

Dynamics  
of  
Technology led Exclusion  
and  
Inclusion

R.A.Mashelkar

02.06.2016

# Technology has changed the Way of Life

The way Society will read, write, draw, hear, learn,  
exchange, entertain, communicate, collaborate, hire,  
move, navigate, produce,.....

# The way we read

THEN...



NOW...

(Amazon Kindle / Apple iBooks)





# The way we hear

## THEN...

Buy Albums + CDs in Stores /  
Playback via Dedicated Players



## NOW...

(Spotify...)

Discovery of Music Through Friends + Experts /  
Instant On-Demand Streaming on Internet-  
Enabled Devices



# The way we inform

## THEN...

Delayed / Dedicated Reporters + Cameramen /  
Regional or National Reach



## NOW...

(Twitter)

Real-Time / Citizen Reporting via  
Mobile Devices / Global Reach





# The way we capture memories

## THEN...

Dedicated Camera / Manually  
Transfer Digital Files / Develop Films



## NOW...

(Instagr.am / Camera+ / Hipstamatic...)  
Always With You Camera (Smartphone) /  
Instant Digital Effects / Share / Sync / Discover



# The way we produce

## THEN...

Mass Production of High-Volume  
Standardized Items



## NOW...

(Zazzle / Shapeways)  
Customized / Personalized Design / 3D Printing  
Process



# The way we educate

## THEN...

Classrooms / Lectures / Reading Materials



## NOW...

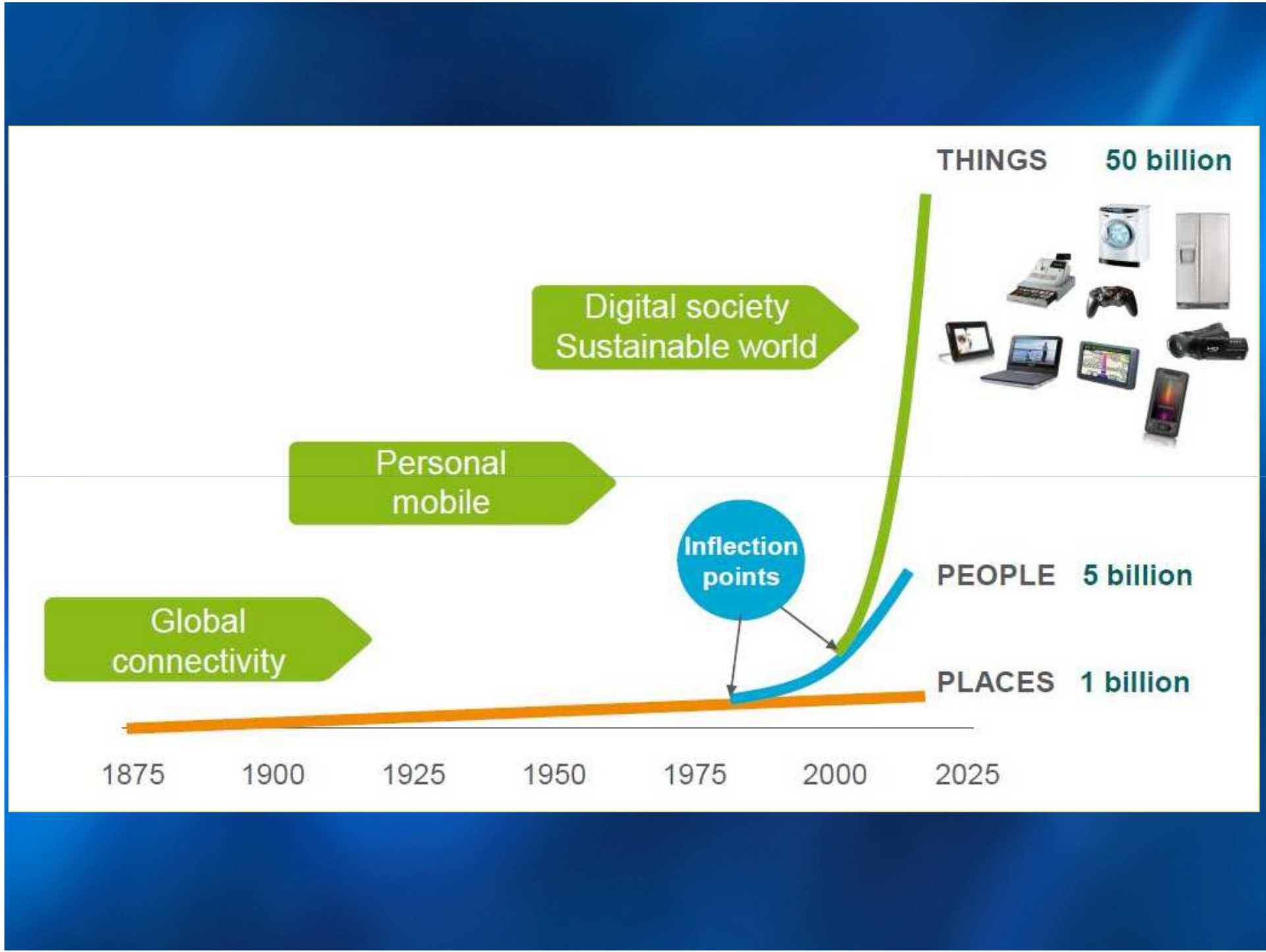
(Codecademy / Coursera / Khan Academy...)  
Interactive / Online / Accessible by  
Anyone Anywhere Anytime

A screenshot of the Codecademy website. The top navigation bar includes 'Courses', 'Creators', 'Jobs', 'Sign In', and 'Create Account'. The main content area features a coding exercise with a text prompt: "Hey! Let's get to know each other. What's your name? Type it with quotes around it like this 'name' and then press enter on your keyboard." Below the prompt is a code editor with a cursor. To the right, there's a 'Learn to code' section with a 'Get Started' button. Below this, there are three columns: 'Program Websites and More' with a code snippet, 'Learn with Friends' with social icons, and 'Track and Share Your Progress' with a progress bar showing 31% completion.



# Game Changing Technology

- Mobile Internet
- Automation of Knowledge Work
- Internet of Things
- Advanced Robotics
- Artificial Intelligence
- Autonomous Vehicles
- 3D Printing
- Next Generation Genomics
- Energy Storage
- Advanced Materials
- Renewable & Unconventional Energy



THINGS

50 billion

Digital society  
Sustainable world

Personal  
mobile

Inflection  
points

Global  
connectivity

PEOPLE

5 billion

PLACES

1 billion

1875 1900 1925 1950 1975 2000 2025

# Game Changing Digital Disruption

- World's largest taxi company owns no taxis (Uber)
- World's largest hotel room provider owns no hotels (Airbnb)
- World's largest movie house owns no cinemas (NetFlix)
- World's largest phone company owns no tel infrastructure (Skype, WeChat)
- World's largest software vendors write no software (Apple, Google)
- World's most valuable retailer has no inventory (Alibaba)
- World's fastest growing bank has no actual money (SocietyOne)



# Drivers for Exclusion

- Disparity in Income (**loss of jobs** , poverty...)
- Disability
- Distance
- Discrimination (gender,race,caste,...)
- Other socio-political-cultural-economic factors..

# Technology led Exclusion(Unemployment)

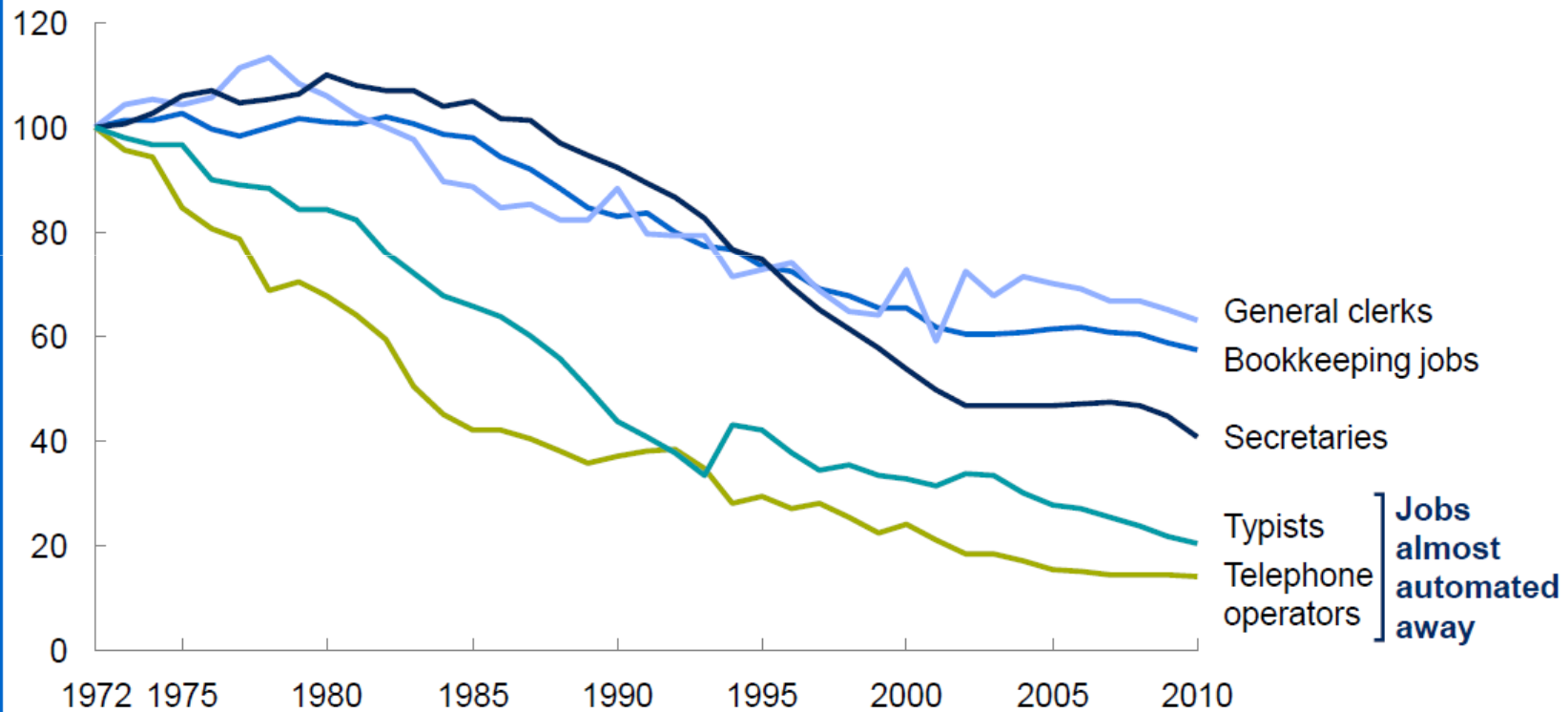
- Technologies that automate **physical tasks** done by human beings (typists to tellers to switch operators...)
- Technologies that do the **intellectual tasks** (automation of knowledge work, artificial intelligence...)
- Technologies enabling **customer service tasks** (self help kiosks, grocery store scanners...)

## The number of some types of transaction workers in the United States declined more than 50 percent between 1970 and 2010

### Decline in transactional jobs between 1970 and 2010<sup>1</sup>

% workforce share decline for select highly automatable jobs

Index: 100 = 1972



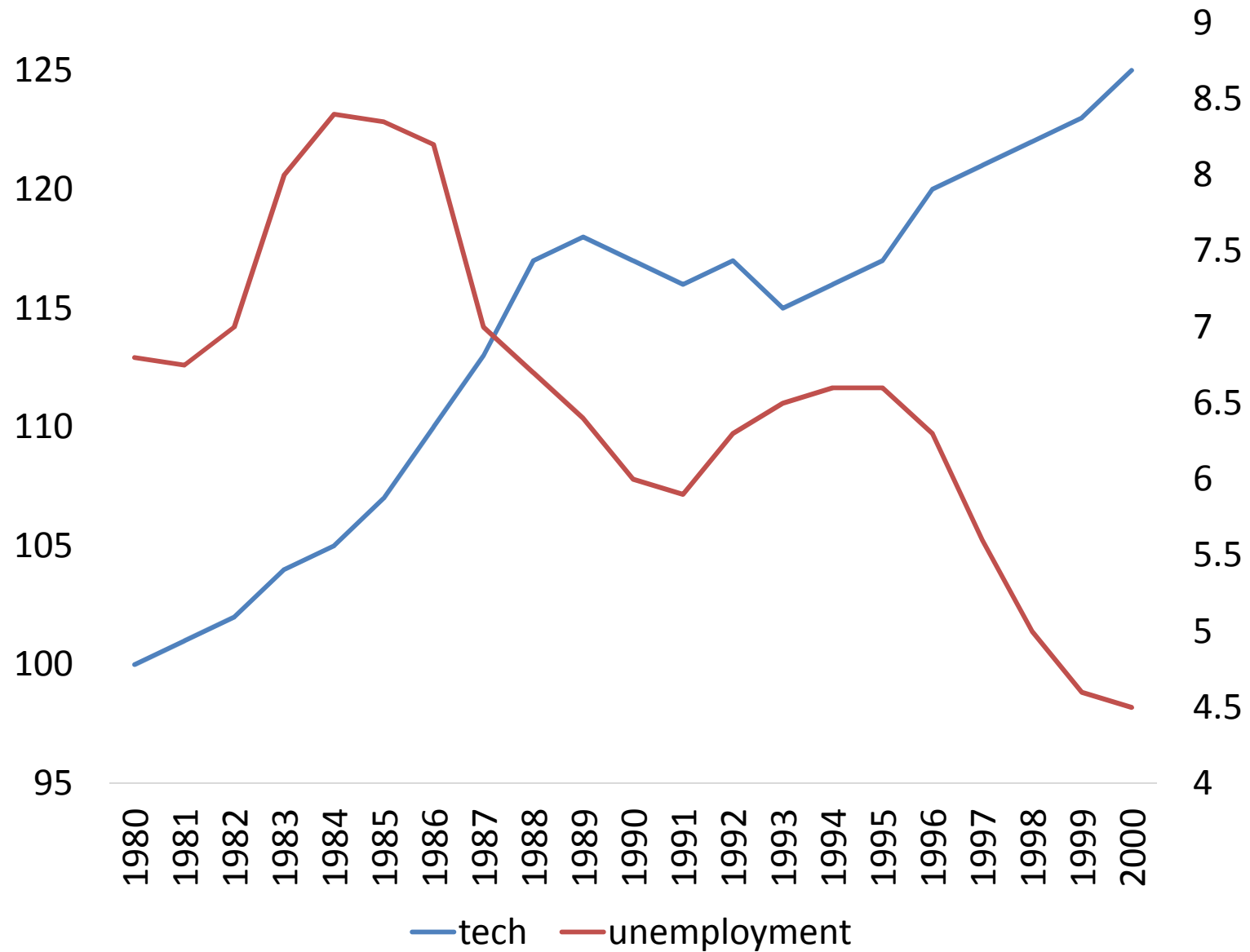
<sup>1</sup> Job types that can be scripted, routinized, automated (e.g., cashiers, receptionists, stock traders). Data are for the US private economy. Occupation data normalized in 1983 and 2003 to account for classification differences.



# Technology led Employment

- Technology led productivity gain led **economic growth**
- Access to products and services at **lower costs** leading to more **consumer saving** as well as **spending**
- **More employment** in consumer goods markets

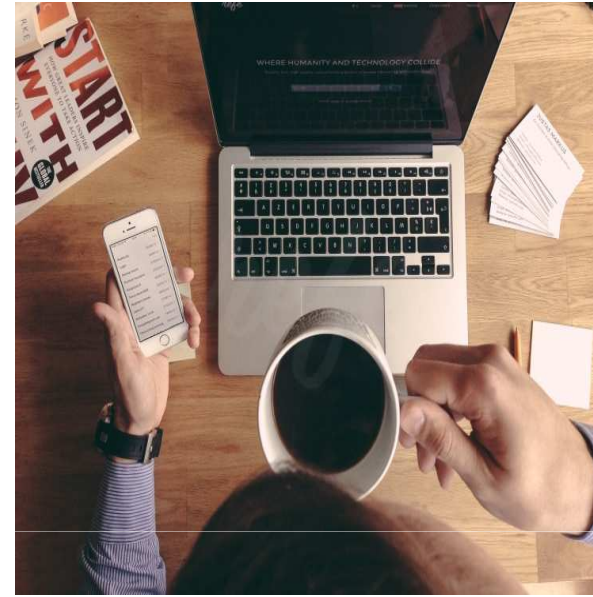
# Technology adoption and unemployment



# Technology led Job Creation in Shared Economy



Access  
over  
ownership



Freelancing:  
new  
employment  
model



On-  
demand  
Service



Maximum  
asset  
utilisation



# Technology Growth Leads to Tech Job Growth

- More people needed to **create** new technology
- More People needed to maintain new emerging technology (3D Printing, Advanced Robotics, IOT...)
- More people required to **assist** other people in using new technology
- New technology requires new labour forms, to **design, test, implement, refine** new technology such as smart automated information systems

# Emerging Trends on Replacing Human

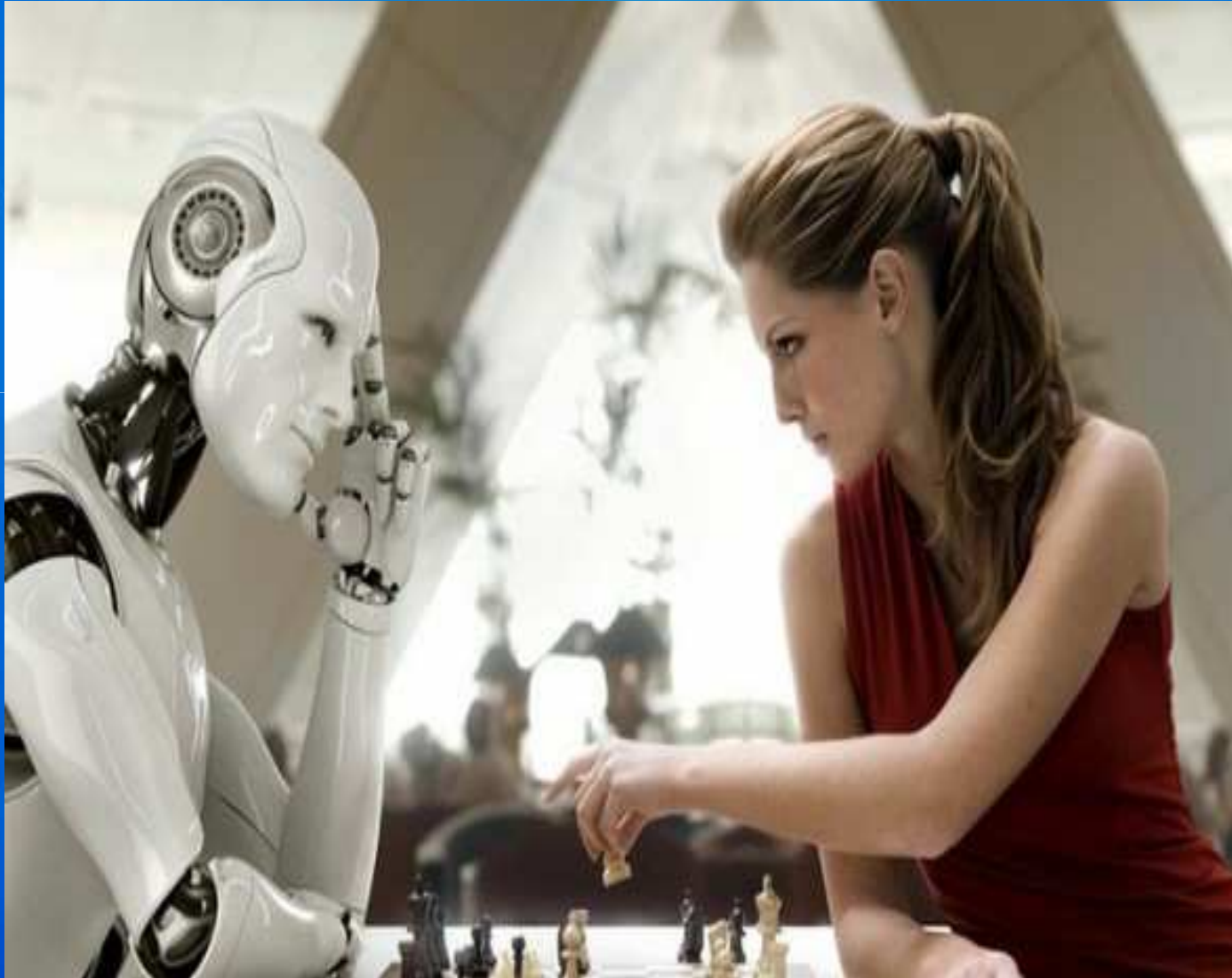
- Jobs that require emotional and relational work, creativity, synthesizing, problem solving, & intelligent interpretation will still continue to require human intervention, but that itself is reducing. Why?
- Exponential growth of computing power leading to superlative increase in artificial intelligence
- Google translate displacing translators, investment advice algorithms displacing investment advisors...

# Jobs that require head and heart- writing, music, acting, **movie making**?

- New technology of morphing. Allows movie producers to isolate, digitize and store every visual expression, movement and sound of an actor. Then reprogram them in virtually any recombination.
- In future replacement of sound stages, sets & even actors by 'synthespians', which are 'created from libraries of gestures and expressions housed in a computer bank of live actors' appear to be on cards!



# Technologies beating Human in Intellectual Tasks



# AlphaGo bot bullies human world Go champion, takes the series 3-0

AFP, Seoul | Updated: Mar 12, 2016 15:14 IST



AlphaGo takes a third consecutive win over Lee Se-Dol -- one of the ancient game's greatest modern players. Deemed as a major breakthrough for artificial intelligence. (YouTube)

## The Risk of Jobs being Replaced by Automation

● Ethiopia	85%
● China	77%
● Thailand	72%
● India	69%
● S.Africa	67%
● OECD	57%
● USA	47%

Source: Technology at work v2.0, Martin school, 2016



# Drivers for Exclusion

- Disparity in Income (loss of jobs , poverty...)
- Disability
- Distance
- Discrimination (gender,race,caste,...)
- Other socio-political-economic factors..

Can some of these Challenges be overcome by  
Technology led Inclusion?

## New Dictionary of Innovation Emerging!

- More from less for more (MLM)
- Gandhian innovation
- Affordable excellence
- Frugal innovation
- Reverse innovation
- Inclusive innovation





*Innovation's Holy Grail – MLM*

**C.K. Prahalad**

**R.A. Mashelkar**

**Harvard Business Review– July, August 2010**



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COMMITTED TO  
IMPROVING THE STATE  
OF THE WORLD

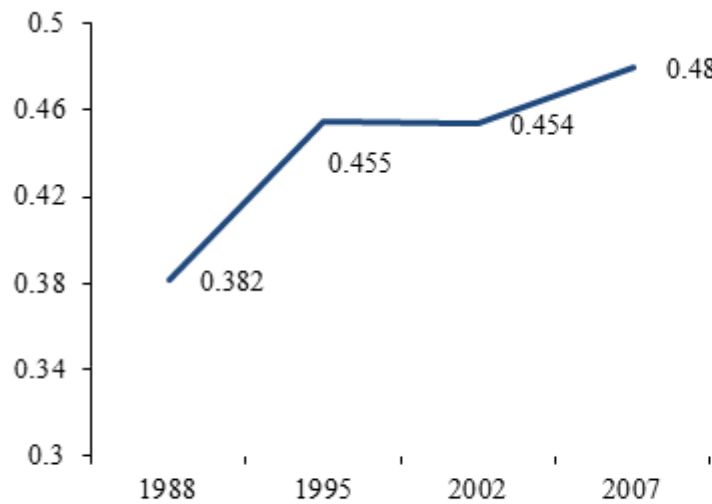
Special Session  
**More From Less For More**  
16 Nov 2010

World Bank- Inclusive Innovation Summit China

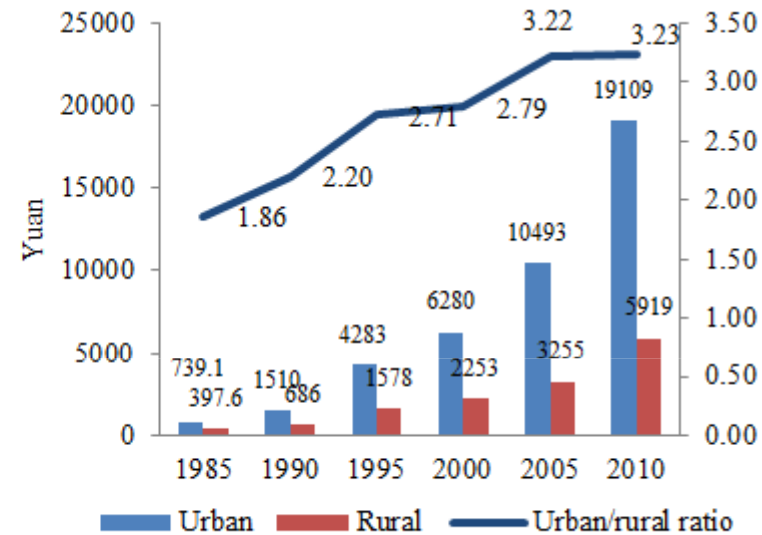




## Income Disparity in China



Gini index of income inequality in China

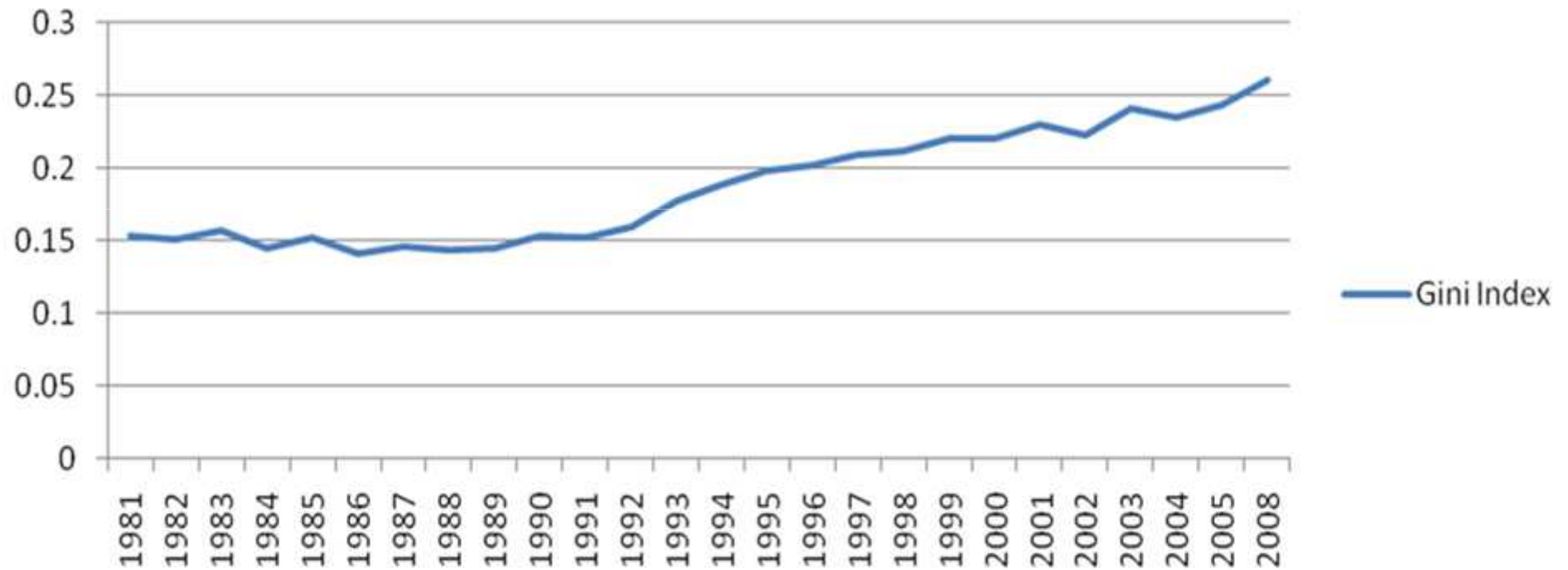


Rural-urban disparities in annual per capita disposable income

## Indian Challenge:

Both Incomes & Income Inequality Rising!

### Indian Gini Index



# Vietnam Inclusive Innovation Project (GRA as a Knowledge Partner)

- World Bank funded ( USD 55 million)
- Developing inclusive technologies
- Scaling up, and commercialization
- Capacity building





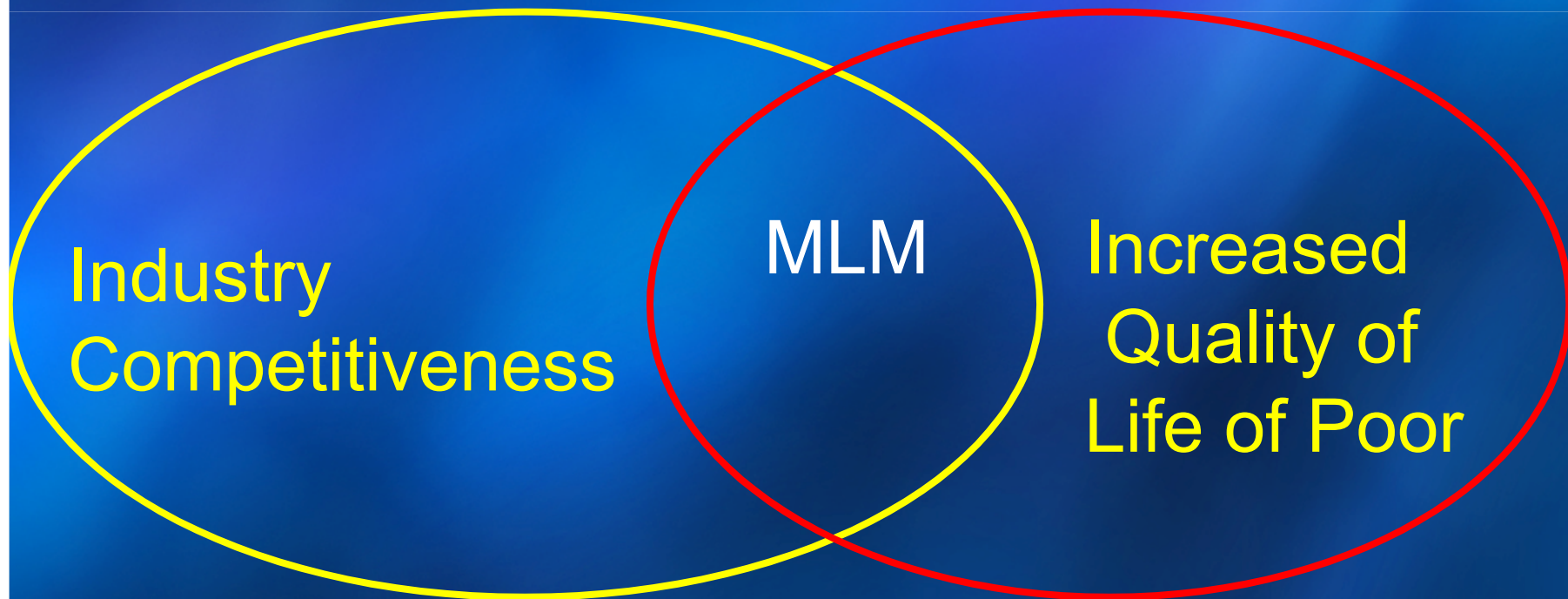
Vietnam

MLM Led Inclusive Innovation

A True Win Win



Deputy PM Nhan



# Asian Development Bank – MLM Address - Eminent Speaker's Forum



- Invited as Eminent Speaker by Asian Development Bank in its Eminent Speaker's Forum in Manila on 5th December 2014
- Presented 'Inclusive Innovation: More from Less for More'
- ADB now setting up MLM Innovation agenda.

# Spreading the Message of MLM Innovation in Europe



- **Cambridge** (21 June, 2010) – Judge Business School Inaugural BP Lecture
- **Belgrade** (18 December 2012) – Public Lecture
- **Brussels** (3 April 2013) – I4G Group (EC)
- **Clermont-Ferrand** (5 April 2013) – Michelin Corporate Innovation Board
- **Brussels** (11 March 2014) – EU Innovation Forum 2014
- **Paris** (19 March 2014) – OECD
- **Paris** (3 July 2014) – OECD



'Innovation under Adversity'  
in Innovation Forum 2014, Brussels



## The Big Question

Why should EU or OECD be interested in Inclusive  
Innovation?

‘If inclusive innovation delivers access equality despite income inequality, then EU needs it here and now, just look at the income inequality among the 28 member states of EU, and then the need to create access equality across EU!’

*Comment by participant during Q&A after RAM lecture*



## *EU's MLM Opportunity*

### *RAM Letter to Commissioner Maire Goeghegan-Quinn*

*(2 June 2014)*

*'This can be done by moving the emphasis from `quality and sustainability' to `quality, sustainability and affordability', considering the economic diversity of the 28 member states of EU'.*

*Tender Document by EC (26 June 2015) says `in addition to the requirements of `quality and sustainability' ask also for quality, sustainability and affordability', considering the economic diversity and situation in the 28 EU Member States and beyond'.*



**EINLADUNG**

**KOLLOQUIUM ZU EHREN  
VON ALFRED GOSSNER**

Donnerstag 29. Oktober | 14.30 Uhr  
Fraunhofer-Haus | München



## **MORE FROM LESS FOR MORE:**

**STEIGERUNG DER RESSOURCENEFFIZIENZ UND  
DER ENTWICKLUNGSORIENTIERTEN FORSCHUNG  
ALS VORAUSSETZUNGEN GLOBAL NACHHALTIGER  
ENTWICKLUNG**

**14.30 Uhr**

### **Begrüßung und Moderation**

Prof. Dr. Alexander Kurz,  
Vorstand Personal der Fraunhofer-Gesellschaft

### **Impulsvortrag zum Thema des Kolloquiums**

Prof. (Univ. Stellenbosch) Dr. Alfred Gossner,  
Vorstand Finanzen, Controlling, IT der Fraunhofer-Gesellschaft

### **Laudatio**

von Ilse Aigner, Staatsministerin für  
Wirtschaft und Medien, Energie und Technologie  
und Prof. Dr. Reimund Neugebauer,  
Präsident der Fraunhofer-Gesellschaft

### **More from less for more: the challenge of inclusive innovation**

Prof. Dr. Ramesh Mashekar, National Research Professor in India,  
President Global Research Alliance

Fachvorträge mit Beispielen aus der Fraunhofer-Forschung

**ab 17.30 Uhr**

### **Aperitif, anschließend festliches Abendessen**

### **Veranstaltungsort**

Fraunhofer-Haus | Hansastraße 27c | 80686 München

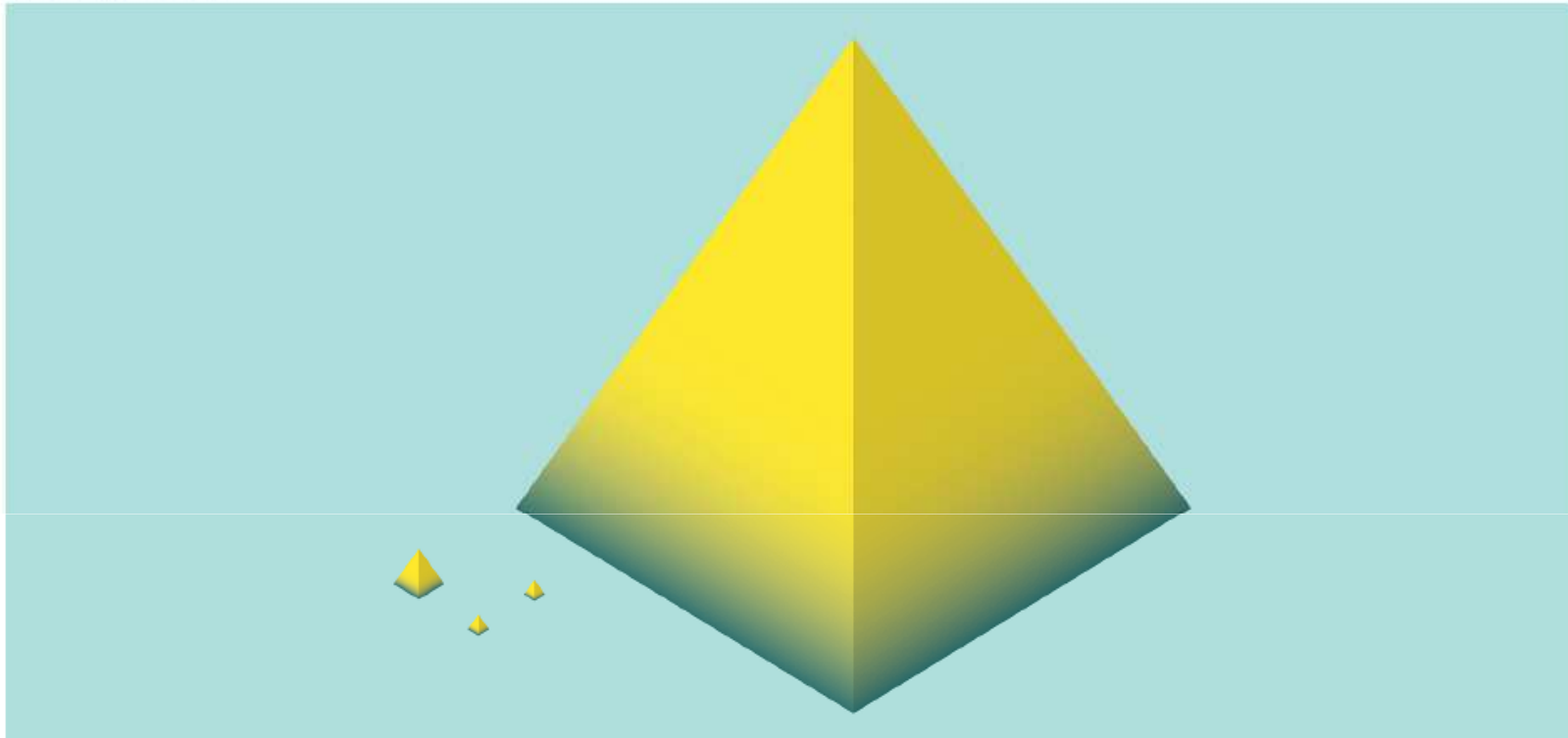
### **Ansprechperson für Rückfragen**

Fraunhofer-Gesellschaft, Kommunikation | Dorothee Veronesi  
Telefon +49 89 1205 1368 | dorothee.veronesi@zv.fraunhofer.de



## ***MLM Innovation - OECD Drivers***

- 1. Increasing income disparity***
- 2. Constrained investment capital resulting from the crisis*
- 3. Potential for companies to benefit from increasing the size of the pie (emerging 1b market)*
- 4. New opportunities in bottom up innovation – co-creation*
- 5. New sources of job creation*
- 6. Drive towards circular & sharing economy*
- 7. Source of new value creation through new business models and value chains it spans*



ECONOMICS & SOCIETY

# Reaching the Rich World's Poorest Consumers

by Muhammad Yunus, Frédéric Dalsace, David Menascé, and Bénédicte Faivre-Tavignot

FROM THE MARCH 2015 ISSUE

MLM is not about ...

Stripping products and services to make them cheap, somehow

Inclusive Innovation is about .....

Giving high quality at affordable prices!





# Technology led Inclusion

## The Big Question!

Can we achieve Access Equality despite Income  
Inequality?

# Income Inequality 1000 : 1 ?



Access Equality 1:1!

# Total Innovation

Policy, Technology, Business Model

Handset

~~\$250~~

\$25

Technological  
Innovation  
(Nokia, Ericsson...)

Call Rates

~~10 cents~~

0.01 cent

Business Model  
Innovation  
HBR Paper  
(Reliance, Airtel...)





One Laptop per Child initiative by the MIT has found Red Hat Inc as its India partner

## MIT designs \$100 laptop for the world's poorest children

PRAGYA SINGH

NEW DELHI, FEBRUARY 8

WHILE streams of IT vendors are talking about low-cost PC solutions for the Indian market, the cheapest ever laptop being designed by Massachusetts Institute of Technology (MIT) for the world's poorest children, is already getting express backup from India.

American software maker Red Hat Inc signed up this week as "founding corporate member" of One Laptop per Child (OLPC), the MIT initiative that is driving

bombay-based Red Hat India is now one of the global foundries where software to run the most affordable laptop is being written.

A sizeable nugget of the software at the core of the laptop, now named "Fedora Core," will be designed in India said Javed Tapia,

Red Hat India's involvement is just what technology guru Nicholas Negroponte would have had in mind when he said at last year's World Economic Forum that the open source software format for his \$100 laptop will give him a "100 million programmers I can rely on."

In addition, most recent United Nations' data shows that India's population will be much "younger" than China's by 2025, making the ruggedised MIT laptop just the solution for PC penetration woes. With the world's largest under-25 population, the government may just have to give the MIT initiative a push.

President, Red Hat - Indian Sub-continent. "Red Hat India programmers are already working on desktop design for our current software. Indian engineering work will probably be found on the \$100 laptop too," says Tapia.

### Business ANCHOR



Will MIT's efforts make the desktop computer obsolete?

Chinese authorities have already latched on to OLPC and hope to contribute a sizeable chunk to the laptop's sales but till date, India does not support specific private PC ventures and has not taken sides in the Linux-versus-proprietary software debate.

Sources confirmed that there is

no change in the Indian government's position, though India was part of initial discussions on the laptop with Negroponte, along with China, Brazil, Argentina, Egypt, Nigeria, and Thailand.

The catch is that MIT will sell the laptops only directly to developing country governments, which are then meant to issue them to children in schools on a basis of "one laptop per child."

"Government support is crucial for the project to work," says Tapia. "India has tried its hand at community-based PC penetration; it must now give younger people a taste of technology at the individual level." As per MIT's preliminary schedule, the \$100 laptop will be ready

for shipment by the end of 2006 or early 2007. However, manufacturing can begin only when "5 to 10 million machines have been ordered and paid for in advance," according to Negroponte's online FAQ on the subject.

The laptop will do everything a computer does today, except store large amounts of data. It will share Internet connections automatically, thus reducing the amount of spending on broadband in all rural areas of developing economies. With Taiwanese PC manufacturer Quanta Computer Inc already signed up to manufacture the laptop, it is a matter of time before its rocks the global boat of PC vendors.



NEW MILLENNIUM  
INDIAN TECHNOLOGY  
LEADERSHIP INITIATIVE  
(NMITLI)

**A Grand Vision**

"To make the 21st Century India's Century - 'Ikkeevin Shatabdi, Bharat ki Shatabdi'"  
Atal Behari Vajpayee, Prime Minister of India, 3rd January, 2000

**A Great Ambition**

"Let us take up the challenge to create Indian Science that will lead and not follow"  
Dr. J. R. D. Tata, Minister (PRD & S&T), 21st February, 2000

**Action**

...em India envisioned by ... 50 crores in the ...

**10000 pamphlets  
sent across the  
country**

**1 July 2000**

- Nano-technology applications from drug delivery to solar phot
- LCD with two orders of magnitude faster switching times than
- Multifunctional PC within Rs. 10,000 using emerging technolo
- Bio-based carbohydrates as feed stock for chemical industry.
- Clinically validated herbal based therapeutics for TB and AIDS
- Indeed any of your dream ideas that can make all the differer

**Multifunctional PC within Rs. 10,000**

Secretary SUGGA-  
Secretary, DSIR and Director  
Anurandhan Bhawan, Rafi Marg,  
New Delhi-110 001.

**INDIA TECHNOLOGY INITIATIVE**

# Mobilis- \$ 200 Laptop



10 May 2005

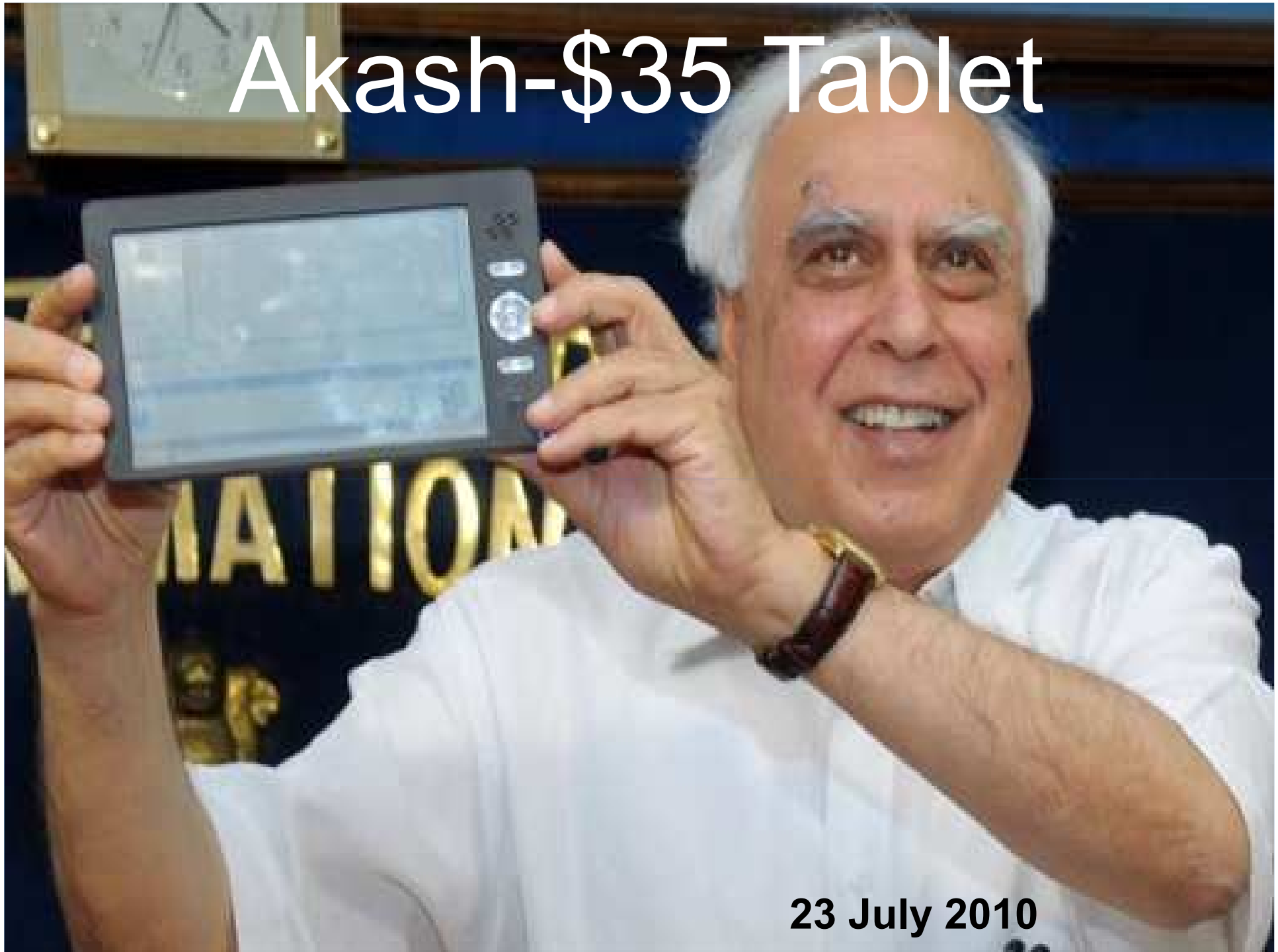


# DSK Mobilis

Inclusive Application Device



# Akash-\$35 Tablet



**23 July 2010**











## JAM – Jan Dhan, Aadhar & Mobile

Jan Dhan  
accounts:  
**213 million**

Aadhar card-  
holders:  
**1 billion**

Mobile Phone  
Subscribers:  
**1 billion**

“ *Large-scale, technology-enabled,  
real-time delivery of welfare services* ”



# Pradhan Mantri Jan-Dhan Yojana (PMJDY)



- Biggest technology led financial inclusion initiative in the world
- Provide access to various financial services for the excluded
  - basic savings bank account
  - need based credit
  - remittances facility
  - insurance and pension
- Most bank accounts opened in one wee: **18 million +**
- 210 million+ accounts created so far



## Technology led Identity based Inclusion



- Unique identification for each Indian resident
- Basis for efficient delivery of welfare services.
- 210 million Aadhaar cards created in 2015 – organizational innovation!
- Around a billion individuals hold an Aadhaar card – nearly 95 per cent of the adult population



# JAM: A Game Changer

- JAM distributes benefits across a range of government programs—from education and labor schemes to subsidies and pensions
- LPG scheme witnessed the world's largest direct benefit transfer program, with about 151 million beneficiaries receiving a total of about \$ 4.36 billion in their bank accounts.

JAM - a great catalyst for plugging leakages from Public Distribution System (PDS) & ensuring efficiency in the movement from farm to market



# Drivers for Exclusion

- Disparity in Income (loss of jobs,poverty...)
- Disability
- Distance
- Discrimination (gender,race,caste,...)
- Other socio-political-cultural-economic factors..

## Three Essentials of Technology led Inclusion...

- Availability
- Accessibility
- Affordability

But 'total inclusion' will require 'extreme' affordability!

## Extreme Affordability Dreams!

- High Quality Hepatitis B vaccine – 40X cheaper...
- High Quality Cataract Eye Surgery – 100X cheaper...
- High Quality Open Heart Surgery - 20X cheaper...
- High Quality Artificial Foot – 300X cheaper...

**No dreams, - India has done it!**





c. 1800



c. 1920



Today



**\$12000 foot**

# TIME

Heroes of Medicine

The \$28 Foot

THE GLOBAL SCOURGE OF LAND MINES  
LEFT THOUSANDS LIMBLESS, AND THEN  
TWO GIFTED INDIANS DEVELOPED

## The \$28 Foot

BY TIM MCGIRK

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**Jaipur Foot Patient**



MLM is not about ...

Stripping products and services to make them cheap, somehow

It is about .....

Giving high quality at affordable prices!



# MOM- \$74 m MLM Mission!





Watch

Read

Attend

Participate

About

Search...

R.A. Mashelkar:

# Breakthrough designs for ultra-low-cost products



TEDIndia 2009 · 19:40 · Filmed Nov 2009

Subtitles available in 23 languages

 [View interactive transcript](#)



5,93,426 Views at 6 AM  
Today!

# Affordable Excellence No Dream – A Reality!

## Case - Hemoglobin Detection

### Affordable

25 fold Reduction in Price!

High cost (~ \$ 25 per test) to ultra  
low cost (\$ 0.5 per test )

### Excellence

From 'invasive' with needles to 'non-  
invasive' with no needles

Breakthrough High-tech Innovation needed

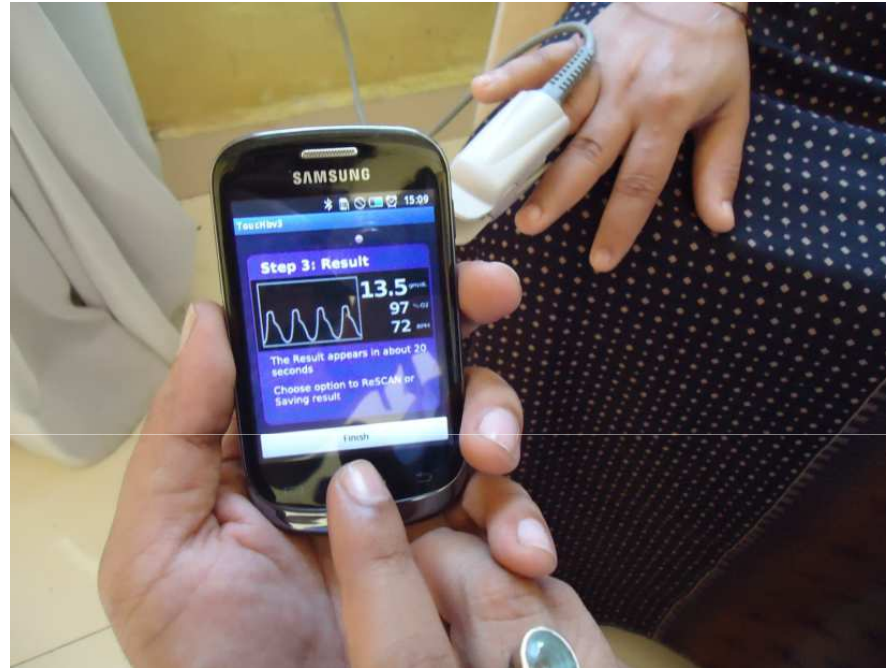


# Anjani Mashelkar Inclusive Innovation Award- 2012



# MLM through Cutting Edge Technology

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**High Technology :**

Photoplethysmography +  
Spectrophotometry +  
Sophisticated photon scattering software

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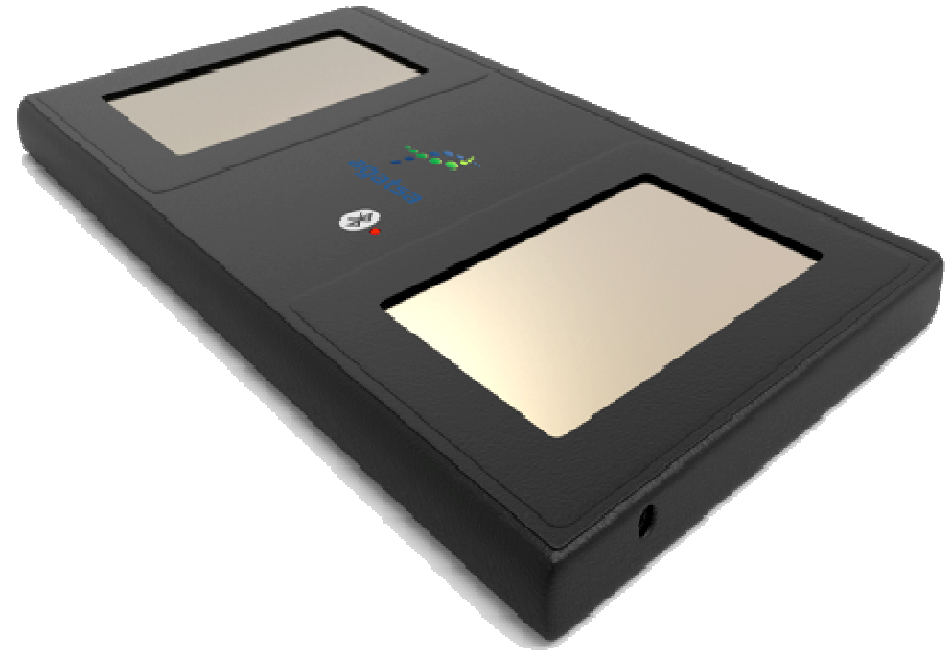




An IOT Based Revolution in personal **Cardiac** care

Personal 6 Lead ECG event monitor

Anjani Mashelkar  
Inclusive Innovation  
Award Winner (2015)



Listen to your heart...

[#thumbsupforsanket](#)



[www.agatsa.com](http://www.agatsa.com)





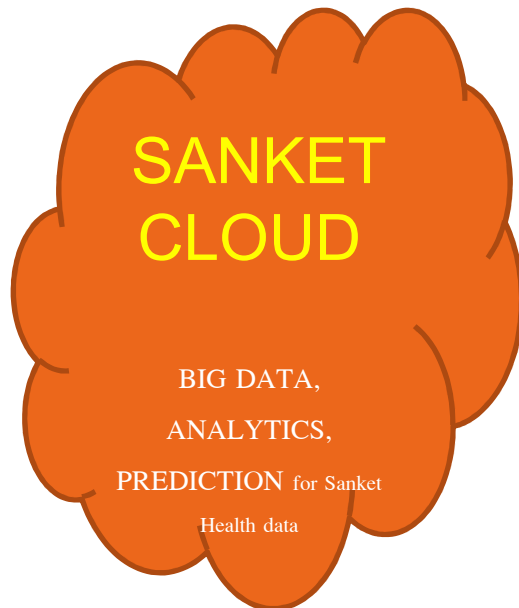
# How simple is it ?



Download the free Mobile App



Touch Sanket with thumbs



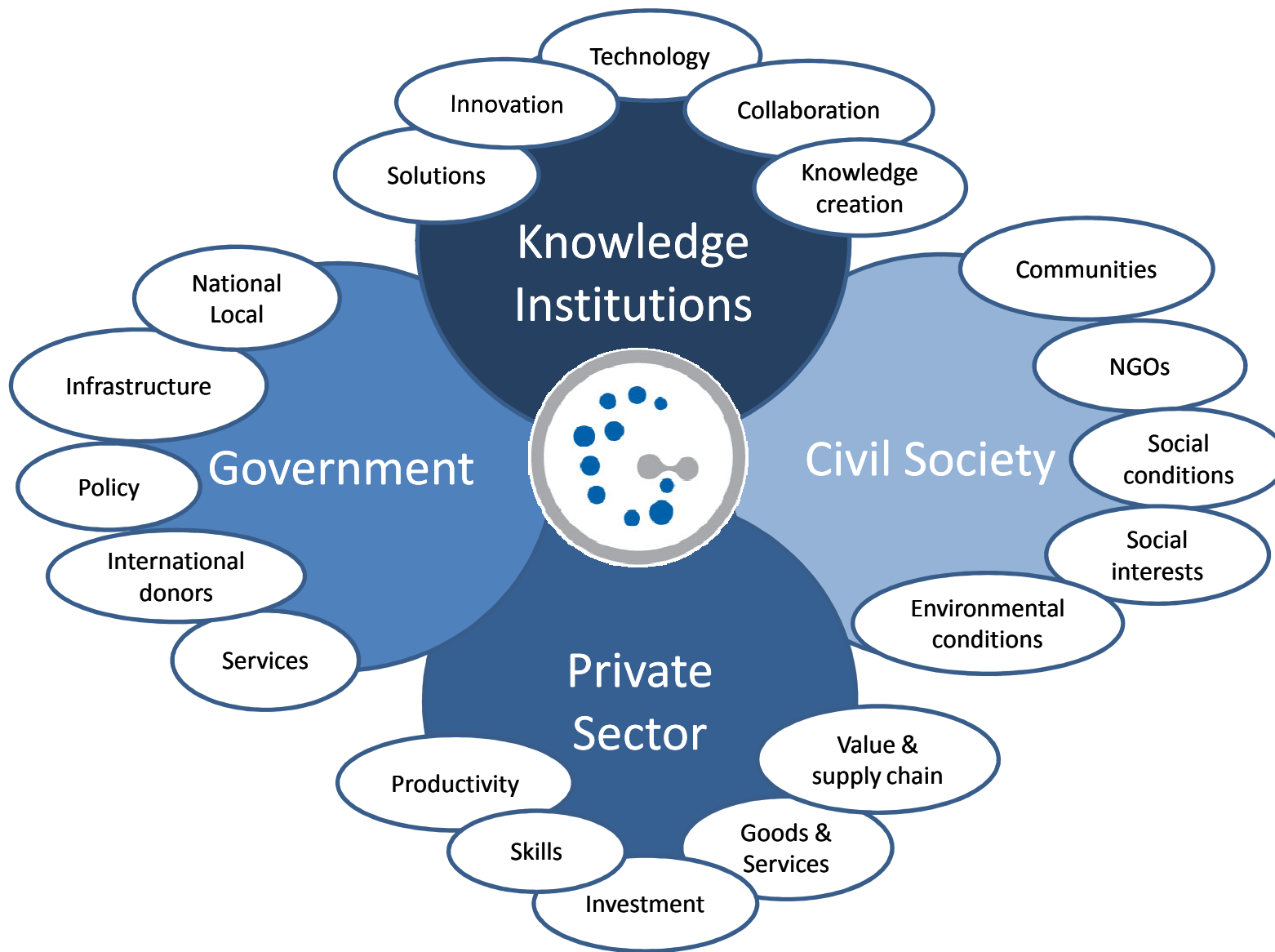
IOT enabled Report/Trend Sharing by Email, Whatsapp and even simple SMS



Get ECG in Mobile app in 15 seconds



# True Inclusion Needs Robust Inclusive Innovation Ecosystem





Dynamics  
of  
Technology led Exclusion  
and  
Inclusion

# Drivers of Change

## extreme longevity

Increasing global lifespans change the nature of careers and learning

## rise of smart machines and systems

Workplace robotics nudge human workers out of rote, repetitive tasks

## computational world

Massive increase in sensors and processing power make the world a programmable system

## superstructured organizations

Social technologies drive new forms of production and value creation

## new media ecology

New communication tools require new media literacies beyond text

## globally-connected world

Increased global interconnectivity puts diversity and adaptability at the center of organizational operations



# Jobs 2020: Top 10 Critical Skills

- Complex problem solving
- Critical thinking
- Creativity
- People management
- Coordinating with others
- Emotional intelligence
- Judgment and decision making
- Service orientation
- Cognitive flexibility

# A Final Thought

The proportion of the population that needs to engage in traditional full time employment, in order to keep the humanity fed, supplied, healthy and safe, will decrease.

This will hopefully lead to a **humane restructuring** of the general social contract around the number and type of jobs and employment in the world, and again, **hopefully a better world.**



Thank You