

Robust Digital Backbone for Bangladesh's TB Diagnostics Investments.

Ensuring Strong ROI for Point-of-Care Diagnostics



Executive Summary:

Bangladesh has been investing in its digital backbone for diagnostics for several years. Most recently, in 2022, Bangladesh invested donor funds into rapidly expanding the digital backbone, in particular to ensure visibility into critical operational and clinical data from a large fleet of GeneXpert devices.

Accomplishments:

- Rapid connection of 469 GeneXpert instruments in 9 weeks.
- Partnership with local company for in-country capacity building
- Real-time insight into TB diagnostics and operations

A TB Landscape Fraught with Challenges:

“Molecular diagnostics require investments in devices, people, logistics and recurring supplies. A strong digital infrastructure is necessary to make sure these diagnostic investments pay off.”

-Chris Macek, CEO, SystemOne

Bangladesh is one of the world's 30 high TB burden countries with 360,000 estimated new cases of TB diagnosed every year, of which 30,000 are children.

In 2020, over \$78 million was invested in TB, from both domestic and international sources, including over \$49 million from the Global Fund.

Purchases in 2020 included 606,000 GeneXpert cartridges. At minimum, this represents an investment for \$6,000,000+ for a single year.

The NTP recognized that such massive investments cannot be optimized without reliable data about the diagnostic devices' operations and clinical outputs.

A Digital Backbone Addresses Numerous Diagnostic Cascade Challenges

Health leaders in Bangladesh understood that the high investments in diagnostics would fail to meet their potential without a reliable digital infrastructure to address common problems associated with molecular diagnostics.

Human Challenges:	Technology Challenges:	Landscape Challenges:
<ul style="list-style-type: none"> • Results don't get to patient or healthcare worker • Errors from lack of training • No aggregation of results • No communication of data • No or slow new case alerts 	<ul style="list-style-type: none"> • Devices and module failures • Reagent expiration • Power failures in facilities • Calibration issues • Lack of timely maintenance 	<ul style="list-style-type: none"> • Sub-optimal instrument usage and utilization • Lack of testing when devices fail • Supply shortages or overages

International donor agencies have long recognized the challenge of managing a diagnostic network with poor operational and clinical information. “At the highest level, lack of data means an absence of epidemiological information for decision-making, reduced pandemic preparedness, reduced testing when devices fail to be repaired, and unaddressed supply shortages or overages,” said Brad Cunningham, COO, SystemOne.

The Bangladesh NTP was committed to addressing these challenges as early as 2016, when they worked with SystemOne to network 39 GeneXpert diagnostic devices and begin managing the data.

The Mission: Scale the Network Over 10x

The Bangladesh NTP and SystemOne had demonstrated that rapid data transmission and a real-time management system from GeneXperts would help:

- get patients onto treatment faster
- maintain device calibration
- automate reports to reduce errors and paper
- rapidly identify and address maintenance issues
- optimize catchment areas and required diagnostic devices
- understand and manage supplies and expiration dates
- ensure utilization
- optimize testing algorithms
- increase linkage to care for patients diagnosed with TB and MDR-TB
- rapidly offer disease surveillance data to optimize TB mitigation and treatment resources

Yet, to connect 469 additional devices, SystemOne, the NTP and in-country partners would need to think differently.

Partnership, Training and Dedicated Support

The right in-country partner:

SystemOne's in-country contacts identified 4axiz IT Ltd as a capable local partner to help roll out the system. "Choosing the right in-country partner was pivotal to success," said Imtiaz Ebne Sayeed Mohamed, SystemOne's Bangladesh Country Manager. "4axiz was able to reveal field-level risks and challenges which could be addressed in an orderly manner rather than discovered while installing technology."

Avoiding the numerous pitfalls:

Some of the field-level risks and challenges that 4xiz uncovered were similar to other high-burden countries, but some were unique to Bangladesh.

The field risks included:

- laptops with inadequate number of USB ports
- backdated or obsolete hardware and software
- absence of wifi receivers
- limited technical capacity in lab personnel
- insecure networks

To address the issues, the installation team prepared a hands-on training plan under the guidance of SystemOne, and also received support from central and local level NTP officials.

The right equipment

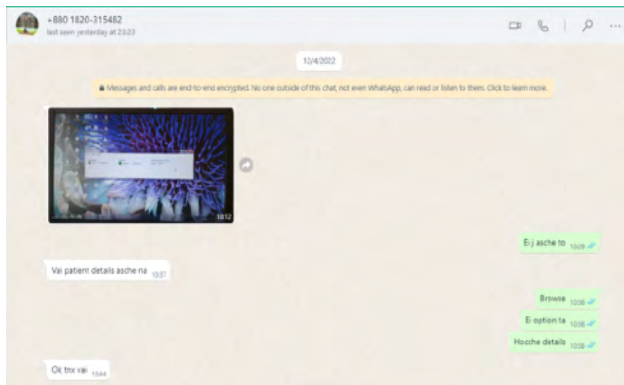
The Aspect software package was designed for rapid and easy installation, and was paired with high-quality dedicated routers to provide a high-reliability digital backbone that gives the Bangladesh ministry of health and Tuberculosis Program real-time visibility into clinical results, operational issues and the supply chain.

"One of the first steps in rolling out connectivity at a national scale, as we have in Bangladesh, is selecting robust technology at the edge", said Bryan Richards, Chief Technology Officer at SystemOne. "The fleet of remote devices and data transfer mechanisms must be tolerant of network partitions. The assumption that remote endpoints are always online is one of the main reasons that most other systems fail. Poor quality networks often result in increased data costs and it is vital to invest in the right equipment and software algorithms that can adapt in remote environments. Continuously evaluating different networking hardware and software products is core to what we do. Over the past 11 years SystemOne has acquired insights into pragmatic solutions that actually work".

The Right Tools for Effective In-Country Support:

Establishing connectivity in a lab is not enough. The trick is to maintain it, despite human errors, technological problems and endemic landscape issues such as power failures and harsh conditions in the labs (that might include anything from malware and viruses to mishandling of technology, high temperatures, humidity, and dust). To support NTP staff and rapidly resolve issues that could stop or compromise connectivity, the team followed a regimen of:

- direct phone calls
- physical visits
- creating and using a Whatsapp group for Medical Technologists, Labs, DSMOs and Divisional TB Experts for 8 divisions.



Using a Whatsapp group for rapid issue communication and resolution

communicated through field-level requests, the Whatsapp group and direct phone calls. The team solved 80% of the connectivity issues and was able to alert the NTP about conditions that impacted the other 20%, such as failures in uninterruptible power supplies (USPs), cartridge shortages, power failures and diagnostic device module failures. The rapid pace of communications enabled the NTP to quickly address problems in the field and keep the diagnostics up and running.

To ensure seamless handling of requests in the back office, SystemOne helped 4axiz develop a ticketing system to track the issues received from field-level users and ensure rapid response for point-of-care diagnostics sites all over Bangladesh.

The Whatsapp group accelerated knowledge-sharing among group members and ensured that technical issues were immediately reported, followed by rapid troubleshooting. NTP monitoring officials, including DSMOs and divisional TB Experts continuously monitored these groups and provided valuable feedback. Based on these rapid feedback loops, guidelines could be updated in near real-time to make the engagement more effective.

From March to October 2022, the installation team handled 640 issues,

Sustainability: Capacity Development for Medical Technologists, Microbiologists, and District Surveillance Medical Officers:

Train the trainer and country-wide training

SystemOne and 4axiz collaborated not just on system implementation and maintenance, but also created a training program to bolster NTP staff skills and ensure a high degree of comfort with Aspect, SystemOne's connectivity software.

Intensive Train-the-Trainer sessions helped ensure that training would be available across geographies. These were complemented by one-day training sessions for District Surveillance Medical Officers (DSMOs) on the Aspect dashboard, enabling them to monitor district-level clinical results, operational issues and inventory. Additional training was offered to Medical Technologists to ensure familiarity with the software, entering patient data and basic troubleshooting.

“Many people think connectivity is just a matter of installing a few routers and letting the data flow,” said Nawazesh Irani, Director of Customer Experience, SystemOne (Mumbai). “Nothing could be further from the truth. For data to move with high fidelity and reliability, a thoughtful approach is required to training, materials, support and communication protocols.”

As part of capacity strengthening, the team not only developed a comprehensive manual, but also produced video tutorials to help with installations and basic troubleshooting processes, as well as data entry. These remain posted on YouTube, so that the relevant officials can refresh their knowledge from anywhere and conduct basic level troubleshooting themselves.



Images: NTP Staff Training in Dhaka, Chattogram and Rajshahi divisions.

An all-star cast - ensuring stakeholder inclusion and involvement from multiple parties to system adoption:

SystemOne and **4axiz** worked together to identify all the roles that would need to be involved in the deployment at scale and training, including:

- Medical technologists
- District surveillance medical officers
- Divisional microbiologists
- Divisional TB experts

Key contributors from the National Tuberculosis Program included:

Dr. Afzalur Rahman

Assistant Director (TBC & Admin) and Program Manager-TB

Dr. Pronab kumar Modak

Deputy Program Manager, National Tuberculosis Control Program

Ahmadul Hasan Khan

Monitoring and Evaluation Expert, National Tuberculosis Control Program

Sarder Tanzir Hossain

Senior TB Diagnostics Specialist, Infectious Disease Detection and Surveillance (IDDS)

In addition, staff from other organizations were extraordinarily helpful, including:

- USAID
- Brac
- ICDDR,B
- IDDS Bangladesh Project

Much gratitude to the 4axiz team, including Israt Sultana and Imran Galib, and also to Rakibul Hasan (engineer working with Bio Trade Company)



Participants received a user-guide with Frequently Asked Questions as takeaway materials.