioner of Hubli-Dharwad (now transferred to Mysore) visited the eGovernments Foundation to requests custom enhancements and systems for Hubli-Dharwad. He described his own system for classifying

[17] Most cities use this field for interaction between citizens and redressal officers.

grievances as urgent, short-term, and long term and routing the long term to form the agenda for citizen-city planning meetings. The Chief Officer of Kundarpur reported using the pending complaints list as the agenda for internal staff meetings of all departments. Officials in other cities reported accepting complaints via SMS, and routing them to officials in the field via phone or walkie-talkie rather than relying on the system's automatic routing to an officer's inbox.

Early interactions with officials and examination of the usage data also uncovered some less exciting "user innovation," or anomalies in the way that city governments were using the system that would affect grievance aggregates and performance statistics. Some governments were accepting complaints from walk-ins or paper forms, for example, but entering these into the system through the citizen online interface in periodic batches. The complaints then showed up in the system as being submitted through the internet, incorrectly implying a middle- and upper-class bias. The dates of formal submission of complaints also tended to be later than actual dates, affecting the recorded redressal times and rates.

The early experience thus highlights two gaps: First, the question of how to reach out more efficiently to individuals like the ones the Foundation has encountered by chance, as well as how to elicit suggestions from a broader set of city officials including middle and lower-tier "street level bureaucrats" who actually responded to complaints and interact with citizens. Second, how to elicit information about user evasion, shortcuts, and other "innovations" that the PGRM should be redesigned to limit.

The sheer distance between cities and the dynamics of existing city-state interactions enabled by the PGRM impose some constraints. It is difficult (if not impossible) for the Foundation to pull city officials, especially mid and lower-tier managers from their jobs to come to a central location, and the costs of visiting each city repeatedly are prohibitive. The only meetings in which representatives of all cities come together in the same room are the state-wide meetings called by the Government of Karnataka, which are not well-suited to be focus groups on innovation. The State Urban Development Department tends to use the opportunities to impart information via capacity building workshops or critically review the Nirmala Nagara cities. Substantial time is spent on redressal rates and why certain cities have

poor redressal rates, creating a climate in which the city representatives are likely to be on the defensive rather than eager to offer new ideas. eGovernments Foundation actively participates in these meeting to understand the issues faced by the cities as well as review the progress of implementation, leaving little time to draw out information about enhancements and improvements to PGRM itself.

The meetings also tend to be dominated by Commissioners, while many of the insights observed have come from junior officers who may be reticent to speak up in front of the senior officials. The Commissioners, who are specifically requested by the State to come, are likely to have less daily operational contact with the system than junior officers. The Foundation has used break-away sessions (effectively standing around and talking about the 'real problems') to elicit more open responses, but the time available for these is limited. These break-away sessions are also unlikely to elicit any discussion of how the accountability embedded in the system could be evaded, which is an important design consideration for the eGovernments Foundation.

Screening for User-Innovators: Two Strategies

We used two strategies to attempt to uncover additional user innovations as well as hone in more efficiently on both user-innovators with proposals for system enhancement and user-innovators whose "innovations" limited the system's contribution to governance.

We used an online survey as a low-cost screening device to identify users with relevant ideas on how to upgrade the system or create new kinds of reports to support public sector management. At a minimum, we wanted to take advantage of the survey to hold a low-cost "meeting" of city officials. We also attempted to engineer the survey questions to elicit information about evasion of the PGRM, or use of alternate systems. Some questions probed circumstances in which they "did not always" use the PGR. These were phrased tentatively to avoid any sense of accusation that the officials were shirking. We also asked multiple-response questions asking them about how grievances actually were registered/confirmed/routed/redressed that included both extant system features and

potential features that might be used alongside. Lastly, we asked open-ended direct questions about what would be better ways to accept/confirm/route complaints and monitor performance, as well as a very broad question requesting "any suggestions for improvement."

We also screened for problematic user innovations using data mining, or review of the complaints profiles to highlight unusual usage or complaints patterns that might indicate system misuse. Data mining also has the potential to highlight broad patterns in citizen usage that could inform further system design.

Online Survey

The survey format and protocol were designed to be accessible for all relevant officials, but to separate the active from passive users. We distributed a PDF copy of the survey and a link to the online version via email to Municipal IT Officers in the 57 Karnataka cities participating in the Nirmala Nagara program on November 28, 2007. We described the Survey as part of government-supported independent evaluation of the Public Grievance Module that focused on city officials' contributions as expert users. The title, "Nirmala Nagara Public Grievance and Redressal System Improvement Survey," was meant to minimize the obvious connection to the product developer (eGovernments Foundation). We did enlist state support to encourage users to participate; the email was signed by Mr. ZIya Ullah, Joint Director of Reforms in the state government Urban Development Department as well as ourselves.

The email asked the IT officers to distribute the survey to all city officials with any responsibility for the PGR Module. They were asked, in particular, to urge the City Commmissioner/Head Officer, a representative of the NGO charged with registering complaints, an IT Officer, and an Official from the Revenue/Health/Engineering or other departments who typically responded to complaints to respond. We instructed them to provide the online link to those who were comfortable with computers, or to print and distribute the PDF version to be filled out by hand and signed by the official in other cases. We asked them to then enter the completed paper surveys using the online interface as well as mail the completed PDF forms to us to be verified.

Getting to the end of the survey required minimal effort. Many of the questions are multiple-choice and very few have required answers. An official could spend 2-3 minutes checking several boxes and write down his or her name to be considered a "participant" for the purposes of fulfilling the implicit duty to the state government. We also included opportunities for more extensive feedback and open-ended comments, however, for those who were more enthusiastic. We tested the survey format with Mr. Zia Ullah, who has been working very closely on the Nirmala Nagara project and has years of experience working with city commissioners and other administrators.

Data Mining[18]

The data mining exercise was carried out using complaints data from 57 cities over the period July 2005 – May 2007. Our focus was on uncovering unusual patterns of usage that could indicate either citizen misunderstanding of the system, officials' evasion of the system's internal complaints routing features that needed to be followed up , and city-specific practices that affected the system's ability to serve as a platform for managing complaints. The goal was to reduce the set of specific site visits that would need to be done to understand how to reduce evasion of the system.

We first compared usage rates across cities and over time to look for outliers in the number of complaints coming in or sudden shifts in the numbers of complaints. Cities with an unusually low number of registered complaints could simply be cities with satisfied customers, but they could also be cities where alternate grievance tracking systems were still being used and where the PGRM features were not as appealing to public officials or citizens. There are limited objective data with which to calibrate the number of complaints cities "should" have. Sudden changes in the number of complaints are also an indicator of some kind of shift in city usage of the PGRM, perhaps the introduction of an alternative system with feature superior to the PGRM. We also looked at redressal rates over time to identify cities with unusually low or high rates of redressal. Poor redressal suggests that the grievance information is not being

[18] The discussion of data mining borrows from Wallack (2007).

incorporated into the city workflow, while perfect redressal suggests some degree of manipulation of the system.

We also checked for several patterns that could shed light on the nature of citizen usage of the PGRM, namely: distribution of grievances across wards and across types of submission (paper, internet, or phone), repeat users, clusters of complaint types or timing that stood out from the general flow of city grievances. As discussed above, the distribution of grievances across wards is a measure of the effective reach of the PGRM, but variations across cities in the concentration also suggest variation in city strategies for publicizing the system or encouraging usage that we could learn from. Similarly, variation in type of submission provides some insight into the system's ability (or city governments' ability) to reach across the digital divide that could also provide broader lessons for improving the PGRM. Repeated users are interesting as potential user innovators to contact later to seek out their inputs, as well as for understanding whether (and where) the system was reaching a broad user base versus a narrow group. Clusters of unusual complaints are more ambiguous symptoms, but we felt that these anomalies might be good warning signals of either citizen misunderstanding or some kind of city officials' mishandling of complaints that the system was vulnerable to.

The Results: Useful User Innovations? Useful Users?

The online survey and the data mining did highlight a number of interesting possibilities for improving the system, with some important limitations that we discuss below. Both seemed to be more successful as screening devices to identify individuals with insights and cities with practices that could be learned from than as direct sources of information about innovations.

Survey results

City officials' responses provided some new insights into government function in addition to some suggestions that showed increasing familiarity with the potential of IT for supporting information flows underlying new ways to manage provision of public services. Much of the information confirmed existing knowledge of user ideas for improvement so far, which is not especially helpful in our search for new insights, but a hopeful indicator that the

existing practice of intermitted contact with city officials is reasonably informative. The responses confirmed the common reports from the city officials we happened to encounter that the system was cumbersome for routing emergency complaints, for example. “Entering grievances slows down redressal,” and “Easier to communicate directly with departments,” were the two reasons for non-usage of the system that the most individuals ranked as “Very Important” or “Somewhat Important.”

The survey response rate was low, but it did appear to reach a different group than the city officials who are most vocal in intermittent interactions with the Foundation as well as meetings with state officials. There were 74 respondents from 40 cities. Many of the respondents were relatively senior city officials: 29 were Commissioners, Deputy Commissioners, or (in smaller cities), Chief Officers, but there were also 15 officials from various departments and 26 IT staff. The NGOs charged with registering complaints had the lowest participation rate, with just four responding to the survey.

The suggestions for improvement, however, reflected a level of support for IT-enabled offices that was not clear before. Most respondents mentioned improved IT systems as important for efficiently routing complaints, and most of the suggestions concerned processes or content rather than hardware. IT staff tended to want more equipment: IT staff from Bellary wanted walkie-talkies to be compulsory for officials attending complaints, Tumkur’s IT staff wanted a fully LAN connected office, but most of the other respondents advocated various forms of electronic communication without requesting specific hardware. Two Environmental Engineer from Hospet and Kolar advocated using the egovernance system to disseminate more educational content to city officials. Ramanagara’s Commissioner wanted to send SMSs in addition to the implied use of the communications infrastructure requested above, and Ranebenner’s Manager wanted an automatically generated email to be sent at the same time as complaints are registered. Puttur’s Chief Officer and IT staff wanted officials other than themselves and the NGO to check the PGR complaints log. Training was only mentioned once, however, which probably under-represents the real need for training.

The survey also had some components designed to elicit user feedback on the benefits and drawbacks of using the PGRM reports as the basis for explicit internal incentive pay. This has been suggested by some city managers (and implemented by one), but it is not clear that grievances or redressal times/rates fully and uniquely reflect city workers' effort or departments' performance. The number of grievances and the redressal rates, for example, would have to be adjusted for the resources that the department has on hand to provide high quality services. Not all problems are equally easy to resolve – even if different complaints have differing benchmark redressal times, the underlying causes could vary and require different amounts of effort. The Foundation could hypothesize about incentive effects and gather information on work processes to assess the costs and benefits to make its own judgment, but this judgment is only as good as the amount of information about work processes that has been transferred. We also wanted to ask city officials for their judgment, which would incorporate their tacit knowledge as well as the explicit information about work processes that they could have shared with us.

Respondents seemed very attuned to the system's potential as a management tool. Three highlighted the importance of public participation (and public forbearance in not repeatedly submitting complaints) to get an accurate reading of city complaints. Several mentioned that redressal rate depended on more than just effort, but also resources and jurisdiction and that these challenges needed to be acknowledged rather than lumped together with poor effort. Respondents seemed evenly split about the effectiveness of using egovernance to enable citizen oversight/public scrutiny versus focusing on enabling managerial oversight to motivate redressal. Half suggested new kinds of reports for managers, and half suggested various ways that the system could support more information flow to citizens.

The vagueness of many of the IT suggestions so far, however, suggest that true "user innovation" may be slightly premature. Still, the survey does seem to have achieved some kind of separation between the general population of city officials and those who might be active participants in a user innovation group. Twenty-six of the 74 respondents (from 18 cities) stated that they would be interested in being part of a working group with the Egovernments

Foundation to redesign the PGRM. These included Commissioners, Department Officials, IT Officers, and NGOs, so the group would plausibly bring various points of view about how the technology could support governance. The open-ended questions seemed to attract a more "select" group: ten of the 74 respondents answered four or more of the open-ended questions. Most of these also said that they would be interested in being part of a working group. Both of these subgroups had about the same level of experience as the overall group of respondents.

Data mining results

The data mining exercise uncovered some interesting anomalies, especially in citizen usage, that future versions of the system could address. It also highlighted some variations in the geographic reach of the system and in redressal rates that could be used to hone in on cities from which lessons could be learned.

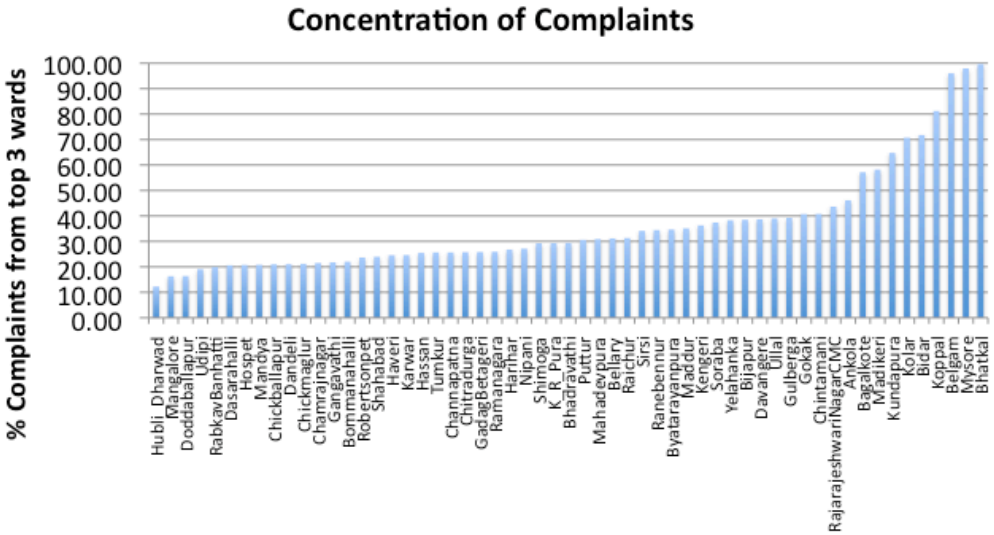
The study confirmed the anecdotal evidence on two types of common mistakes that city officials made. Many cities had at least some examples of clustering of complaints over time suggested some kind of batch entry of complaints rather than real-time entry of complaints as citizens registered them. Some cities also had discontinuities in the number of complaints being registered as internet complaints, suggesting that officials had been entering paper complaints as internet complaints but then suddenly changed the practice.

The patterns of citizen usage were more informative about design changes that could improve the system. First, they suggested that some kind of relabeling of complaint types would be important for tracking comparative city statistics. People sometimes misunderstand the complaint headings and used different terms to refer to the same thing. The comments given for complaints registered about "HL18-BioMedical Waste," complaints in Dandeli, Sirsi, and Bijapur and the "HL20- Hearseworks, Crematorium" in Gokak generally referred to dead pigs, cats, buffalos, dogs, etc., issues that others (in Davangere, Gokak, RabkavBanhatti, Shimoga) referred to as "Death of Stray Animals.[19]

[19] Perhaps the complaints interfaces were different? Adding the Death of Stray Animals and Hearseworks for Gokak would make "dead animals" the second most significant complaint, accounting for 21% of complaints.

Second, it highlighted an interesting usage pattern among city officials. Serial complainants (those with >20 complaints listed under their names) were almost always CMC members or other public officials. Karwar, for example, has 1136 of 5075 complaints listed as coming from CMC members (mostly) or workers – not including the individuals who do not note their affiliation somewhere in the complaint report. Almost all of the top complainants in Table 6 are self-identified CMC councilors, though one non-CMC (or not self-identified as a CMC worker) submitted 79 complaints, two submitted 31 each, one person submitted 20 and one 18. [20] Sirsi's top complainant, with 60 complaints of 2956, also self-identified as a CMC member, and the second highest complainant (21 complaints) was a CMC member. Chickmagalur's top complainant (40 of 2158) self-identified as a "nodal officer" and the second most frequent complainant (47 of 2158) was a Deputy Secretary of the Zilla Panchayat. One interpretation: city councilors/elected officials are using the system as a means of communicating with the bureaucracy. Some cities – especially Udupi with over 8% - also had a significant number of complaints registered in the name of the "public." These may be evidence of NGOs or community groups serving as aggregators of complaints.

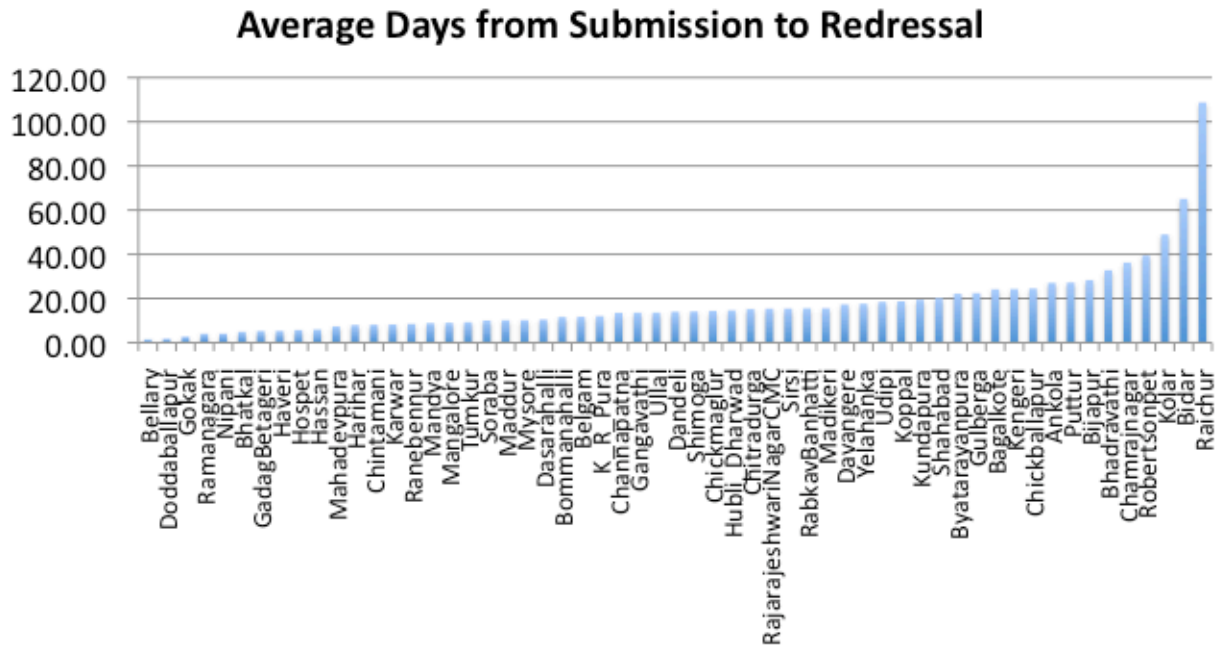
The data mining provided some information for differentiating between cities who had more or less success in encouraging officials and citizens to use the system as a platform for communication about grievances. As mentioned above, usage rates were uniformly low across cities. The geographic concentration of grievances varied more substantially, though. Figure 5 shows the percentage of complaints coming from the top three wards in each city. Cities with



[20] These ave spelled tl riants of spelling.

lower concentrations may be better candidates to learn from about publicity about the system as well as adjustments that may make it more universally user-friendly.

Redressal rates also varied across cities. Figure 6 below shows the average days from submission to redressal (cumulative across departments and time) in comparative perspective.



These redressal rates are an imperfect measure of city performance in responding to grievances since they are not adjusted for underlying differences in the types of complaints coming in through the PGRM. Nevertheless, the variation in redressal rates does suggest that some cities are responding more effectively than others and would be interesting candidates for further study.

Next Steps

The survey and data mining were the first step in a more complete initiative to harness user innovation. We had hoped to identify some user innovations and trouble-shoot for some kinds of misuse from the survey and data mining, but both seemed to have more potential as screening mechanisms than as sources of insights.

The next step is to follow up with cities and individuals who are high-potential targets for further, more resource-intensive observation to understand how they have adapted the system or developed processes for encouraging more widespread usage.

Over the longer run, we are also hoping to refine our ability to screen for user-innovators. We had initially considered following the protocol used in management-science efforts to identify predictors of user-innovators: asking officials questions about their backgrounds as well as their usage of and ideas for the PGRM. The full survey ended up being quite long, however. We were concerned that we would have a very low response rate for all questions. We were also not optimistic that the benefits of asking the additional questions would outweigh the costs of "survey fatigue" for other questions, and the low response rate bore out this hesitation. Past work on user-innovators suggests that they will have three general characteristics: need knowledge, solution knowledge, and motivation. The first two could be covered with questions about governance experience, training, and familiarity with IT. The last, however, is difficult to uncover by simply asking. We were unable to think of a value-neutral way to ask if people cared about citizen perceptions and experiences, or about career aspirations. We were also concerned that officers might be reticent to reveal their career goals to their superiors.

Given these constraints on directly asking potential user-innovators to reveal themselves, another option is to shift focus from ability to bring together IT and governance information to willingness to do so. Given that past experience interacting with city officials suggests that those who are on the front lines of citizen complaints and those who have employees to delegate work to are the most likely to see the PGRM as helping them organize and manage their work flow, we could simply interview this group periodically to see how they are using the system.

In the End, What Have We Learned?

This is a paper about imperfect and ongoing innovation-squared. The PGRM is an innovation in the context of egovernance in the developing world. It is not as widely used as it

could be, and sometimes the grievances it highlights are at odds with the conventional wisdom (and possibly reality) about city priorities, but it is a high-potential foray into using IT to enable more interactive, not just more communicative government. The steps that the Foundation has taken to refine this system are also an innovation in NGO-Government co-creation. E-Governance design has often relied on technologist to develop the systems based on their experience with IT solutions and the information on governance that they have been able to collect. It has not relied as much on people with expertise in governance to innovate and determine priorities based on their experience and whatever information on technology that they have been able to acquire.

Our preliminary results suggest that city officials are a long way from being able to replace the dedicated technologists as the main source of innovation in governance, but that there are emerging and observable differences in city and city officials' usage of the system that could be tracked to identify new features for the public grievance system. We have yet to see if the pool of officials and cities that appear to have adapted the system or developed processes for encouraging its use really have developed scalable innovations for the system.

Refining this ability to identify innovators and systematically harvest these new innovators' ideas will be important. over time as younger, more computer-friendly civil servants climb the ranks and the current egovernance experiments evolve. The user-centered methods here have great potential to guide the next generation of e-governance technology as governance experts with a minor in technology emerge to work with the current group of technologists with a minor in governance. The eGovernments Foundation's efforts to involve city officials in egovernance design may not bear immediate fruit, but the practice in communicating with users and identifying those most likely to be innovators will complete the feedback loop that is much needed in creating effective e-governance solutions that bridge the gap between the people, administrators and elected representative on the one hand and technologists and urban administrators on the other.

References

Bardhan, Pranab (2002). "Decentralization of Governance and Development," *Journal of Economic Perspectives*. 16(4): 185-205.

Balutis, A. (2001). "E-Government 2001, Part I: Understanding the Challenge and Evolving Strategies," *The Public Manager*, Spring (p.33)

Balutis (2001b). "E-Government 2001, Part II: Evolving Strategies for Action," *The Public Manager*, Spring (p.41)

Faguet, Jean-Paul (2004). "Does Decentralization Increase Government Responsiveness to Local Need?" *Journal of Public Economics* 88 (3-4): 867-893.

Gupta, Babita, Subhashish Dasgupta, Atul Gupta (2008). "Adoption of ICT in a government organization in a developing country: An empirical study," *Journal of Strategic Information Systems* 17, 140-154.

Herstatt, Cornelius, and Eric von Hippel, (1992). "Developing New Product Concepts via the Lead User Method: A Case Study in a "Low-Tech" Field," *Journal of Product Innovation Management* 1992:9: 213-221

Howard, M. (2001). "E-Government Across the Globe: How will "e" change government?" *Government Finance Review* (p.1)

Johnson, Craig (2003). "Poverty, Politics, and Panchayati Raj," London: Overseas Development Institute Working Paper 199.

Lau, T.Y., Aboulhoson, Mira, Lin, Carolyn, and David Atkin, (2008). "Adoption of E-Government in Three Latin American Countries: Argentina, Brazil, Mexico," *Telecommunications Policy* 32 (2008): 88-100.

Luthje, Christian, Herstatt, Cornelius, and Eric von Hippel (2005). "User-innovators and 'local' information: The case of mountain biking," *Research Policy* 34: 951-965.

Mansfield, E. (1968). *The Economics of Technical Change*. W.W. Norton and Company, New York.

Morrison, Pamela, Roberts, John, and Eric von Hippel (2000). "Determinants of User Innovation and Innovation Sharing in a Local Market," *Management Science* December 2000, pp. 1513-1527.

Oates, Wallace, (1972). *Fiscal Federalism*. New York: Harcourt Brace Jovanovich.

Oates, Wallace, (1977). *The Political Economy of Fiscal Federalism*. Lexington, MA: Lexington Books.

Polanyi, M. (1958). *Personal Knowledge: Towards a Post-Critical Philosophy*. Chicago: University of Chicago Press.

Riggs, William, and Eric von Hippel, (1994). "Incentives to innovate and the sources of innovation: the case of scientific instruments," *Research Policy* 23 (1994): 459-469.

Tiebout, Charles, (1956). "A Pure Theory of Local Expenditures," *Journal of Political Economy* 64(5): 416-24.

von Hippel, Eric (1988). *The Sources of Innovation*. New York: Oxford University Press.

von Hippel, Eric. (1994). "Sticky information and the locus of problem solving: implications for innovation," *Management Science* 40(4), 429-439.

von Hippel, Eric, (2005). *Democratizing Innovation*. Cambridge: MIT Press.

Wallack, Jessica. (2007) "Fire Alarms in Action: Making Sense of User Feedback on City Services," *Mimeo, UCSD.*