10 years of TEM

What can we learn from a decade of ICT(4)D Research?

Edward Cutrell

Microsoft Technology for Emerging Markets

Microsoft Research India

Established January, 2005

Nine research areas

- Algorithms & Modeling
- Cryptography & Complexity
- Machine Learning & Optimization
- Mobility, Networks, and Systems
- Multilingual Systems
- Programming Languages and Tools
- Security & Privacy
- Technology for Emerging Markets
- Vision & Media

Currently ~55 full-time staff

Collaborations with government, academia, industry, and NGOs in India

Image: Sridhar Vedantham

http://research.microsoft.com/india

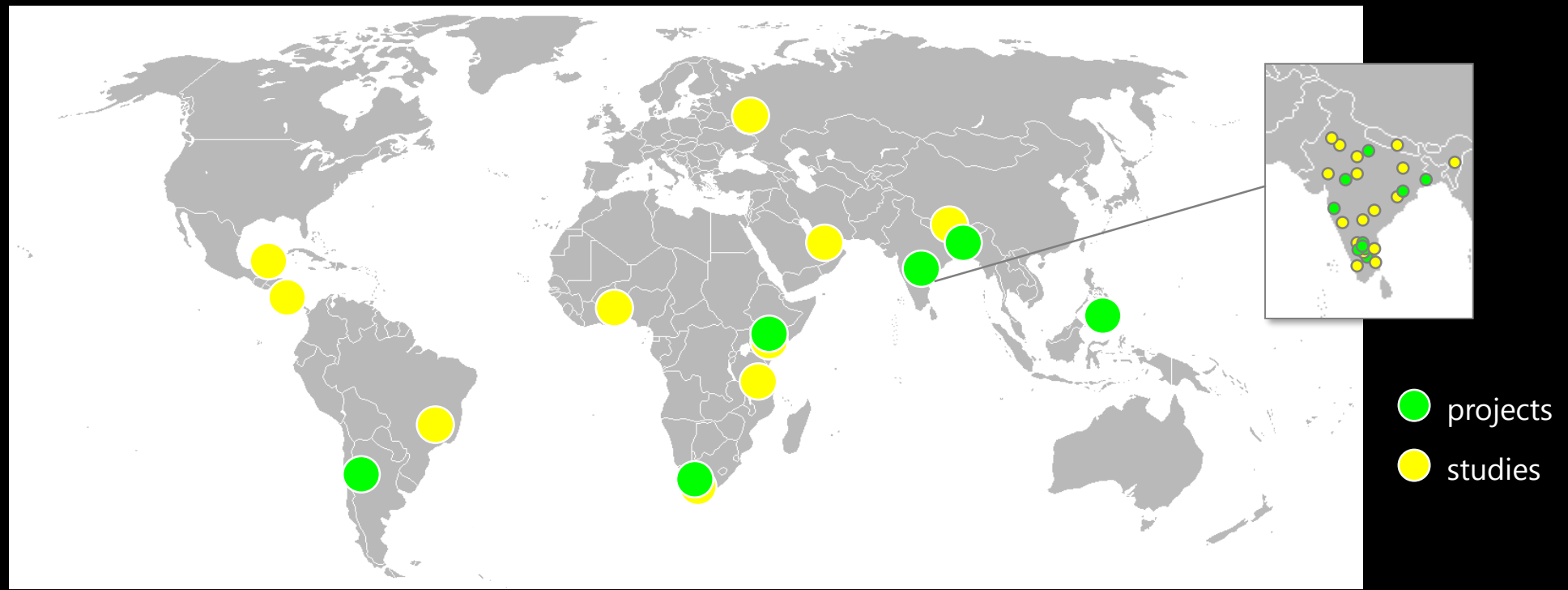
Technology for Emerging Markets

At Microsoft Research India

Understand existing and potential technology users in developing communities

Design and evaluate technology and systems that contribute to socio-economic development

Collaborate with development organizations, governments, academics & industry



Technologies for Emerging Markets

Jacki O'Neill

People

Technology

Bill Thies

Ethnography

Interdisciplinary Collaboration

Linguistics

Computer Science & Engineering

Kalika Bali

Design

Human-Computer Interaction

Andrew Cross

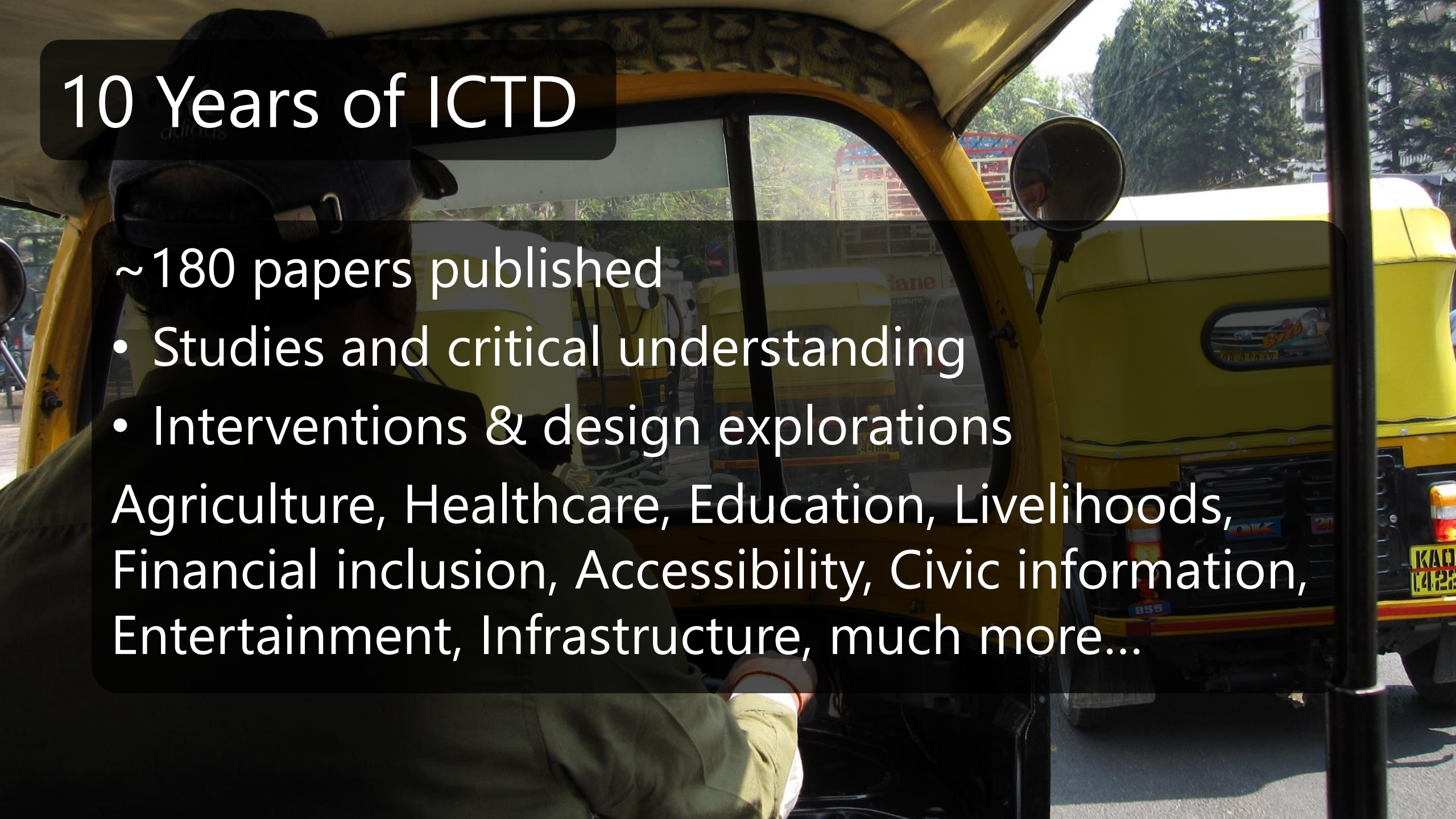
Indrani Medhi

Nakull Gupta

Himanshu Zade

Ed Cutrell
(Group Lead)

Saiganesh Swaminatham



10 Years of ICTD

~180 papers published

- Studies and critical understanding
- Interventions & design explorations

Agriculture, Healthcare, Education, Livelihoods, Financial inclusion, Accessibility, Civic information, Entertainment, Infrastructure, much more…

What makes a successful intervention?

Four projects from the past 10 years that demonstrate some core necessities for a successful ICT4D intervention

- Digital Green
- Paper-based digital slate for microfinance (MILPA)
- VidWiki
- Sangeet Swara


Digital Green
(ITID 2009)
Rikin Gandhi &
collaborators
www.digitalgreen.org

Agriculture Extension

Dissemination of expert agriculture information and technology to farmers

"Training & Visit" extension popularized by the World Bank in 1970s

- Face-to-face interactions of extension officers and farmers

100,000 extension officers in India

- 610,000 villages in India with average 1,000-person population
- Extension agent-to-farmer ratio is 1: 2,000

Typical extension officer salary is US$1200 per year

Design problem

Can information and communication technology improve the cost-effectiveness of agriculture extension?

Digital video for extension

Video provides…

- Resource savings: human, money, time
- Accessibility for non-literate farmers

Early Experimentation

Six months in field trying various combinations

Over 200 days of surveys, ethnographic investigation, and iterative design

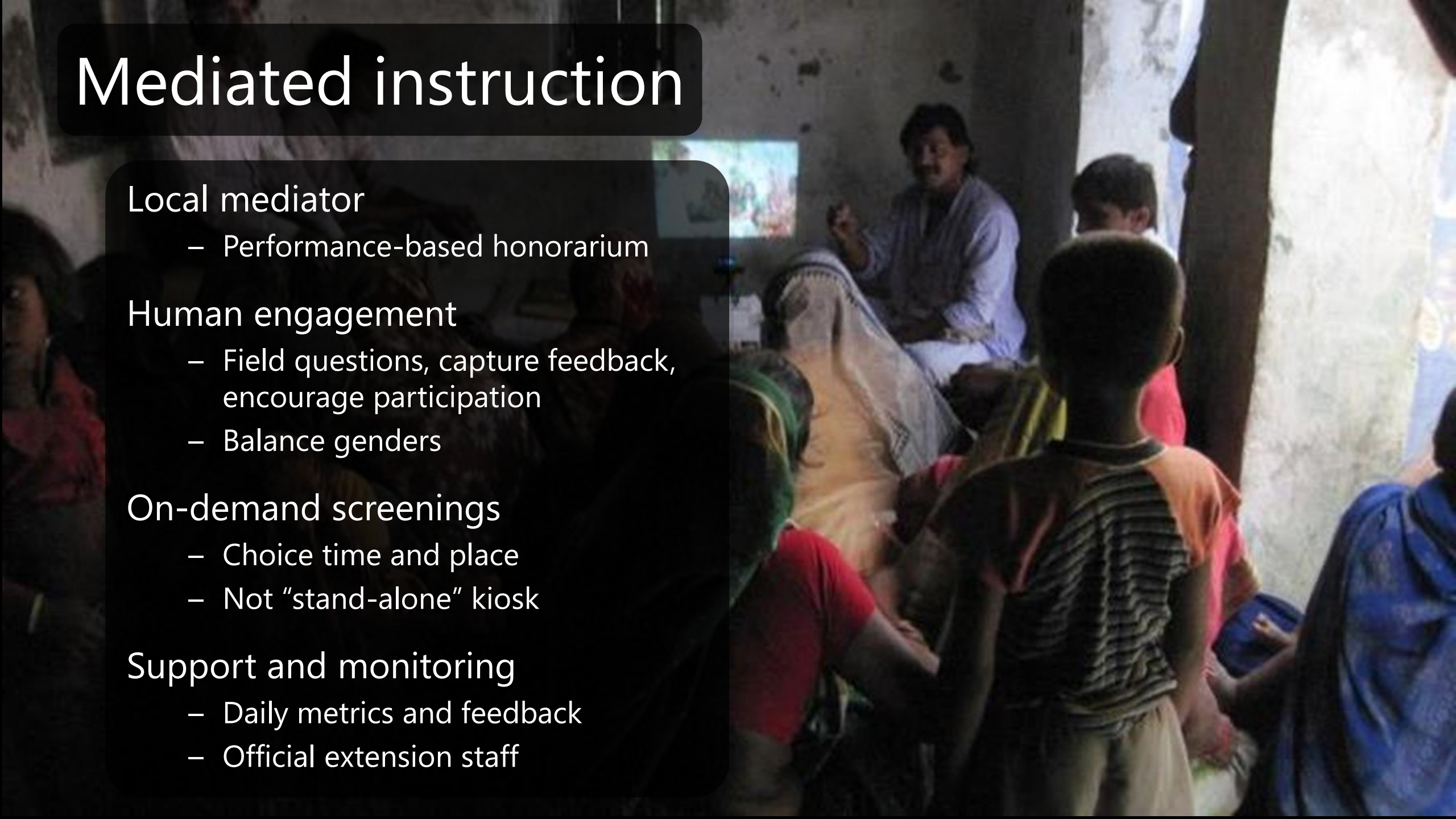
Participatory Content Production

Introduction to innovations
- Standard extension procedure

Rough “storyboarding”
- Repetitive pattern; easy to learn
- Minimize post-production

Local farmers on their own fields
- Reduce perception of “teachers”
- Promote “local stars”

Mediated instruction



Local mediator
- Performance-based honorarium

Human engagement
- Field questions, capture feedback, encourage participation
- Balance genders

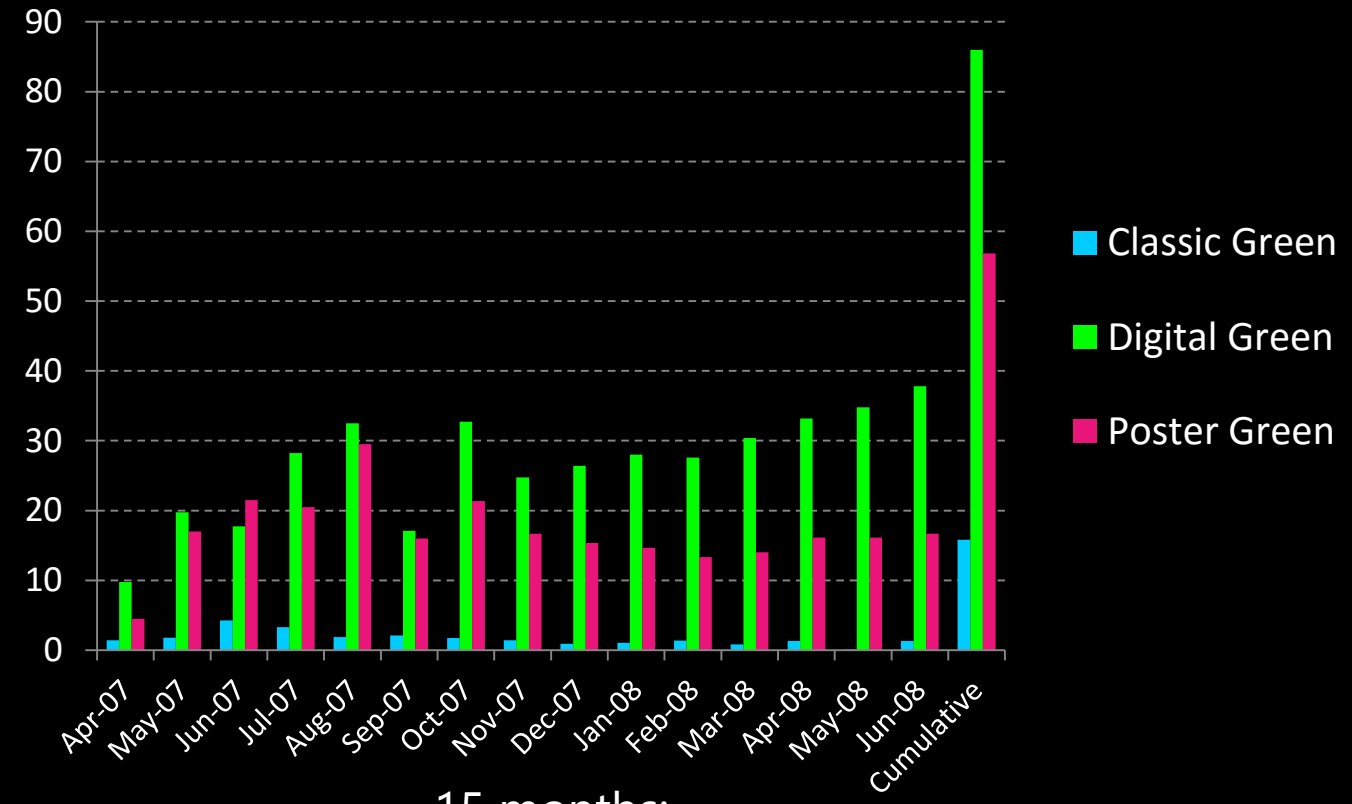
On-demand screenings
- Choice time and place
- Not “stand-alone” kiosk

Support and monitoring
- Daily metrics and feedback
- Official extension staff

Evaluation results - 15 month study

7 times more adoptions over classical extension

- Sustained local presence
- Mediation
- Repetition (and novelty)
- Integration into existing extension operations
- Social homophily between mediator, actor, and farmer
- Desire to be "on TV"
- Trust built from identities of farmers and villages in videos



15 months:
13 villages, 3 nights a week, 1,000 regulars

Cost-Benefit

System	Cost (USD) /Village/Year	Adoption (%) /Village/Year	Cost/Adoption (USD)
Classical GREEN	$840	11%	$38.18
Digital Green	**$630**	**85%**	**$3.70**
Poster Green	$490	59%	$4.15

Note: Decreasing amortized cost of hardware with time and scale

Digital Green is **10 times** more effective *per dollar* spent than classical extension!

Current status

Participatory video and mediated instruction enables 10x increase in cost-effectiveness of traditional agriculture extension.

Spun off independent NGO to scale Digital Green in 2010

Now in 9 states in India, and parts of Ethiopia, Afghanistan, Ghana, Niger and Tanzania

Reached >600,000 people in 7600 villages with 3700 videos, and as many as 340,000 of the viewers have adopted one or more of the best practices promoted through these videos.

www.digitalgreen.org

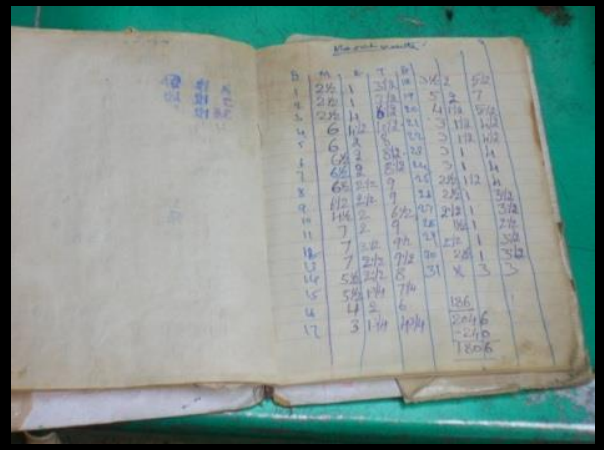
Hugely successful ICT4D story

- Fantastic, dedicated partners
- Clear, demonstrable utility & usability with careful, systematic validation
- Demand from partners and end-users
- Adaptability to new models & technologies
- Reliant on local relationships and talent
- Evolved from careful interdisciplinary research closely allied with direct field experience

Paper, Pen & Digital Slate for Microfinance
(ICTD 2010)

Aishwarya Ratan & collaborators

Can handwritten pen and paper-based work processes directly generate and manipulate digital data?



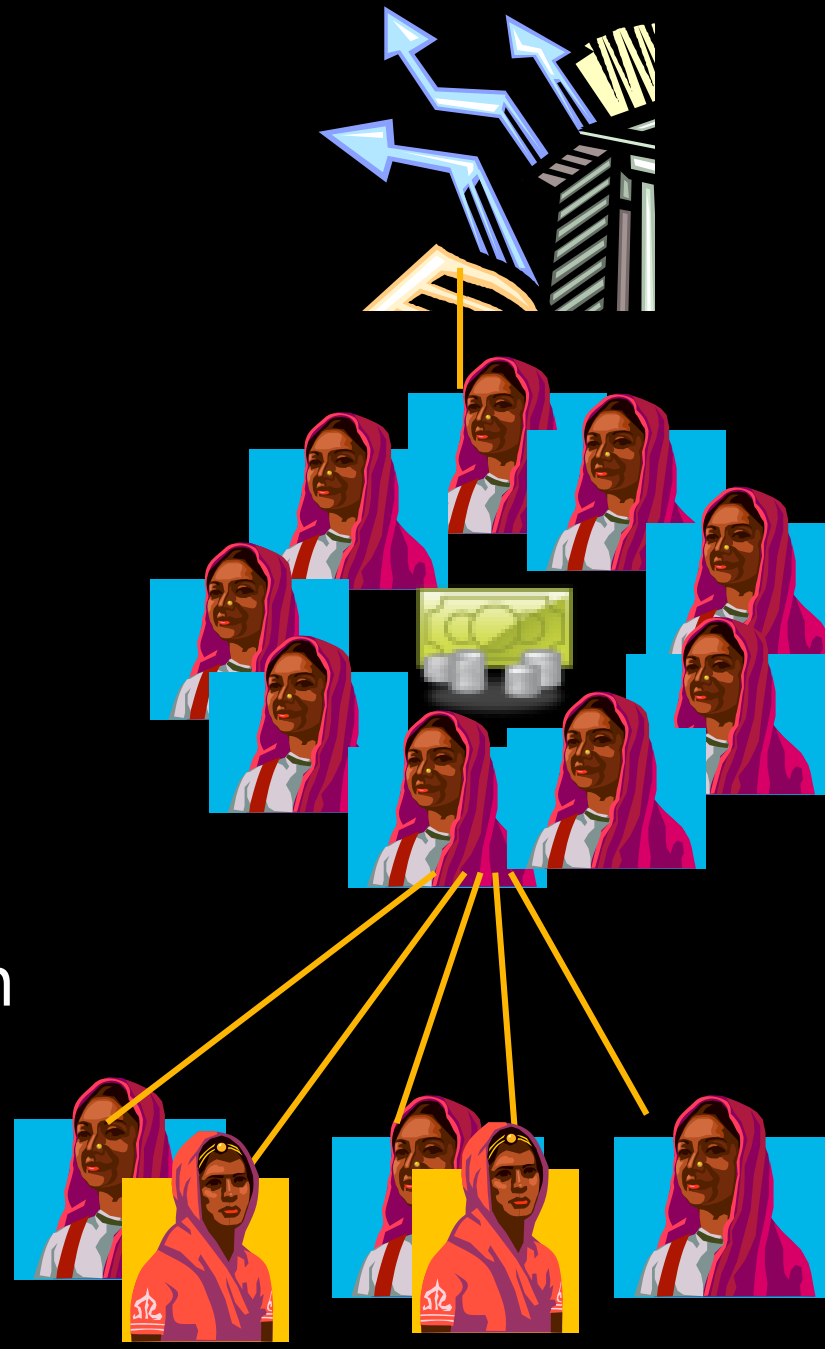
Images: PRADAN member, Aishwarya Ratan, Mahesh Gogineni, Bing images, PRADAN, Alex Taylor

Domain

86 million women participants in 6 million microfinance Self-Help Groups across India

-Linked with banks
-Decentralised, autonomous, self-run

Active in leading social, political and economic initiatives, but limited financial leverage/growth
[Sinha et al, EDA & APMAS, 2006]



PRADAN's 'Computer Munshi'

SHG weekly meeting in Village

RMTS-1

Same day

RMTS-1 copy dropped in the Drop Box

RMTS-1

Next 1-2 days

picked up and transported to CM by Postman

RMTS-2

RMTS-2 Generated by CM in Town

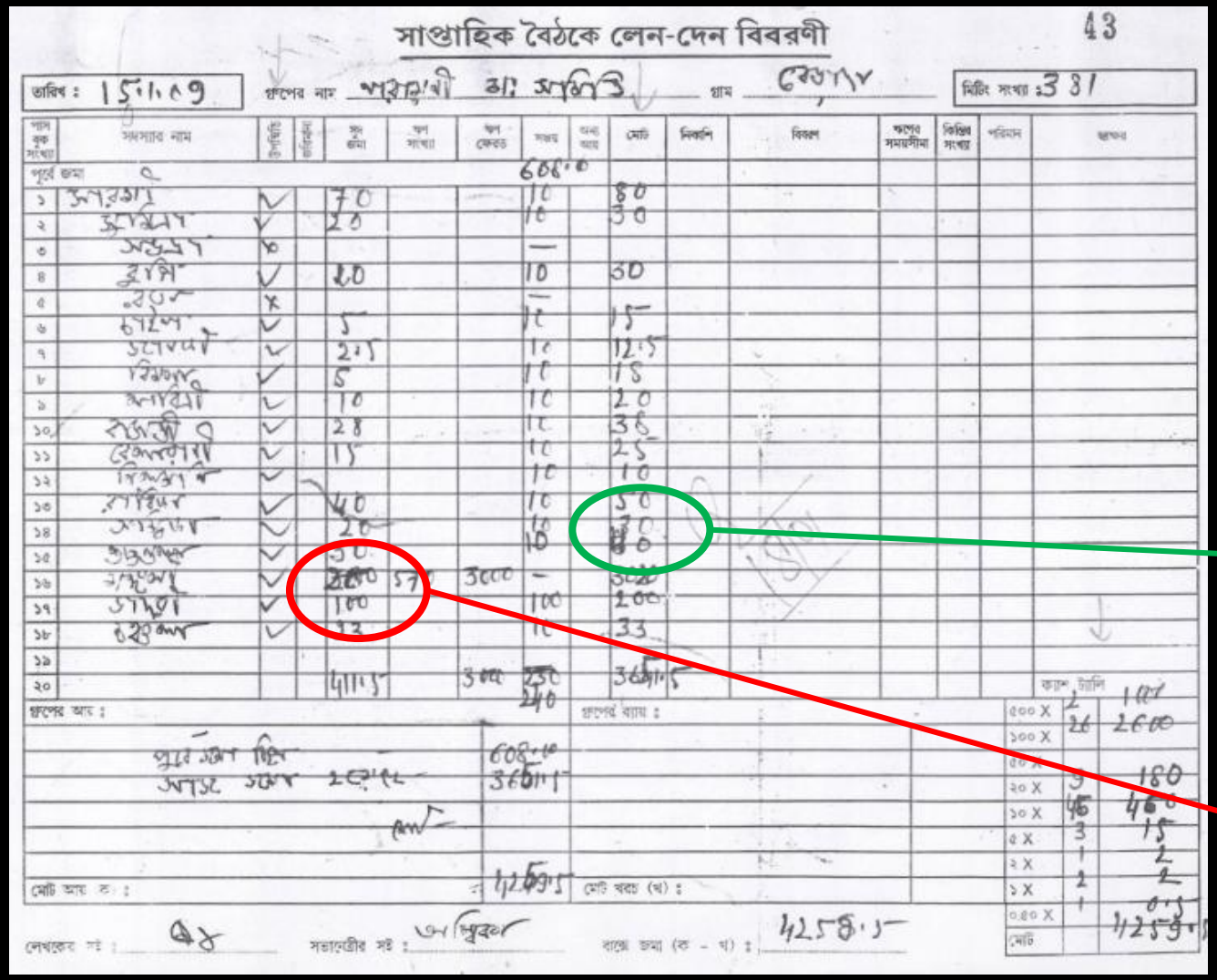
RMTS-2

Next 4-5 days

RMTS-2 delivered by Postman to SHG

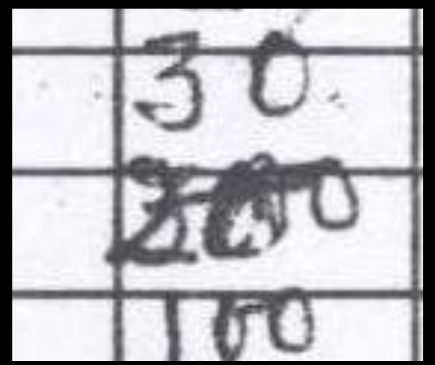
Images: PRADAN members, Aishwarya Ratan

Target problem



- Inaccuracy
- Incompleteness
- Inefficiency

- Paper copy

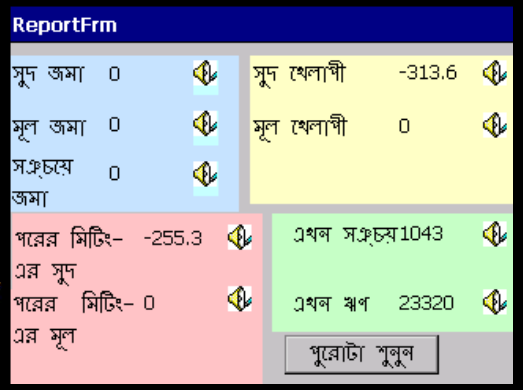


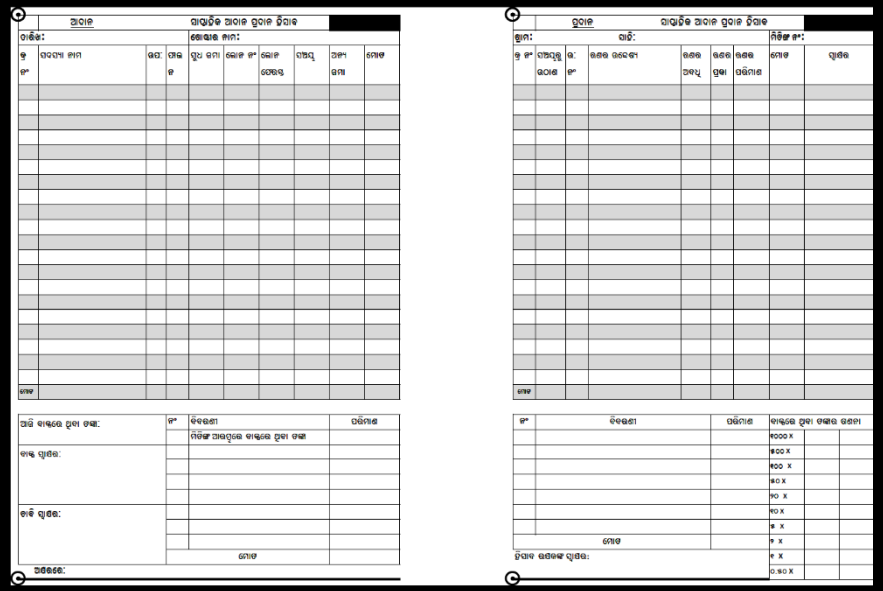
An SHG meeting transaction recording form

Image: PRADAN, Sunandan Chakraborty

Prototype device

MILPA slate developed by UPG in Microsoft, Redmond for a school project (canceled). Allows handwritten ink entries on ordinary paper to be immediately digitized and processed.





- .NET CF app follows structure of paper form
- Sequential flow
- Numeric input with pen on paper
- Navigation using stylus on touch screen

Images: PRADAN member, Sunandan Chakraborty

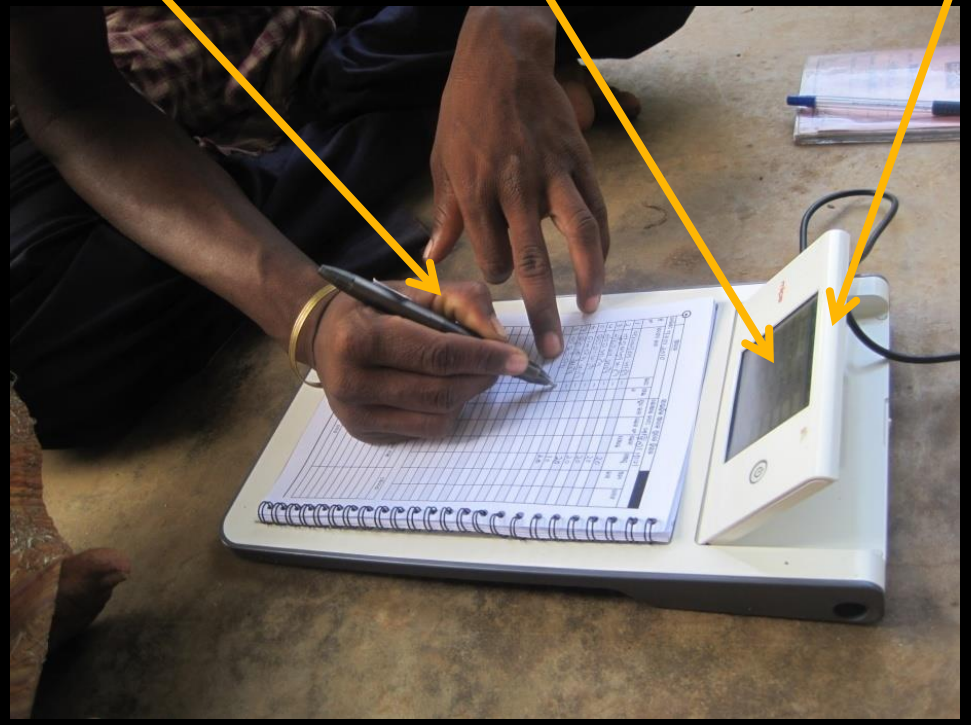
How does it work?

1 Handwriting numbers on paper

2 Simultaneous digitization of entries

3 Process entries against database; prompts and checks

4 Audio report for validation



Images: PRADAN members, Aishwarya Ratan

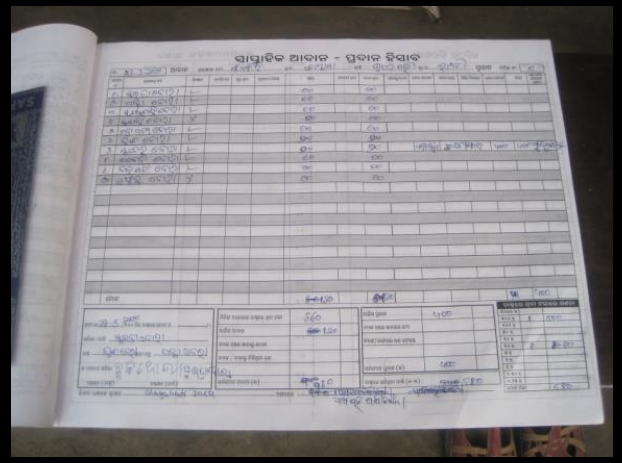
Field Trials

Within subjects comparison

Trial 1: West Bengal, 10 SHGs, median education: 7 yrs (w/ munshi)

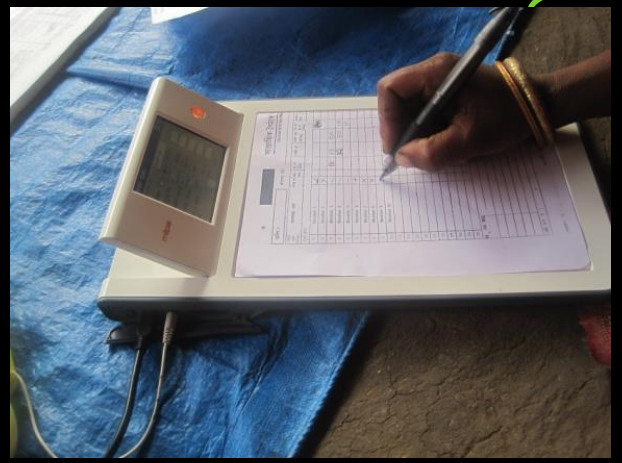
Trial 2: Orissa, 4 SHGs, median education: 3 yrs (no munshi)

1 **2** **2-3** **3-2** **3**



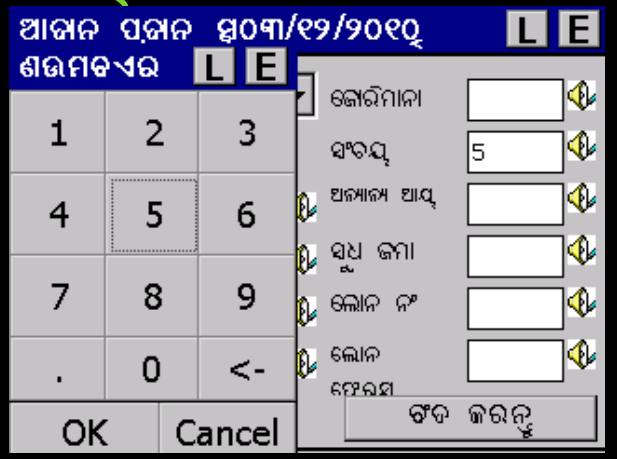
PAPER-ONLY (PO)

Baseline system
Trial 1 and 2



DIGITAL SLATE (DS)

Designed solution
Trial 1 and 2



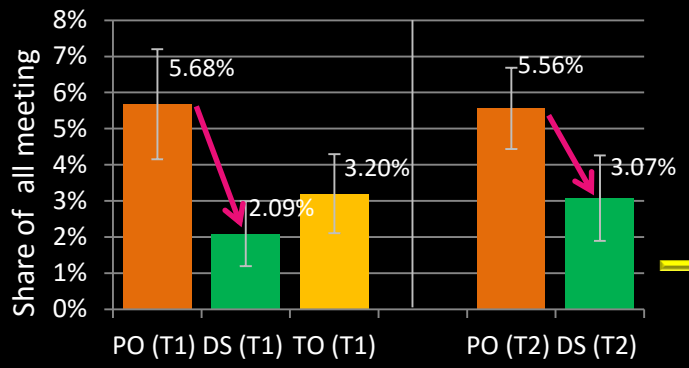
TOUCH-SCREEN ONLY (TO)

Alternative solution
Trial 1

Images: PRADAN, Aishwarya Ratan

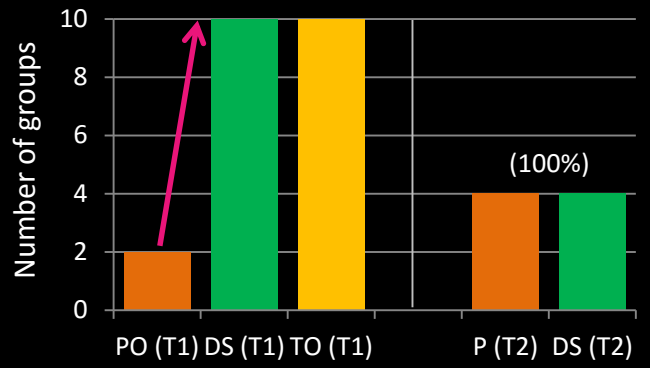
Field Trial Results

- Paper-Only (PO)
- Digital Slate (DS)
- Touch screen-Only (TO)



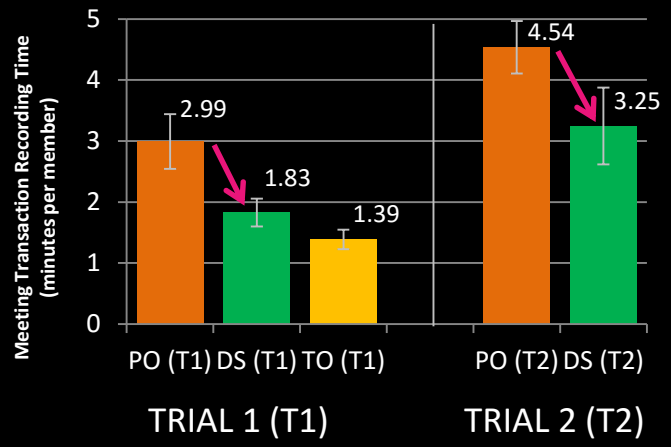
Accuracy

Average error rate when recording data decreased.



Completeness

Completion of the Cash Tally module increased.



Efficiency

Average meeting transaction recording time decreased.

Field Trial: Survey responses

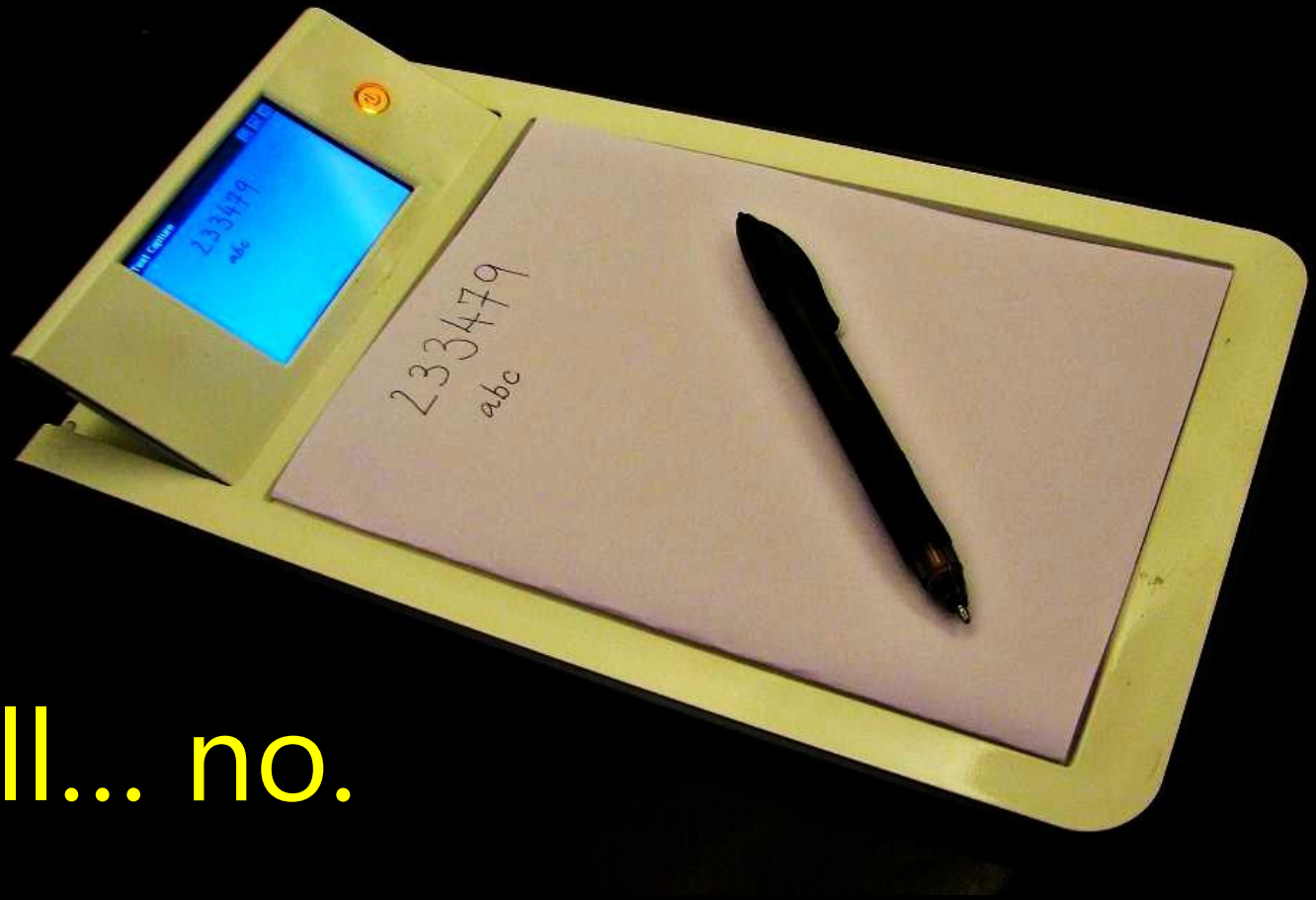
1. Listening to updates (n=52)	Share of responses
a. Writer saying figures and passbook entry	0.06
b. Machine saying figures and passbook entry	0.88
c. No preference	0.06
2. Final format for group records (n=52)	
a. Paper form and digital slate record	0.81
b. Just digital slate record	0.17
c. Just paper form record	0.02
d. No preference	0

SHG Member:
"I like that the machine is speaking. We are illiterate people. We don't know what goes on. But when it speaks, we can know."

[**We] "must have the khaata (paper form)."**

Writer:
"I can use a calculator and I have used others' mobile phones. But writing by hand is a habit. I feel it is better."

Slam-dunk for digital slate?



Well… no.

So what happened?

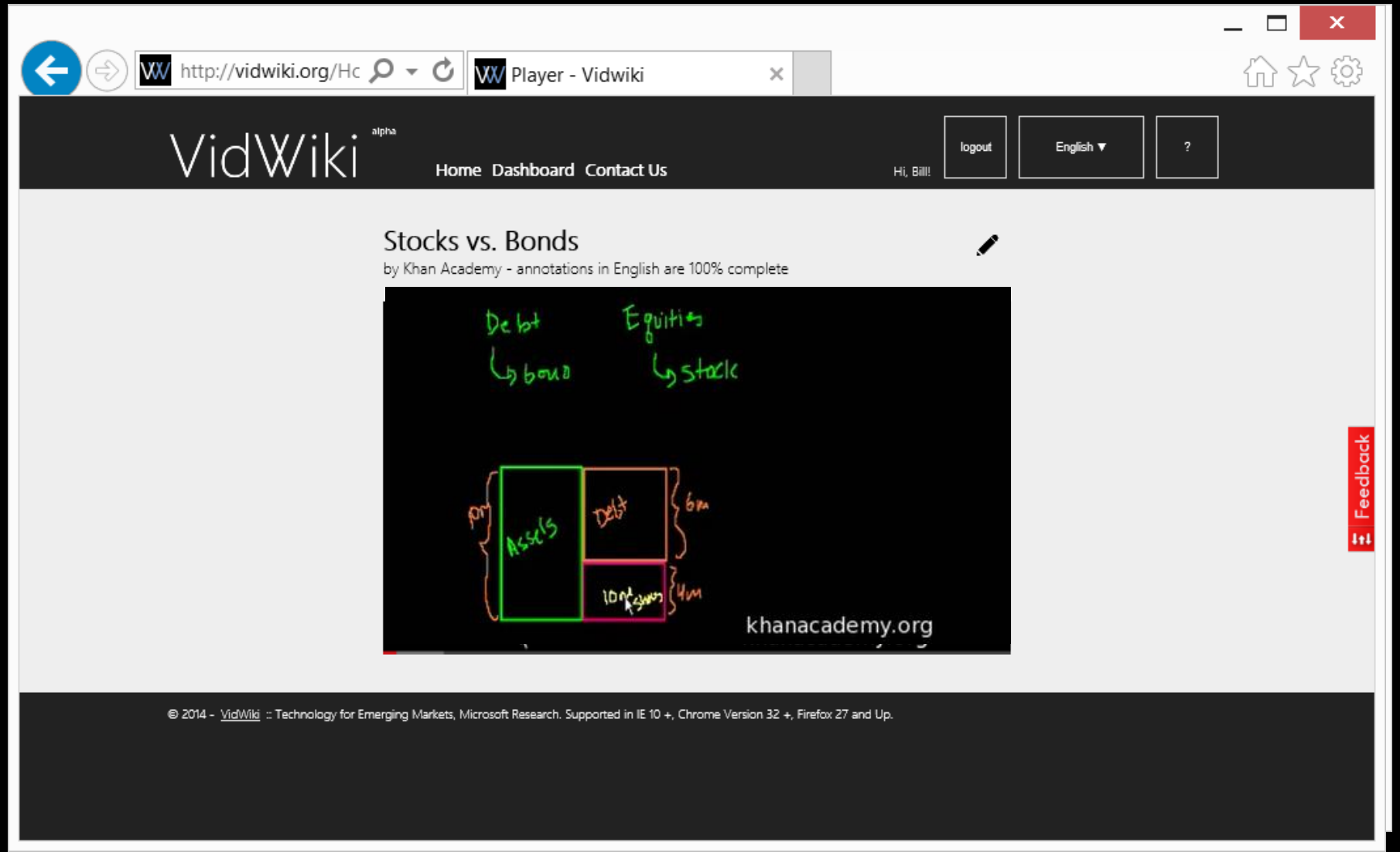
- Fantastic, dedicated partners
- Clear, demonstrable utility & usability with careful, systematic validation
- Demand from partners and end-users
- Manufacturing set up, licensing arranged

BUT…

- Low-cost smartphones were just beginning to appear
  - Multi-function, cheaper
  - Demand evaporated with slightly lower marginal utility

VidWiki: Enabling local production of content

(CSCW 2014, Andrew Cross & collaborators)

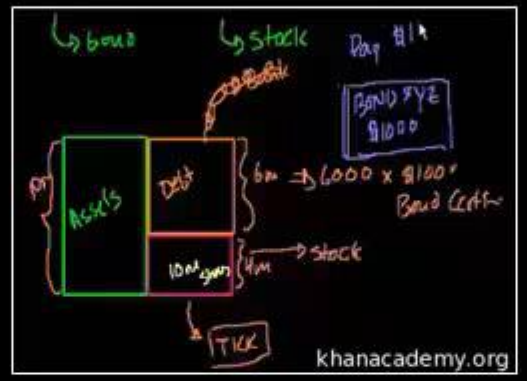


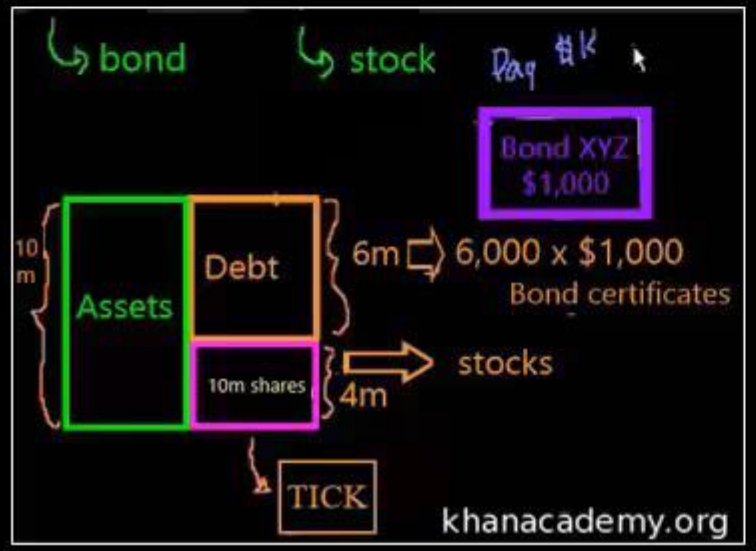
VidWiki by Microsoft Research India

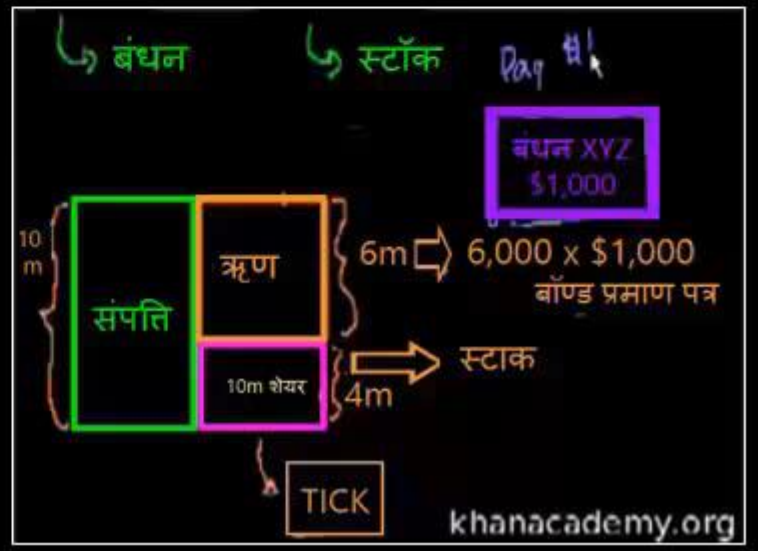
Leveraging the Crowd to Enhance Online Educational Videos

annotating handwritten videos with typeface text overlays in multiple languages

Note: This slide was actually a video demonstrating the system. You can view the video at: www.vidwiki.org







VidWiki current status

- Stable demo, sitting on the shelf (vidwiki.org)
- Cool technology
- Clear, demonstrable utility & usability with careful, systematic validation
- Lots of enthusiasm from everyone!

BUT

- No partners
- Crowd-based, requires catalyst to get to critical mass

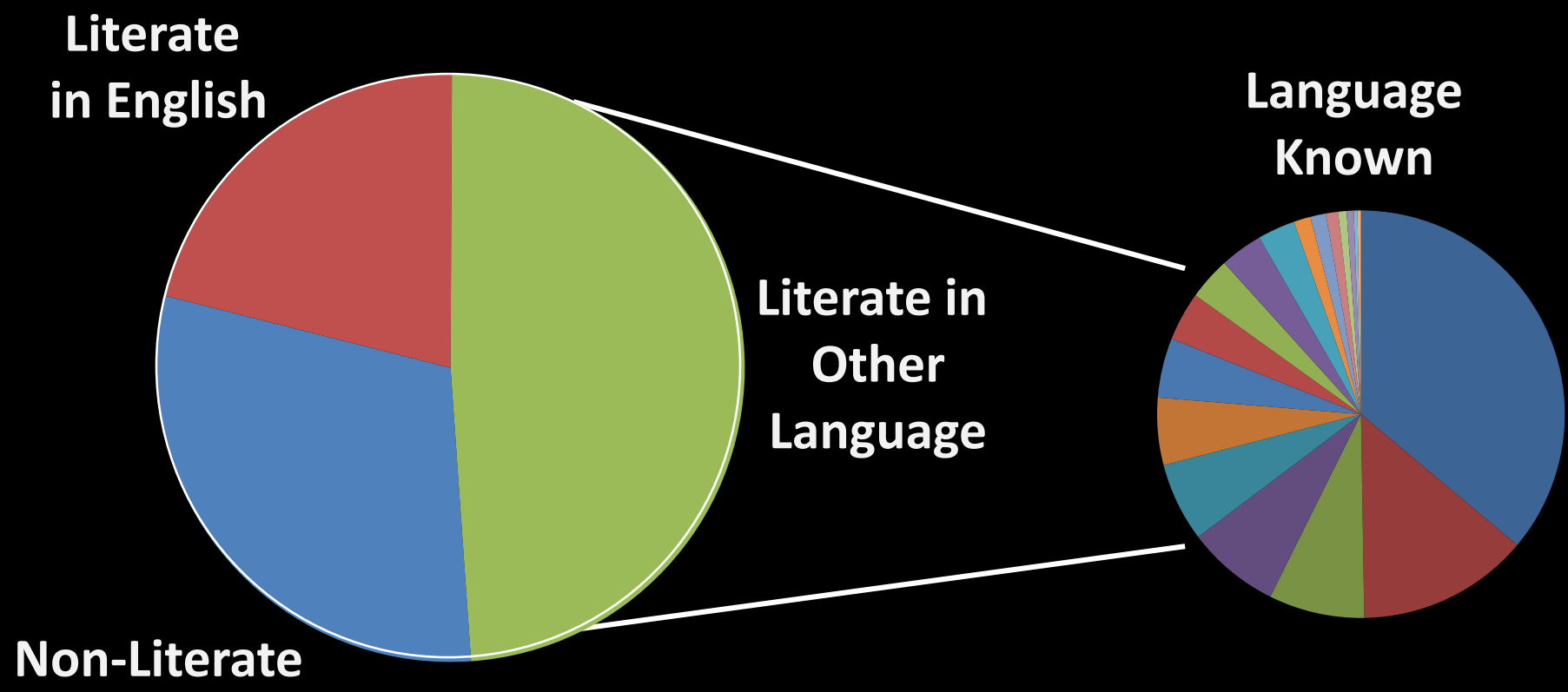
Sangeet Swara:

A Community-moderated voice forum in rural India

(CHI 2015)

Aditya Vashistha
& collaborators

Voice Remains Primary Interface for Mobile Subscribers in India



Voice forums for development

Job Opportunities by Entertainment
Raza et al. CHI 2013

Citizen News Journalism
Mudliar et al. ICTD 2012

Viral Entertainment Platform
Raza et al. ICTD 2012

Outreach to Sex Workers
Sambasivan et al. CHI 2011

Community driven Intelligent Maps
Kumar et al. ICTD 2009

Content Creation and Dissemination
Agarwal et al. ICTD 2009

Supporting Treatment of HIV+ Patients
Joshi et al. CHI 2014

Improve Medication Adherence
Pai et al. ICTD 2013

Community Radio
Koradia et al. ICTD 2012

Feedback on School Meals
Grover et al. DEV 2012

Agriculture Discussion Forum
Patel et al. CHI 2010

Freedom Fone
Clark et al. ICTD 2009

Health Information for CHW
Sherwani et al. ICTD 2007

Millions of calls & hundreds of thousands of voice messages in local languages!

Moderators

- Team of 10-15 people
- Generate meta tags like content type, gender
- Review & improve quality
- Translate and transcribe
- Publish it on IVR and web

How to reach the scale of large Internet websites?

Scaling IVR Systems

Community Moderation

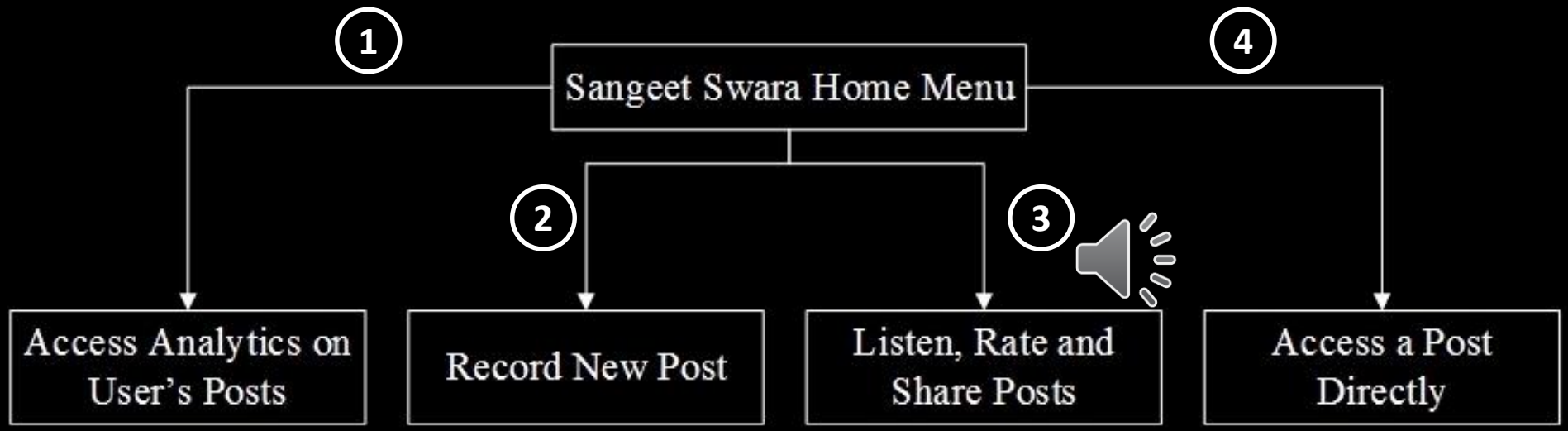
- Interface issues
  - Difficult to skim
- User issues
  - Limited exposure to technology
  - Cognitive load and domain knowledge
  - Value the community

Call Cost

- User pay for the calls for receiving
  - Good content
  - Social incentives
  - Financial incentives

Sangeet Swara

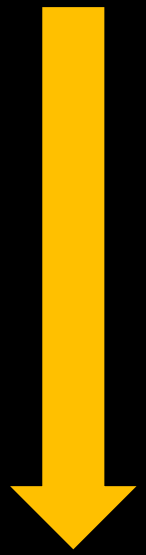
A Community-Moderated Voice Forum for Songs, Poems, Jokes, & Cultural Content



To share this song with friends, Press 4.

Sangeet Swara

A Community-Moderated Voice Forum for Songs, Poems, Jokes, & Cultural Content



Playback Order

Now you are listening to a post with Rank X
.. post is played ..
.. vote is solicited ..

Now you are listening to a post with Rank Y
.. post is played ..
.. vote is solicited ..

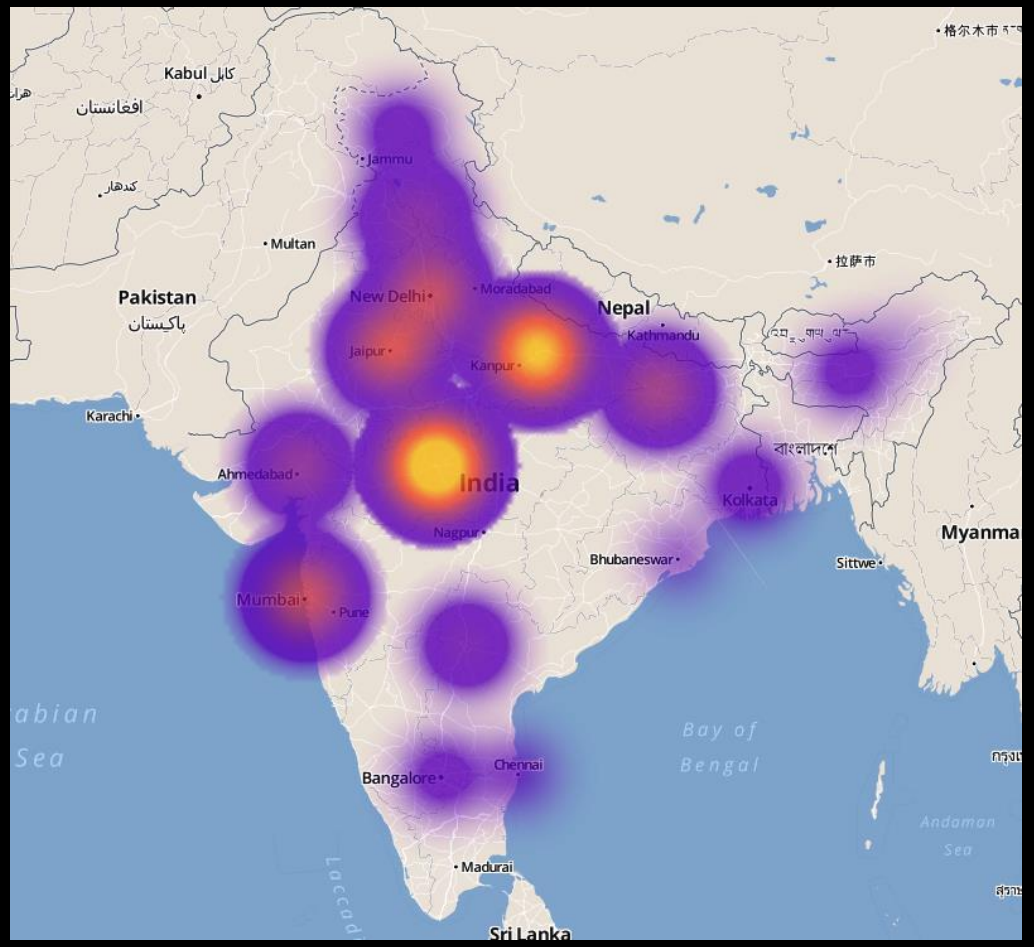
Now you are listening to a post with Rank Z
.. post is played ..
.. vote is solicited ..

Rank Order

Deployment

Traffic in 11 weeks

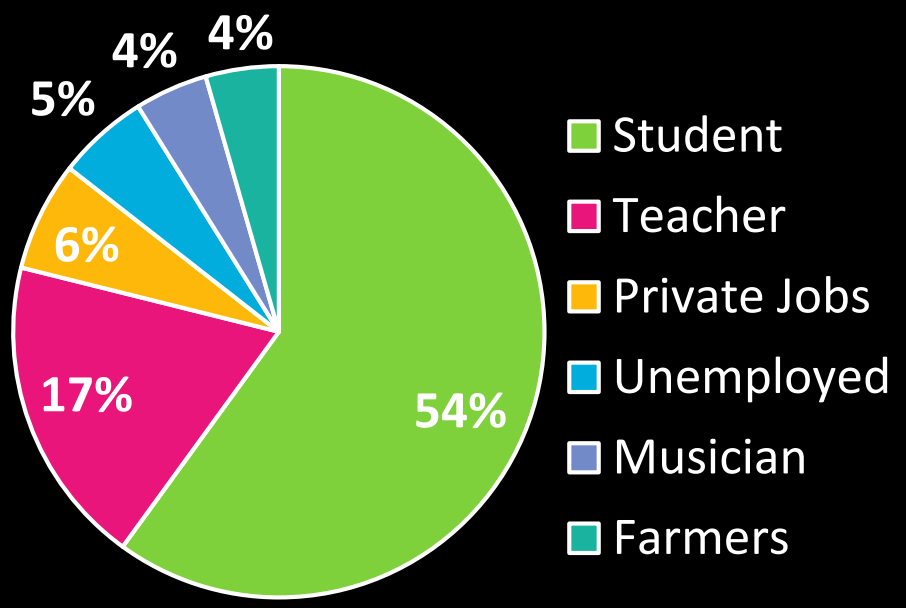
- 25,000 calls
- 5,400 audio posts
  (by 500 people)
- 140,000 ratings
  (by 1,500 people)
- 200,000 playbacks
- Avg. call 5 min



Spread from 73 people to 1500+ by word of mouth

User Analysis

- 50% from rural areas
- 94% male 6% female
- Impassioned use by VI (26%)
- Earn ~2.6 USD/day
- 61% used SMS, 16% used email & Facebook
- Masters (16%), Bachelors (40%), School (41%)



Emergent ownership and use by the visually impaired

"I am a blind person so I couldn't get educated. I want to thank you because you enabled all blind people to get in touch and share. No matter how much I praise, it won't be enough."

"You are like my father, my god, I want to thank you again and again, this small kid wants to respect you from the bottom of the heart. I want to welcome you again and again."

Platform for Musicians and Rural Users

"Sangeet Swara is trying to get talent from people in villages and towns. It is a channel for talented people who never got an opportunity to show their talent. Sangeet Swara is trying to get recognition and provide a channel for such people."

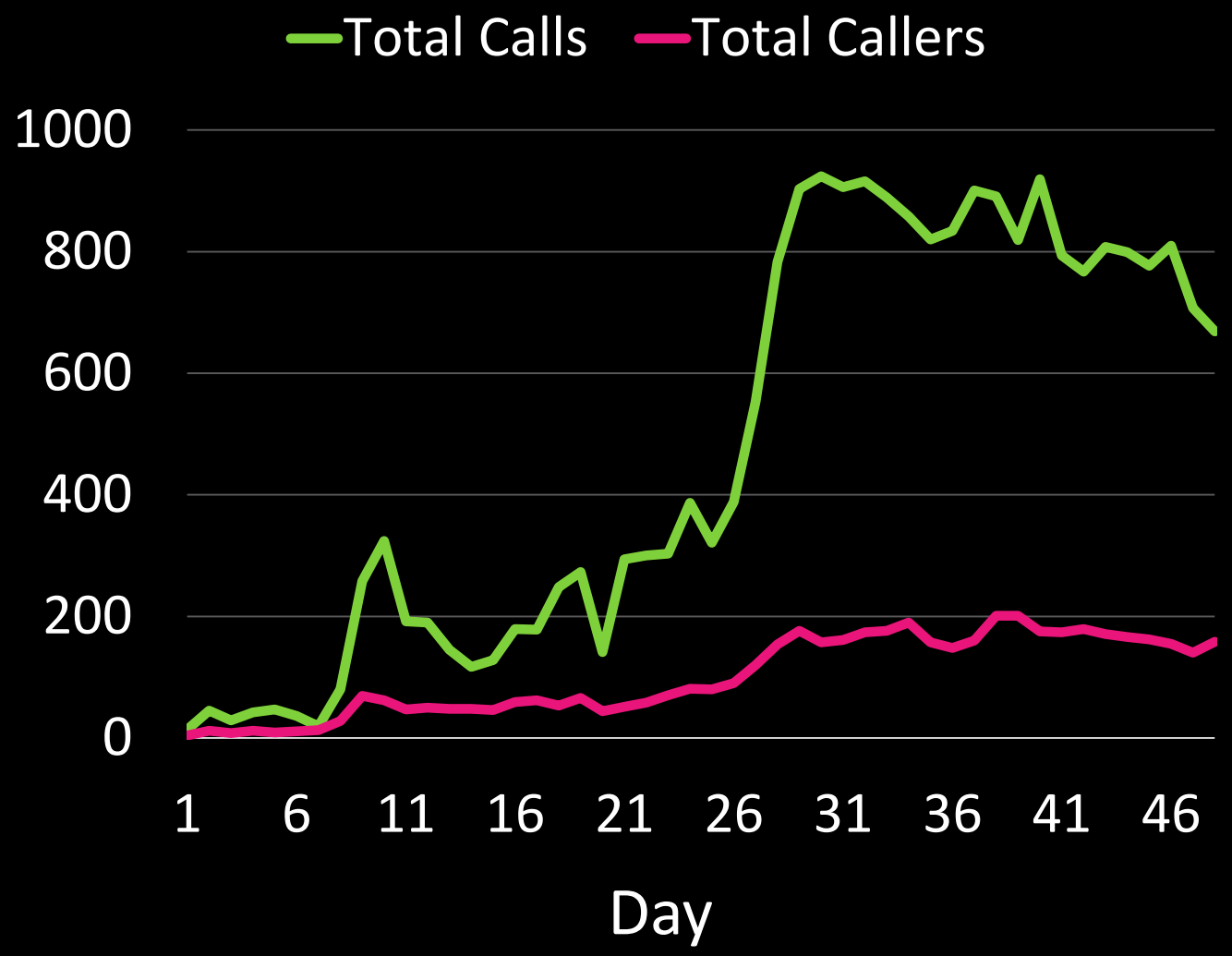
P4 (Male, Musician, 22 years, New Delhi)

Instrumental Benefits

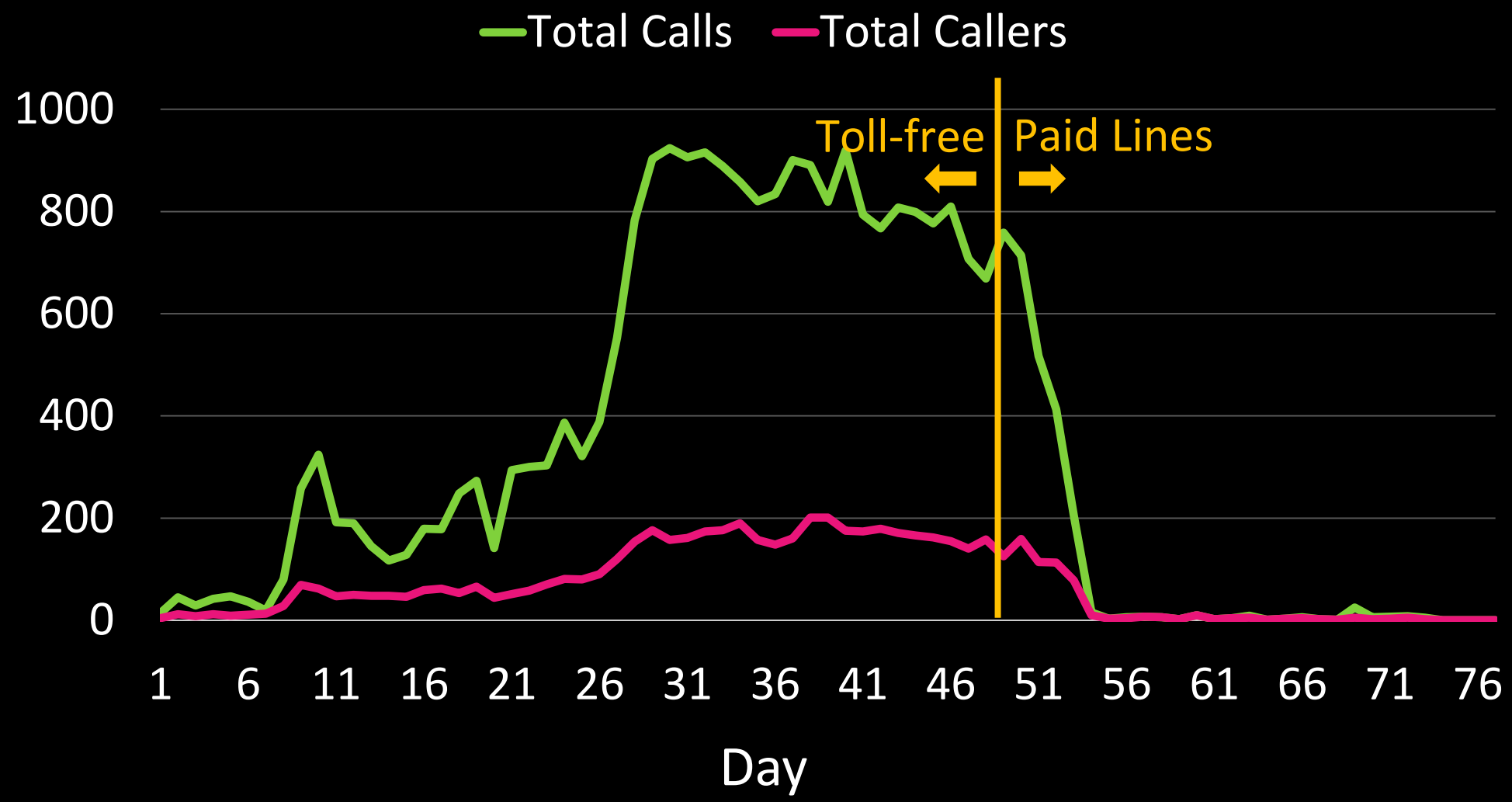
"I get a lot of knowledge by using Sangeet Swara. Some people record questions, which increases our knowledge. We get to listen to things we have never heard. We learn new vocabulary and sometimes new accent as well. I feel great when people give me feedback, be it good or bad. I consciously think of ways to improve my messages."

P5 (Male, Student/Farmer, Uttar Pradesh)

Toll-free Access



Toll-free Lines to Regular Lines



Sangeet Swara status

- Clear demand from users, useful and usable, solid validation
- Dedicated partners (CGNet)

BUT…

- Cost/benefit for this population doesn’t work

Great opportunity for more research to see if it can be self-sustaining!

Successful ICT4D interventions are hard!

- Good idea
- Solid partners
- People have to want it
- Understand your constraints and design to them (financial, technical, social, etc.)
- Adaptable to new technical and market changes
- Field-based ethnographic or sociological collaboration hugely beneficial