

Artificial Intelligence for Social Good: Our Approach at Wadhwani AI

P. Anandan

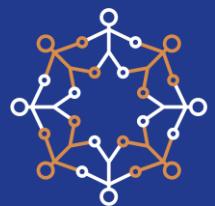
Sep 13, 2018



Wadhwani AI
AI FOR SOCIAL GOOD

Wadhwani Institute for Artificial Intelligence (Wadhwani AI) is an independent, nonprofit research institute and global hub for developing AI solutions for social good.

Our mission: **AI for ALL**



Wadhwani AI
AI for ALL

Wadhwani Institute for
Artificial Intelligence
WadhwaniAI.org

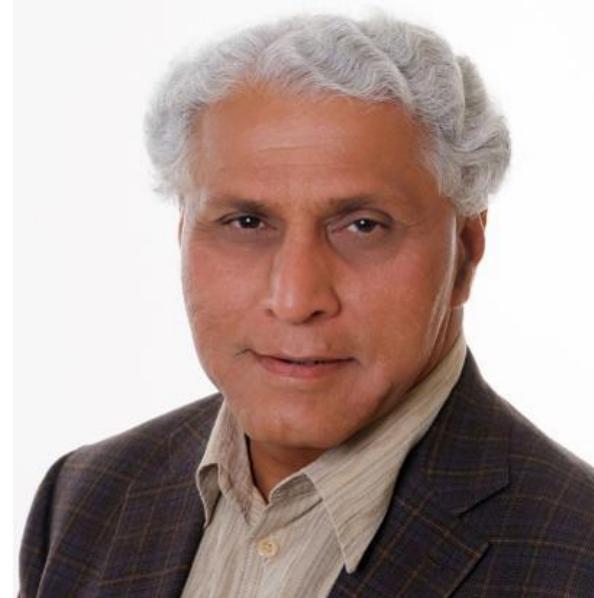


#AIforALL
@WadhwaniAI

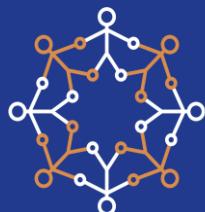
OUR FOUNDERS

Tech Entrepreneurs Dr. Romesh Wadhwani and Mr. Sunil Wadhwani are committing \$3M/year for 10 years (total \$30M) as well as their own time and the benefit of their entrepreneurial experience

DR. ROMESH WADHWANI



MR. SUNIL WADHWANI



Wadhwani AI
AI for ALL

Wadhwani Institute for
Artificial Intelligence
WadhwaniAI.org

Our main goal is to develop AI solutions to benefit the under-served billions in developing countries, in domains including:

- Health
- Agriculture
- Financial inclusion
- Language
- Infrastructure
- Education



Wadhwanai AI

AI for ALL

Wadhwanai Institute for
Artificial Intelligence
WadhwanaiAI.org

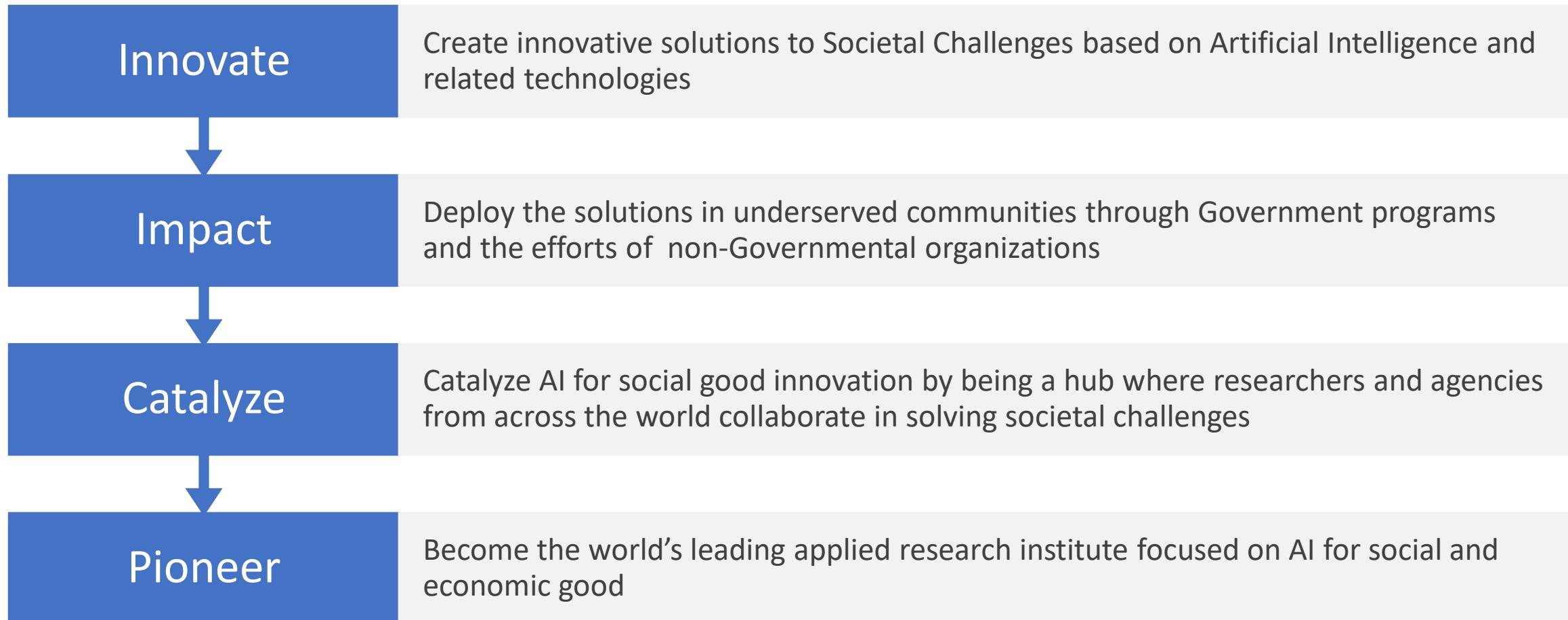


#AIforALL
@WadhwanaiAI

Wadhwani AI launched on Feb 18 by the Hon'ble PM of India Shri Narendra Modi

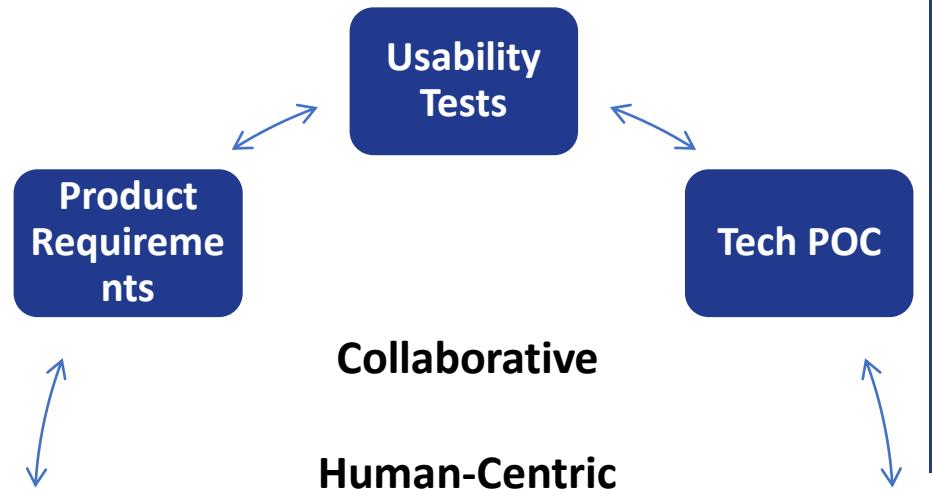


OUR MISSION



UNIQUE APPROACH

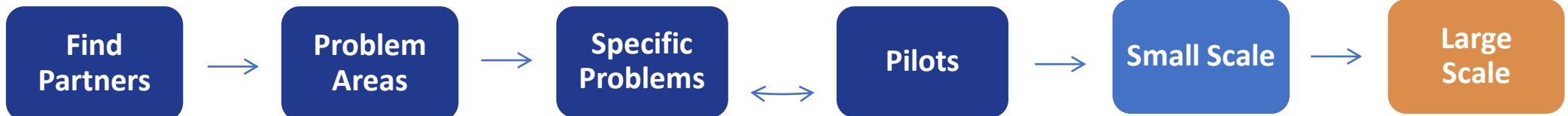
Our AI researchers work alongside diverse team members: data scientists, engineers, designers, product managers, domain experts, partnership managers, and entrepreneurs.



PARTNERS AND CHAMPIONS

PATH, Gates Foundation, WISH Foundation, and Government of India are among our early partners and champions. Researchers from Stanford, USC, University of Washington, and NYU are among our research partners.

**Nonprofits / Dev Orgs
Governments
Corporates / Startups
Research & Academia**



Wadhwani AI

Our Initial Focus Areas

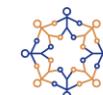
TUBERCULOSIS



FRONTLINE HEALTH



COTTON FARMING



Wadhwani AI

Frontline Health

September 2018



Wadhwani AI

AI FOR SOCIAL GOOD

Frontline Health: Background



- Primary Health resources: 27k PHCs and 150k Sub-centers, with 32k doctors, 250k ANMs and 1 million ASHAs form the frontlines
- Govt wants to upgrade existing facilities to 150k tech-enabled Health & Wellness Centres (HWC)
- Opportunities to:
 - overcome skill gaps
 - expand care beyond mother-and-child, cope with workload
 - digitize measurements and tests
 - connect the data dots
- Partners: WISH, Gates

Frontline Health: Journey to date

-  **Early exploration (Mar-July 2018):** Identified a list of initial use cases based on research and interviews. Interviewed creators of (or surveyed) apps used by primary health workers in India (e.g., CAS, Mobile Kunji, etc.) and globally (Ada, Babyl, Blackwell)
-  **Field research (June 2018):** Team members visited rural PHCs and Sub-centers managed by WISH
-  **Initial use case:** Advisory app for frontline workers
-  **WISH/Gates/ Wadhwani AI workshop (August 10th 2018):** Led a day-long workshop to generate ideas for AI solutions in primary health, with inputs from the field, program and systems levels
-  **New use cases:** Identified and prioritised three new use cases after workshop
 - Detection & management of high-risk pregnancy (*Ongoing*)
 - Anthropometric imaging for growth tracking (*Ongoing*)
 - Triaging app for frontline workers
-  **Upcoming workshop at Gates Bihar Partners Meet (Sep 20-21 2018):** Conducting a second AI-focused workshop to generate deeper insights and identify specific solutions



High-risk pregnancy (HRP): Solution Areas

Possible solutions mapped to hypotheses

No ANCs or check-ups,
hence HRP is never
detected



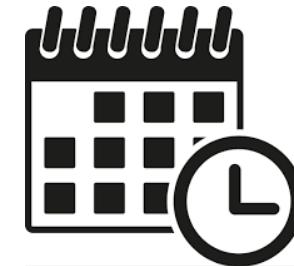
E.g., Geotagged HRP hotspots using socioeconomic indicators + satellite imagery for better last-mile outreach

Some ANCs happen
but HRP is not properly
detected in time



E.g., Tools for better early outreach, HRP Diagnostic kit for ASHA + AI-powered ultrasound + App to calculate a risk score / risk vector

HRP is detected but
not managed in the
antenatal period



E.g., Geotagged reminder / alert system for regular follow-up with high-risk pregnant woman

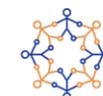
HRP is detected but
not managed during
childbirth



E.g., “Capacity + logistics planning” for PHCs and First Referral Units (FRU) for childbirth

Leading hypothesis

Hypothesis #2



Wadhwanai AI

Conducted Gates+Wadhwani AI+WISH Workshop on AI for Public Health (Aug 10th)



- Day-long workshop (10 AM to 6 PM) at the Gates Foundation office on August 10
- 27 participants across seniority levels: from field staff at WISH to country leads at Gates
- Excellent participation and engagement
- Identified over a dozen broad use case areas and prioritised 5
- Buy-in from Gates and Wish Foundation

High-risk pregnancy (HRP): Overview

What makes HRP a compelling problem area

Critical Public Health Issue

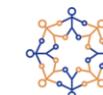
- High-impact problem area with cascading effects on mother and child health and well-being
- Strong political will: aligned with UN-SDG and National Health Policy goals

Rich data

- Data collection processes in place, rich datasets available
- Individual pregnant women already tracked by ANMs, records digitised and available through the national Mother & Child Tracking System

Pathways to scale

- Strong partners in the form of Gates (rich experience and insights at the policy, strategy, and implementation levels) and WISH Foundation (deep expertise in implementation)



Wadhwani AI

Anthropometric Imaging: Overview

- Anthropometric imaging identified as a high-priority need by Gates India and WISH Foundation, especially to identify low birth weight babies
- Had a preliminary conversation with Kenneth Brown (Nutrition team, BMGF Seattle) on 7 Sep to discuss the anthropometric imaging tool developed by Gates grantee Body Surface Translations (BST)
- Currently evaluating different technical approaches with a focus on accuracy, cost, and computational power

Tuberculosis Eradication

September 2018



Wadhwani AI
AI FOR SOCIAL GOOD

Tuberculosis: Background



- 2016: 2.8 million new cases, 0.43 million deaths in India
- 2016: 10.4 million new cases, 1.7 million deaths globally
- 2016: DR-TB cases grew 13% from 130,000 to 147,000 in India
- Indian government target : eliminate TB by 2025
- WHO target : eliminate TB by 2050
- **Partners : PATH (and WISH)**

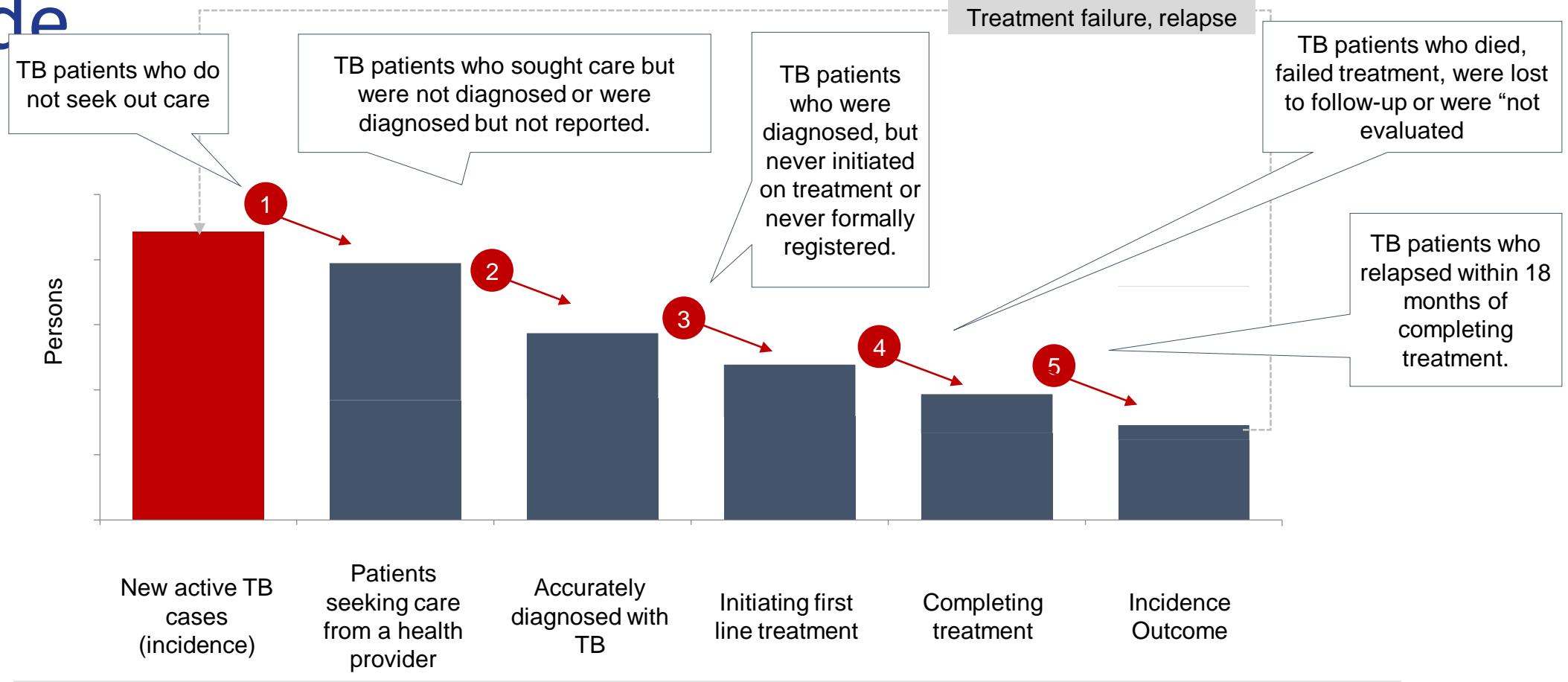
Tuberculosis

TB is recognized as a crisis, predominantly affecting low-income populations. Drug-Resistant TB (and Multi-Drug-Resistant TB) are growing at alarming rates.

- TB affected 2.8 million and killed 0.43 million in 2016 in India.
- DR-TB cases grew 13% from 130,000 to 147,000 from 2015 to 2016
- Government has set the ambitious target of eliminating TB by 2025*
- **Use-cases**
 - Diagnosis through sputum slide analysis
 - Decision support for Multi-Drug Resistant TB
 - Treatment adherence & patient risk assessment
 - Automated X-ray analysis for screening
 - Outbreak prediction
- **Partners**
 - PATH
 - Will approach Mumbai Corporation, and relevant state and central bodies as needed.
- **Data & Piloting:** PATH is the leading international non-profit working on TB. Its flagship TB program is in Mumbai (in partnership with Mumbai Corporation), with support from government's Central TB Division, WHO, and Gates. The program has patient level data and also screening and diagnostics data.
- **Scaling:** PATH advises government at central level. Elements of the program are already being borrowed for national level scaling as part of RNTCP (Revised National TB Control Program).

Guiding framework: The tuberculosis treatment cascade

DROP-OFFS
AT EACH
STAGE

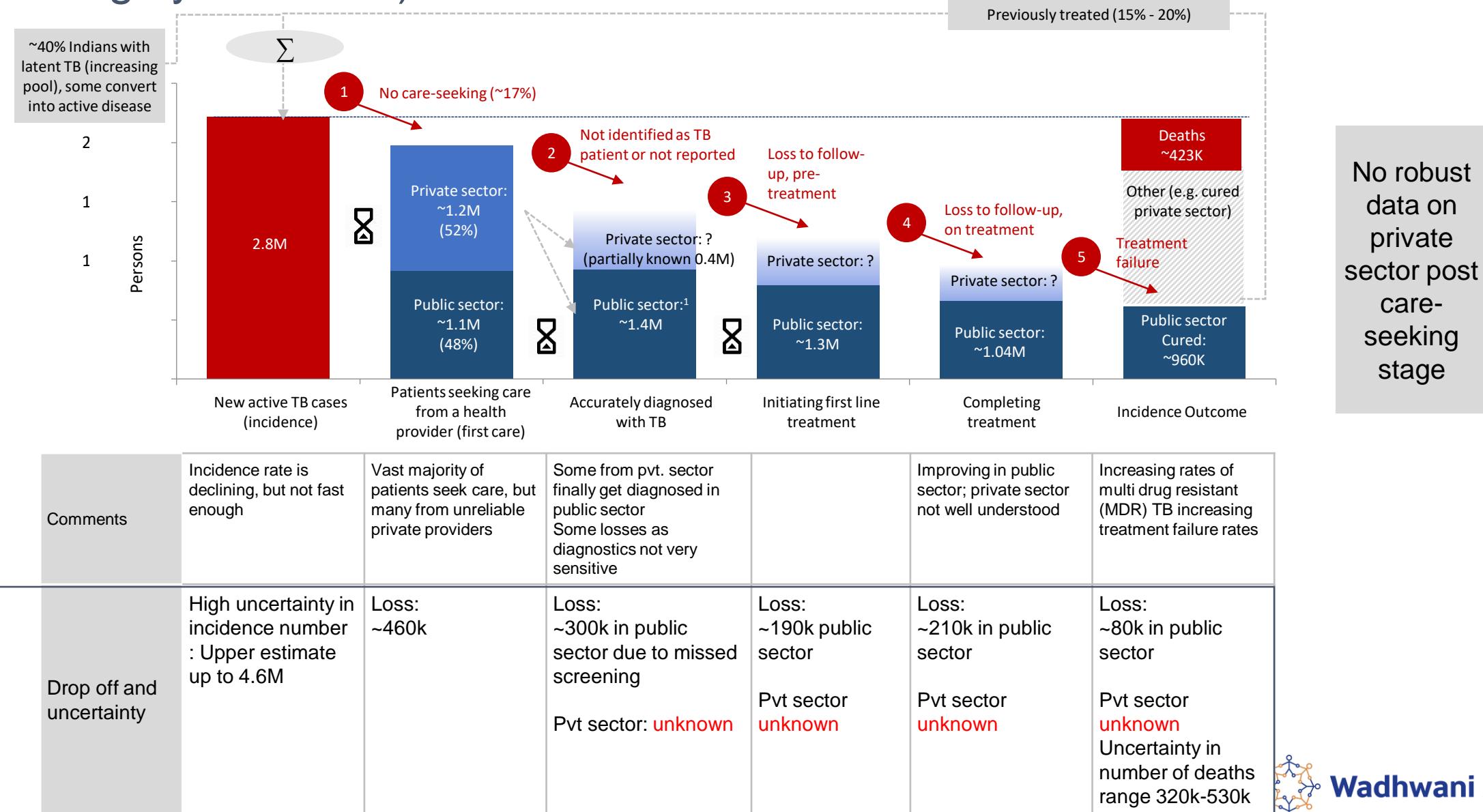


Cascade: Path that a TB patient takes from development of active TB to incidence outcome following treatment. We structure challenges in TB by stage of cascade



Wadhwani AI

Losses at each stage of care cascade in public sector in India (Private sector numbers largely unknown)

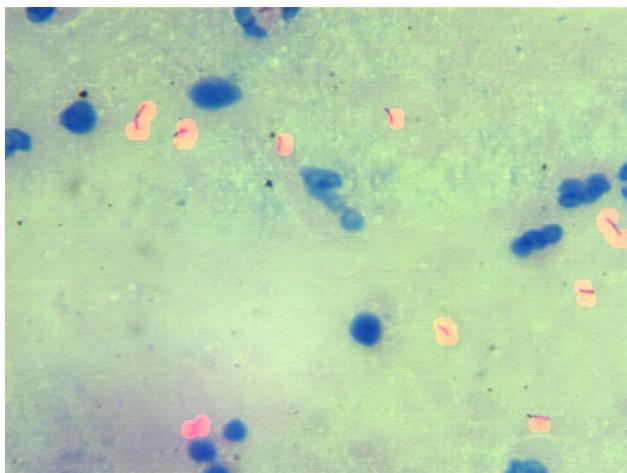


Sputum Microscopy

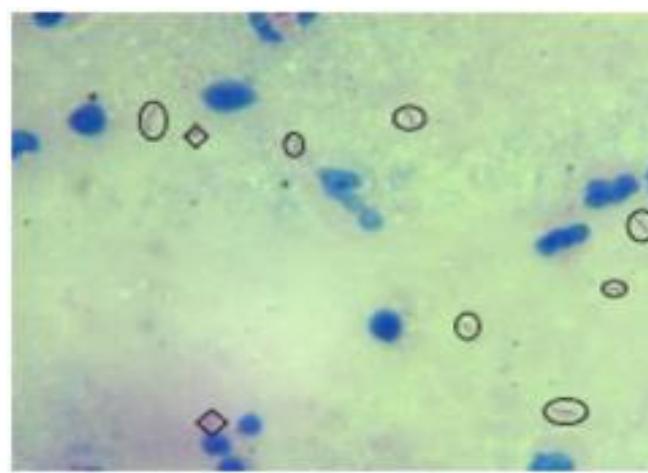
considered but de-prioritized

- Automated counting of bacilli in sputum microscopy for monitoring and diagnosis has been **de-prioritized** as a valuable problem to work on.

Our Prediction



Human Annotation



Previous Technical Progress:

Model	F1-score	Precision	Recall
MobileNet+	93.31	91.04	95.69
SENet	90.29	85.53	95.62
Prior work	74.79	83.78	67.55

Key reasons:

- Low sensitivity 60% (CI: 20-80%)
- Does not detect drug resistance
- Better tech either in early stages of deployment or late stages of development. (GeneXpert, TruNat etc.)
- Policy on monitoring is unclear and even if the policy were executed correctly to have sputum testing, we do not expect that it is going to bend the curve, primarily because the bacterial load would be lower.



Wadhwani AI

Potential new use-cases

1. X-Ray - Automated chest X-ray reading for diagnosis and triaging.
2. Anthropometry - Using images for volume/weight estimation in adults.
3. Adherence - AI for identifying individuals likely to drop-out from treatment.
4. Optimizing ACF - Overlay multiple data sets to find patterns and identify hotspots (contributing to prevalence study + Nikshay v.2
5. Ultrasonography - AI-enabled US for screening, diagnosis and monitoring.

Helping Cotton Farmers Achieve Sustainable Living

September 2018



Wadhwani AI
AI FOR SOCIAL GOOD

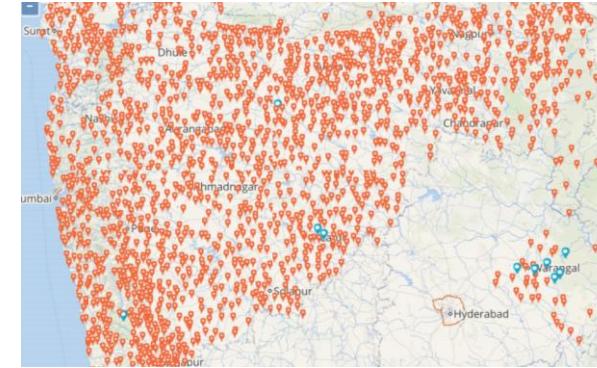
Cotton Farming



- Largest acreage in India after rice and wheat
- At the heart of farmer suicides and widespread protests by farmers. Pink bollworm destroyed 30% of last year's crop
- Enormous government spending in subsidies, minimum support prices, loan waivers, and compensation for losses
- Partners: Maharashtra Dept of Agriculture, CDFI, Skymet

Cotton Farming Challenges and Opportunities

- 9 million farmers approached Maharashtra government for loss compensation in 2017.
- Largest acreage in India, after Rice and Wheat.
- **Use-cases**
 - Acreage estimation
 - Crop yield estimation
 - Crop yield prediction
 - Crop health assessment
 - Harvest grading
 - Disease prediction
 - Crop planning advise
- **Partners**
 - Skymet
 - Centre for Digital Financial Inclusion (CDFI)
 - Maharashtra Department of Agriculture (MDA)



Skymet has 2065 weather stations in Maharashtra (vs. 70 by Indian Meteorology Dept.)

- **Data:** Skymet is India's largest weather data company with historical data including crop yields, and ability to collect variety of data (e.g., high-res imaging using drones). MDA has 11,000 field staff who can gather data.
- **Piloting:** CDFI provides software system 'Kanchi' for Farmer Producer Companies / Orgs; Some national direct benefit transfer programs run on their systems. Skymet and MDA also have relationships and mechanisms to pilot through.
- **Scaling:** MDA's programs are vehicles for scaling. Specifically, it is keenly supporting growth of FPCs.

*Soybean is another crop where promising data exists.

Cotton Farming: Initial Use Case

POTENTIAL AI-ENABLED SOLUTIONS

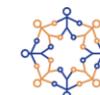
- Disease detection
- Disease prediction
- Crop grading & segregation (Assaying)
- Crop advisory
- Acreage estimation
- Yield estimation
- Yield prediction
- Pricing crop insurance
- Tools for field workers



INITIAL USE CASE

Disease detection

- The 2017 pink-bollworm outbreak that wiped out 1/3 of Maharashtra's cotton crop went undetected by 11k extension workers. Can AI help?
- Plugs into existing behaviour: farmers already send crop pics over Whatsapp to agri experts



Wadhwani AI

HUB

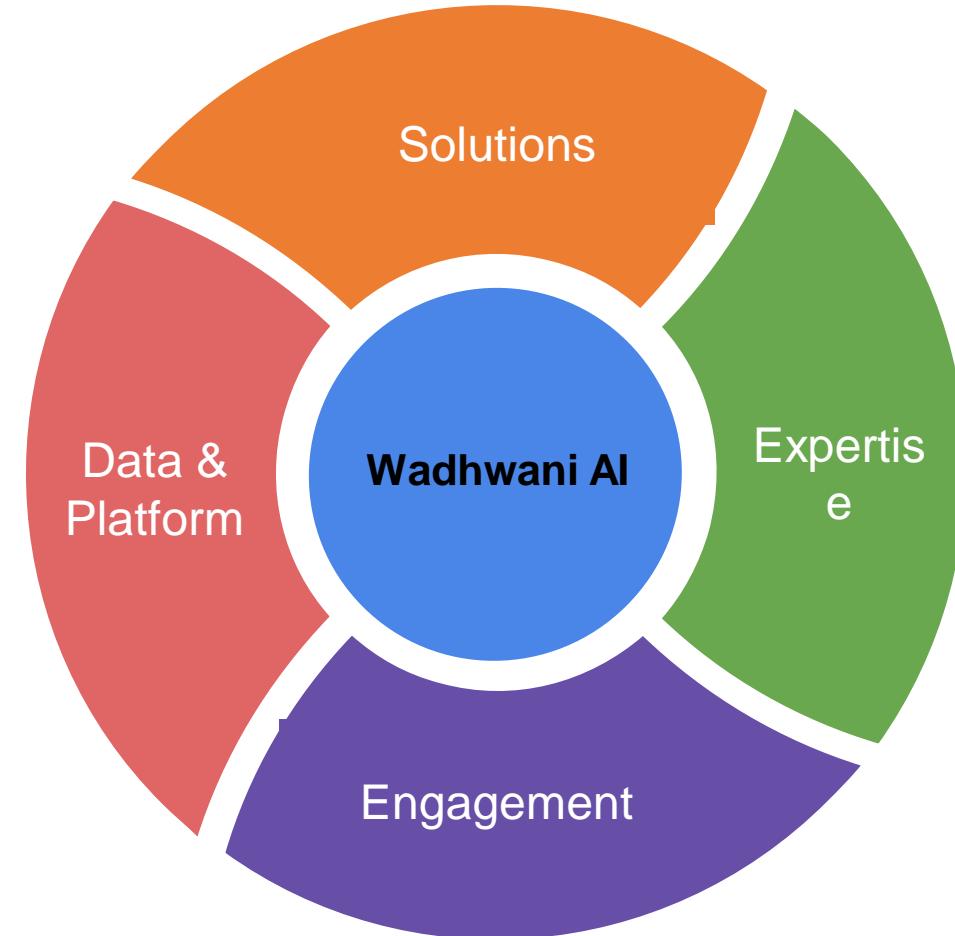


Wadhwani AI

Wadhwani AI Hub

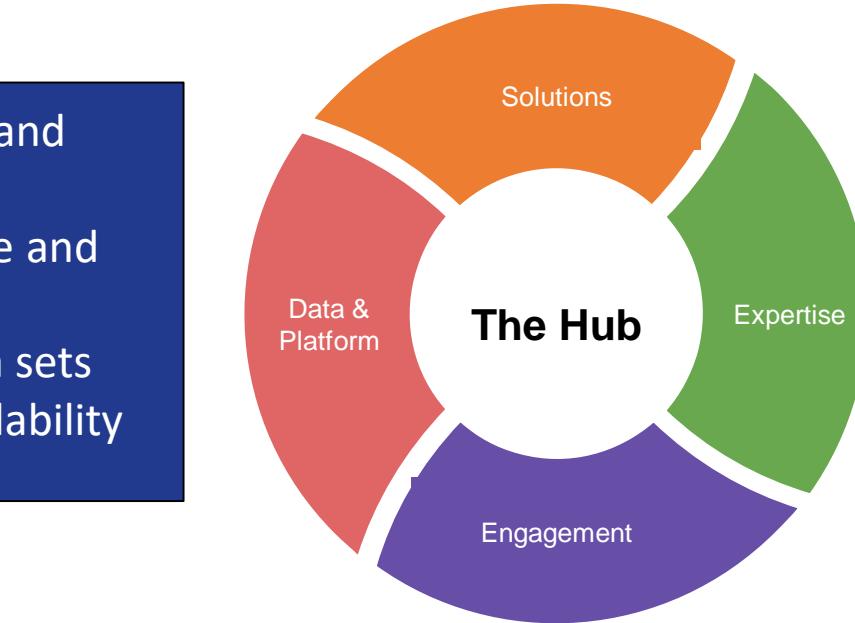
S-E-E-D

Engaging experts and communities to
create solutions, data and tech
platforms



The Hub: Activities

- Data ecosystem creation and availability
 - Sourcing, governance and management
 - Aid discovery of data sets
- Technology Platform availability



- Summits / ConfEx, Talks & Webinars, Seminars
- Interviews, Podcast, Fireside chats
- Hackathons, Workshops & Symposia
- Open House/ Product Launches
- Newsletters

- Periodically publish curated list of relevant information
 - Blogs/white papers
 - Links to research, opinion pieces, etc
- Mentor/facilitate social entrepreneurs
- Facilitate faculty and scholar visits

GLOBAL PRESENCE



Wadhwani AI

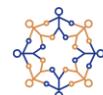
Thought Leadership & PR/Outreach

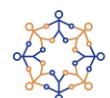
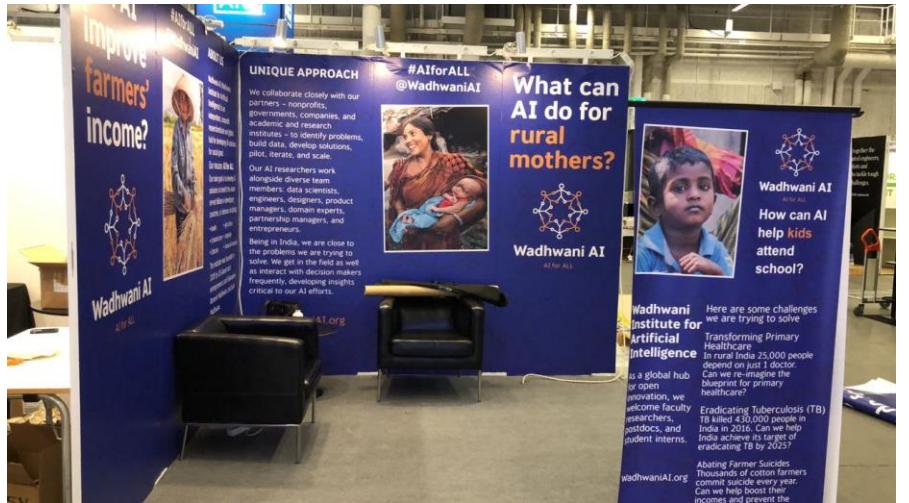
- Key contributor to the [NITI Aayog's India AI strategy document](#)
- Member of the MEITY committee on AI policy and strategy
- Invited speaker at the [UN ITU AI for Social Good Summit](#)
- Lead speaker at the Wilton Park Meeting on AI in Healthcare (UK)

Great inauguration coverage (see
<https://drive.google.com/open?id=1leWL2BqnQmlkI0-INM7aKvJvrAC3o8h8>)

Continuing articles (e.g.,
<http://www.forbesindia.com/article/ai-work/we-want-to-be-an-ai-hub-for-social-innovation-p-anandan/50665/1>)

ICML BOOTH (see pics next page)





Wadhwanai AI



Thank You!

contact@wadhwani.org

<https://www.wadhwani.org/>



vani AI

SICAL GOOD

APPENDIX



Wadhwani AI
AI FOR SOCIAL GOOD