IMPROVING PUBLIC SECTOR PERFORMANCE

THROUGH INNOVATION AND INTER-AGENCY COORDINATION

WORLD BANK GROUP
Global Knowledge & Research Hub in Malaysia

CASE STUDY FROM THE GLOBAL REPORT

Using Smartphones to Improve Public Service Delivery in Punjab, Pakistan

CASE STUDY 13

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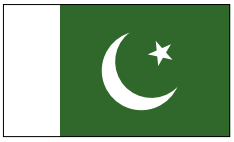
Overview

In Punjab, a 2011 project to improve performance monitoring of public officials that inspected healthcare facilities has led to dozens of reforms across a range of government departments. The project, launched by the World Bank's Pakistan office, used inexpensive smartphones to check that the inspectors were showing up to work and an open-source application to improve the quality and speed of inspections compared to the old paper-based system. Supported by the World Bank's Punjab Public Management Reform Program, the Punjab Information Technology Board (PITB), an innovative government institution, has since launched smartphone and tablet-based interventions to improve data collection across the province and help government officials manage staff and programs more efficiently. Punjab's success shows how governments can use simple applications in many different ways: from tracking disease outbreaks, to monitoring public schools, or as a performance management tool for agricultural extension staff.



PUNJAB, PAKISTAN

POPULATION (2017 est.)[1]
207 million (Pakistan)
110 million (Punjab)

GDP PER CAPITA (current US$)[2]
1,443.60 (Pakistan)

INCOME GROUP[3]
Lower middle income

GOVERNMENT EFFECTIVENESS[4]
28.8%

[1]Census of Pakistan, [2]World Bank (2016), [3]World Bank (2016), [4]World Bank (2016)

Introduction

Like many governments around the world, Punjab, Pakistan's largest province, has long struggled to manage its staff effectively. As of 2011, the province had about 100 million inhabitants, and the provincial government had tens of thousands of employees. Absenteeism was pervasive: doctors sometimes didn't show up to work in public hospitals, and teachers were often missing from classes in public schools.

The Punjab government found it difficult to hold public servants accountable because it did not have a good mechanism to collect administrative data, and the little data it did collect was often unusable or went unused. Inspection reports on health, education, and other sectors were frequently inaccurate, sometimes as a result of corruption, or sometimes because the inspectors too failed to show up for work. Employees often filled out paper forms incorrectly, and sometimes data entry mistakes compromised information digitized from paper forms. Even when field staff submitted data correctly, it often never saw the light of day. When government officials did analyze the information, it could still take weeks or months to publish reports and make decisions.

Those problems were on full display in summer 2011, when an outbreak of dengue fever, a disease transmitted by mosquito bites, swept across the province. Despite sending thousands of public servants into the streets to engage in dengue-prevention activities – such as removing tires, buckets, and other water-bearing containers that could provide a habitat to dengue-carrying mosquitoes – the provincial government failed to stop the rapid spread of the disease. Part of the problem was monitoring. The government couldn't track in a timely manner which areas were hardest hit, where municipal workers were focusing their energies, or even if staff had completed tasks assigned to them.

Response

At the same time the dengue crisis was unfolding, staff at the World Bank's Pakistan office were working on a pilot project in Khanewal, one of Punjab's 36 districts, to see if smartphones could help address the province's management problems. With resources from the World Bank Innovation Fund, health inspectors in Khanewal were issued with smartphones and instructed to use a special application when undertaking inspections of healthcare facilities.

The World Bank team believed that smartphones could improve the quality of data gathering across government, including from inspections. With the smartphones – equipped with cameras, GPS technology, and the simple open source application – inspectors took photos of the healthcare facilities and all staff present. The photos were automatically geo-tagged and time-stamped, and the inspectors uploaded the images to an application created by the World Bank team using Open Data Kit, a free software suite developed by the University of Washington.

Initial results from the experiment were positive. The technology worked, and district officials received faster and more accurate information than they had got from the previous paper-based system.

In October 2011, Shehbaz Sharif, the Chief Minister of Punjab, invited the World Bank team to propose a similar initiative to help with the dengue problem. The team explained how, when equipped with smartphones, municipal workers could take photos of the dengue prevention activities they undertook and upload the location-tagged images to an application that would log all activities on a map of the province. With that information, they explained, the chief minister would be able to manage the government's response to the pandemic in real time.

Responding to a crisis

Though Sharif responded positively to the idea and the World Bank team quickly put together an application to use, it was too little, too late. By the end of the year, over 21,000 people in Punjab had become infected with dengue. Of those, 350 had died (Kugelman and Husain 2018).

The Punjab government was determined to not let the 2012 monsoon season be a repeat of 2011. Sharif hired Dr. Umar Saif, a computer science professor at the Lahore University of Management Sciences, as chairman of the PITB, and tasked him with

developing a system to monitor prevention activities and identify dengue "hotspots" across the province.

After the PITB team perfected the dengue monitoring application and distributed smartphones, provincial staff could take photos of prevention activities, record sightings of mosquito larvae, and pinpoint the homes of infected people. Through a dashboard linked to the application, the chief minister and other city managers could track the government's response to the disease in real time on Google Maps, identify at-risk areas, and help predict localized outbreaks. PITB's efforts helped slow the spread of dengue and prevent a similar pandemic happening the following year. In 2012, Lahore, Punjab's capital, had just 255 reported cases of dengue and no deaths (The Economist 2013).

Building on success

After seeing the success of the dengue application, the World Bank and the provincial government wanted to spread smartphone interventions across the public sector. Despite initial concerns that the technology might not work in rural Pakistan, the pilot project in Khanewal had shown that health inspectors were quick to take up smartphone use and that network coverage was sufficiently robust. A randomized control trial that expanded the project to half of Punjab's 36 districts showed a large increase in attendance at facilities monitored by smartphone-equipped inspectors (Callen et al 2014).

A US$50 million World Bank project, the Punjab Public Management Reform Program, with support also from the United Kingdom's Department for International Development (DfID), provided resources to expand smartphone initiatives in Punjab. The five-year project, launched in November 2013, targeted five key departments for service delivery: Livestock and Dairy Development, Irrigation, Agriculture, School Education, and Health. PITB, supported by the project, would work with those departments to roll out smartphone-based management systems.

Increasing the government's capacity to deliver IT solutions was crucial to spreading the idea to new areas of government. At the beginning of 2012, PITB, which Sharif had created in 1999 during a prior term as chief minister, was a small IT department of about 70 people. PITB began hiring software developers and other technical staff, and was quickly transformed into a large team of over 1,000. Crucially, it attracted highly capable computer scientists and managers.

With the extra resources and capacity, PITB was able to create its own smartphone applications. Although the free tools available from Open Data Kit were ideal for the pilot intervention, the government wanted additional features – icons instead of text for low-literacy users, for example – that could make the applications even more useful for public officials. PITB used DfID funding to partner with Information Technology University (ITU), a Punjab university founded by Saif in 2013, to develop "Data Plug." This was a specialized platform that civil servants could use to rapidly test and iterate advanced data-gathering applications.

Improving performance – and outcomes

One initiative the World Bank-financed program targeted was Punjab's child immunization program, which was supposed to vaccinate all children against preventable diseases such as measles, whooping cough, and polio, but for years had been plagued by poor monitoring and management. Vaccines were readily available, but the government struggled to distribute them effectively.

The 3,750 vaccinators tasked with immunization of newborn babies and children were supposed to complete paper forms documenting their work and submit those forms to supervisors who would enter the information into a database for the health department to analyze. However, the whole process – from delivering vaccinations to recording data to managing the vaccination team – rarely functioned smoothly. Without accurate and timely data, the Punjab government did not know how many children had been vaccinated, which geographical areas had been covered, or even if their staff had delivered the vaccines they said they had.

PITB and the health department launched a smartphone application for vaccinators in four districts in June 2014, and rapidly rolled it out province-wide by October. After the vaccinators received their smartphones (which each cost 12,000 Pakistani

Rupees, or about US$120), the health department instructed them to use the new application to check-in when they arrived at "kit-stations," locations where the program stored vaccination equipment across the province. Vaccinators were also directed to record the phone number of each child's parents, and an automated system contacted 10% of parents to verify that the child had indeed received the vaccination. The health department monitored a dashboard that showed performance rankings of vaccination teams, and officials followed up with lagging districts. Using the data, district managers could identify and reprimand poor performance. Vaccinators quickly realized that their absenteeism would no longer go unnoticed, and attendance reported in the new digital system increased from 36% to over 80% in just four months.[23]

Some vaccinators were unhappy with the new arrangement, claiming that the cellphones were too cumbersome to use, and several phones were mysteriously broken in the first few months. However, they quickly learned that supervisors were using the system to monitor their performance and hold them accountable. "We had a systematic framework in place so that the data was used by line managers," said Saif. "It became the staple diet for the government to evaluate the performance of these vaccinators."

When looking at the data from the first few months of the new system, the project managers found that while absenteeism had dropped off sharply, the geographic coverage of the vaccination program had barely changed. "The attendance was going up – the vaccinators were showing up for work and submitting reports through their smartphones. But the geographic coverage remained low at only about 50%," said Saif. "They would go to places convenient to them, do the vaccinations and send us the pictures, but the far-off places were ignored. Another part of the problem was that Pakistan had not done a census in a long time, and there were communities that had popped up here and there but were not on the government's maps."

PITB partnered with faculty at ITU to find a way to ensure all population centers in Punjab received equal attention from the vaccination team. Using satellite images from Google Maps, the university team used machine learning to identify clusters of households. "We looked at the Google satellite imagery, saw where the household clusters were, and then we layered in virtual polygons representing each neighborhood," said Saif. "Then we correlated the check-ins of the vaccinators with the polygons. If any of the polygons didn't get enough visits from the vaccinators, we knew that some kids had missed out on vaccinations in that area."

An alert system was set up within the dashboard so the polygons stayed green when the area was receiving enough visits, but flashed red when not enough visits had been recorded within a certain time period. "The goal for the government became simple: keep all the polygons green," said Saif.

Expanding and improving

By 2017, many more smartphone and tablet-based interventions had been rolled out in Punjab and other Pakistani provinces, all stemming from the original 2011 health inspector project in Khanewal.

Health inspectors monitoring more than 3,000 facilities across the province used an updated application to check staff attendance, availability of medicine, and the condition of equipment, and another application to record the cleanliness and maintenance of hospital facilities. Inspectors took photos as evidence of their activities, and the photos were linked to a dashboard through which the health department could track hospitals' performance. The same dashboard was also used to monitor the inspectors' performance: the geo-tagged photographs provided evidence of how much work the inspectors were doing each day.

In the education sector, school inspectors armed with tablets collected data on teacher presence, student attendance, and availability of safe drinking water, electricity, and toilets. In 2015, PITB and the education department expanded the use of tablets further by launching a student assessment application. During their monthly visits to each school, inspectors could use the application to spot-test students on English, Mathematics, and Urdu. The tests provided an indication of learning outcomes without the cost and complexity of organizing large-scale student assessments.

In the agricultural department, PITB launched an application called AgriSmart to monitor 2,700

agriculture extension workers and help expand farmer assistance across the province. Similar to the vaccination program, absenteeism dropped and geographic coverage increased after the application launched and extension staff learned they were being monitored. In November 2017, the agriculture department began pilot testing a financial incentive system for extension staff, using performance data gathered through the AgriSmart application.

As word spread about Punjab's success with smartphone and tablet interventions, other provinces in Pakistan began their own initiatives. In Sindh province, a bloated education department packed with ghost teachers and plagued by absenteeism had strained public resources for years. In 2016, the province, supported by a World Bank team, began using smartphones equipped with fingerprint readers to improve the accuracy and timeliness of reporting on school inspections. Proponents hoped that the improved inspections could help the education department remove ghost teachers from the payroll and decrease absenteeism.

Despite the best efforts of reform leaders in the Punjab government, occasionally they ran into entrenched groups that stifled implementation of reforms. In an effort to root out water theft in rural areas, PITB encountered tough opposition. "Pakistan has one of the largest irrigation systems in the world, and there is a lot of theft in the system from large landholders, and smaller landholders don't get water for their crops," said Saif. "There are irrigation inspectors who are supposed to make sure that the water doesn't get stolen… but they are protected by the rural elite, and we have not been able to make them use the smartphones."

Reflections

The smartphone revolution in Punjab showed how a government could easily improve data collection and service delivery by using cheap and easy-to-use smartphone applications. Information collected through the applications was more accurate than that collected through paper-based systems, and, in addition, could be matched with photos, videos, and location data. The additional data provided real evidence that officials had completed the tasks assigned, and not just filled in paper forms from home. Location data clearly showed geographic coverage and ensured difficult-to-reach areas did not miss out on public services. The information helped the government plan what services would be needed when, for example by using the dengue tracking application to predict localized outbreaks.

The improved performance of public employees resulted in better outcomes for citizens, particularly in the highly successful vaccine program intervention. When the vaccine application was first launched in October 2014, vaccinators reached just 25% of the polygons the PITB used to measure geographic coverage across the province. In May 2016, that figure had increased to 88%.[24] As a result of the increased attendance and coverage, the percentage of fully immunized children under 20 months rose from 62% in 2014 to 81% in 2016, and 95% of children were fully vaccinated against polio (Government of Punjab 2016). The increased vaccination coverage helped reduce the risk of contracting polio. After having 7 polio cases in 2013 and 5 in 2014, Punjab had only 2 cases in 2015 and 0 in 2016.[25]

In most cases, PITB did not encounter resistance to its initiatives. This was partly due to strong support from the chief minister, and partly due to the approach PITB took when working with government departments. "A large part of our success has been managing relationships with other departments in a way where our work is seen as a positive contribution," Saif said. "The departments themselves have ownership. We are not seen as outsiders, there is co-creation and joint ownership."

Financial and political support from the chief minister was also crucial to PITB's success. "PITB is [chief minister Sharif's] baby," said Saif. "He created it in 1999, a time when few people had appreciation for IT-driven reforms in government. He is a big believer in IT and he made sure that I was included in all important meetings of the government."

Initial worries about a backlash over increased monitoring proved unfounded. "I was initially very worried that there would be resistance," said Zubair Bhatti, who led the World Bank team. "If all the inspectors decided to throw their phones into a canal there was not much we could do about it." However, Bhatti said field staff usually reacted positively; they

appreciated that supervisors could see the work they were doing and hold accountable colleagues who were slacking. PITB also tried to encourage buy-in by providing additional benefits. "When we gave out the smartphones we always included some minutes for them to call friends and family," said Saif. "That way they would see some value in looking after the phone."

The instant transmission of verifiable data through the smartphone application reduced opportunities for corruption and created a less stressful environment for inspectors. In the time between an inspection and writing a report, field staff could be pressured to inflate staff attendance, overlook infringements, or write overly positive evaluations. But after the rollout of smartphone applications, inspectors uploaded photographic evidence of the inspection in real time, reducing the opportunity for others to influence the inspection report.

The digital data generated from the initiatives also helped the government promote transparency. The provincial government created an open government website, http://open.punjab.gov.pk, which made information available to the public. As of 2017, the site featured education data on teacher attendance, student attendance, and school inspections. It also featured data from the vaccination program, including the photos and location of vaccinated children as recorded by the vaccinators through the smartphone application.

Several key features of smartphones suggested that the interventions introduced in Punjab could be widely replicable. Smartphones do not require uninterrupted power supply, which is a huge benefit in remote areas that may experience regular power outages, and data gathering does not need an active internet connection. Training costs are low, especially since smartphones are easy to use and quickly becoming widespread. Several high-quality free open source software suites exist, which enable fast iterative design changes to smartphone applications. As prices decrease and network coverage increases, the potential to replicate PITB's interventions – mainstreaming the use of smartphones for day-to-day data gathering and performance monitoring – to the rest of the developing world increases even more.

Saif said there were three key things to the success of a smartphone intervention. First, "you have to get the technology absolutely right," he said. "If it works 100% of the time, everyone will use it. But if it only works 99% of the time, then no one will use it." Second, the intervention had to provide benefits to decision-makers in government who could then champion the reform. "If you don't have an owner in a decision-making position who benefits from the application, the chances are that the technology will not get used or institutionalized within the government," Saif said. Third, the IT team had to build positive relationships and work together with staff in the reform area to "co-create" solutions. "When all three of those things worked, our interventions succeeded," said Saif. "In cases where one of those things was missing, we struggled."

Success Drivers

Punjab's experience of using smartphones to improve delivery of public services reflects all **five** of the five key dimensions for successful public sector innovation.

Political leadership from Chief Minister Shehbaz Sharif was essential to get this reform off the ground. Crucially, Sharif was able to find a strong leader in Dr. Umar Saif, Chairman of the Punjab Information Technology Board (PITB), who went on to become the driving force behind digital reforms across the Punjab government. Sharif included Saif in important meetings, and through those interactions the PITB was able to build partnerships with other government organizations and strengthen its credibility.

Increasing **institutional capacity** to deliver IT solutions was critical. After Sharif hired Saif to run the PITB, the new chairman quickly recruited top software developers and computer scientists to the organization. The PITB also formed a partnership with a local university to further increase its capacity to develop innovative digital solutions for government departments.

Creating **incentives** for civil servants to show up to work and perform well at their jobs was a key goal of many of the PITB's reforms. By increasing monitoring of vaccinators, for example, first by monitoring attendance and then by scrutinizing geographic coverage, the Punjab government was able to quickly improve the percentage of children receiving vaccinations across the province. Smartphones proved to be a useful tool for collecting performance data, and the agriculture department began to experiment with financial incentives for extension staff using data collected through its PITB-designed smartphone application. The government also encouraged buy-in from civil servants by offering phone credit for personal use to workers issued with smartphones.

Smartphones increased **transparency** in school inspections. They reduced opportunities for corruption by allowing inspectors to upload data in real time and minimized pressure to overlook infractions or write overly positive reports. Through dashboards, the chief minister and government departments could access real-time data on what employees were doing and track progress on government programs. The government also published large portions of data from its smartphone interventions on its open government website, where citizens could access information and monitor the government's performance.

Technology advancements, particularly innovations that increased the usability and decreased the cost of smartphones, were leveraged by the government to deliver better services to its citizens. The PITB also assisted government departments in switching from paper-based processes to digital systems, which helped minimize data entry mistakes and made it possible to analyze data on a much larger scale. Crucially, most interventions used open source software and freely available data (for example, satellite images from Google Maps), which made the PITB's programs low-cost and highly scalable.