

Gandhian Engineering: More From Less For More

R A Mashelkar

Innovation

Doing Things Differently

Making a Big Difference

Making Impossible Possible

Engineering Challenge:

Getting More
from Less

Can all these functions be combined in to one?



Telephone



Computer, email, internet



Calculator



Camera



Video Camera



Music System

Only Engineers can do it!

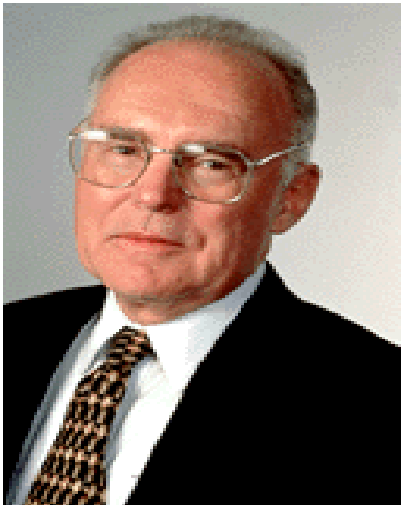
MORE FROM LESS



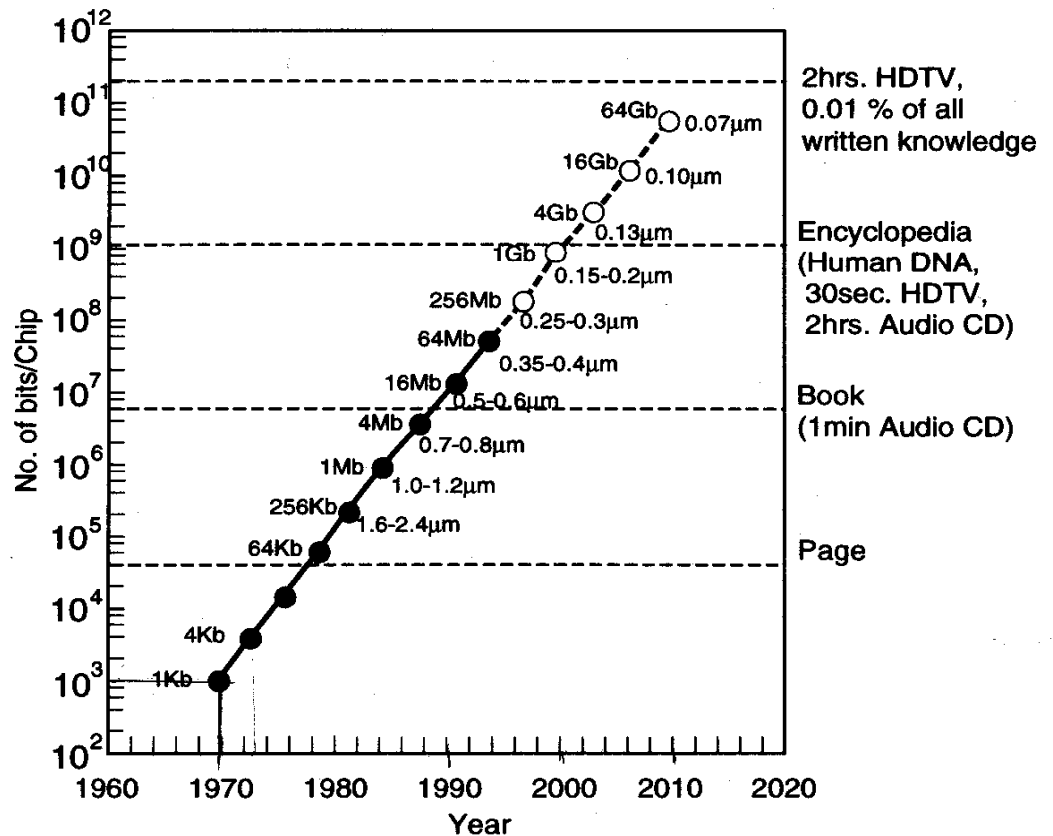
Moore's Law- More from Less

Gordon E. Moore

The Intel co-founder and chairman emeritus

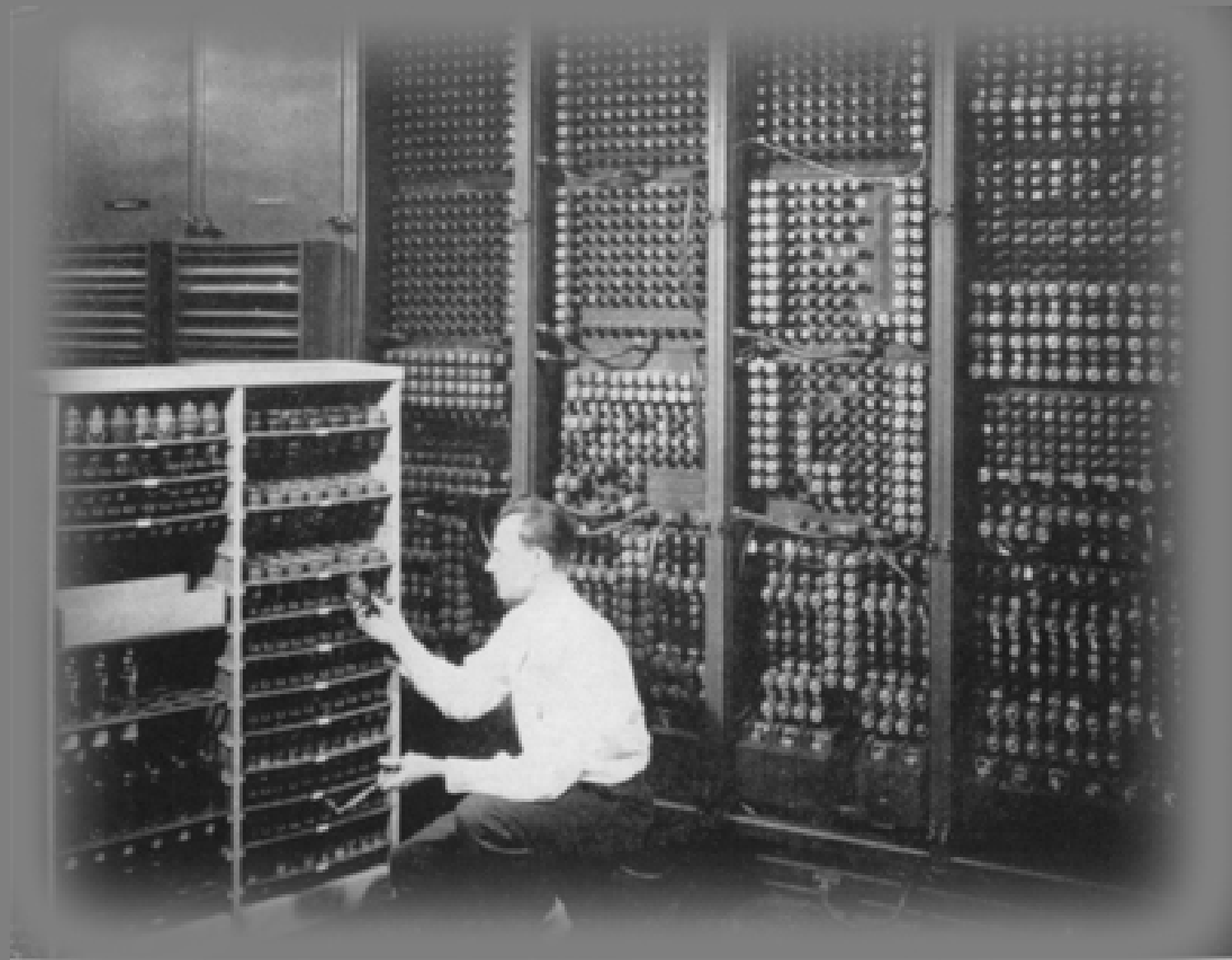


•Moore's Law: *Almost since the inception of the IC, the number of transistors incorporated into a memory chip has increased by a factor of 4 every 3 years with unerring regularity.*



The growth in complexity of Si IC technology as measured by the number of transistors in a dynamic random-access memory(DRAM)







But this laptop is for \$2000

Can we make it for \$ 100?



Gandhian Engineering:

Getting More
from Less
for More



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

bui-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 Subcontinent, "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.

Mobile desktop PCs



10 May 2005

Performance

Haves



Have - Nots



Price

Performance

Haves



Have - Nots



Price

Performance

Have - Nots



Haves



Price

Innovator

“Innovator is one who does not know that it cannot be done”

“Innovator is one, who sees what everyone sees, but thinks of what no one else thinks”



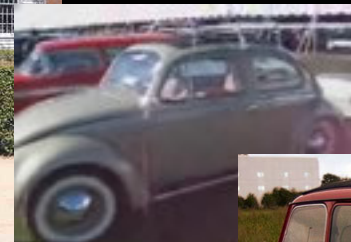


TATA NANO



| Car | Year introduced in U.S. | Horse power | Price |
|-------------|-------------------------|-------------|--------|
| Model T | 1908 | 20 | 19,700 |
| Beetle | 1956 | 24 | 11,333 |
| Mini | 1961 | 34 | 11,777 |
| Tata Motors | 2008 | 33 | 2,500 |

‘ Adjusted to 2007 U.S. dollars
Source : Tata Motors



Transformational Innovation

“Very soon, your chauffeur will drive to your house in a Nano. You will need to make space in your driveway for your chauffeur's car, but more importantly, you will need to make space in your minds for this transformation.”

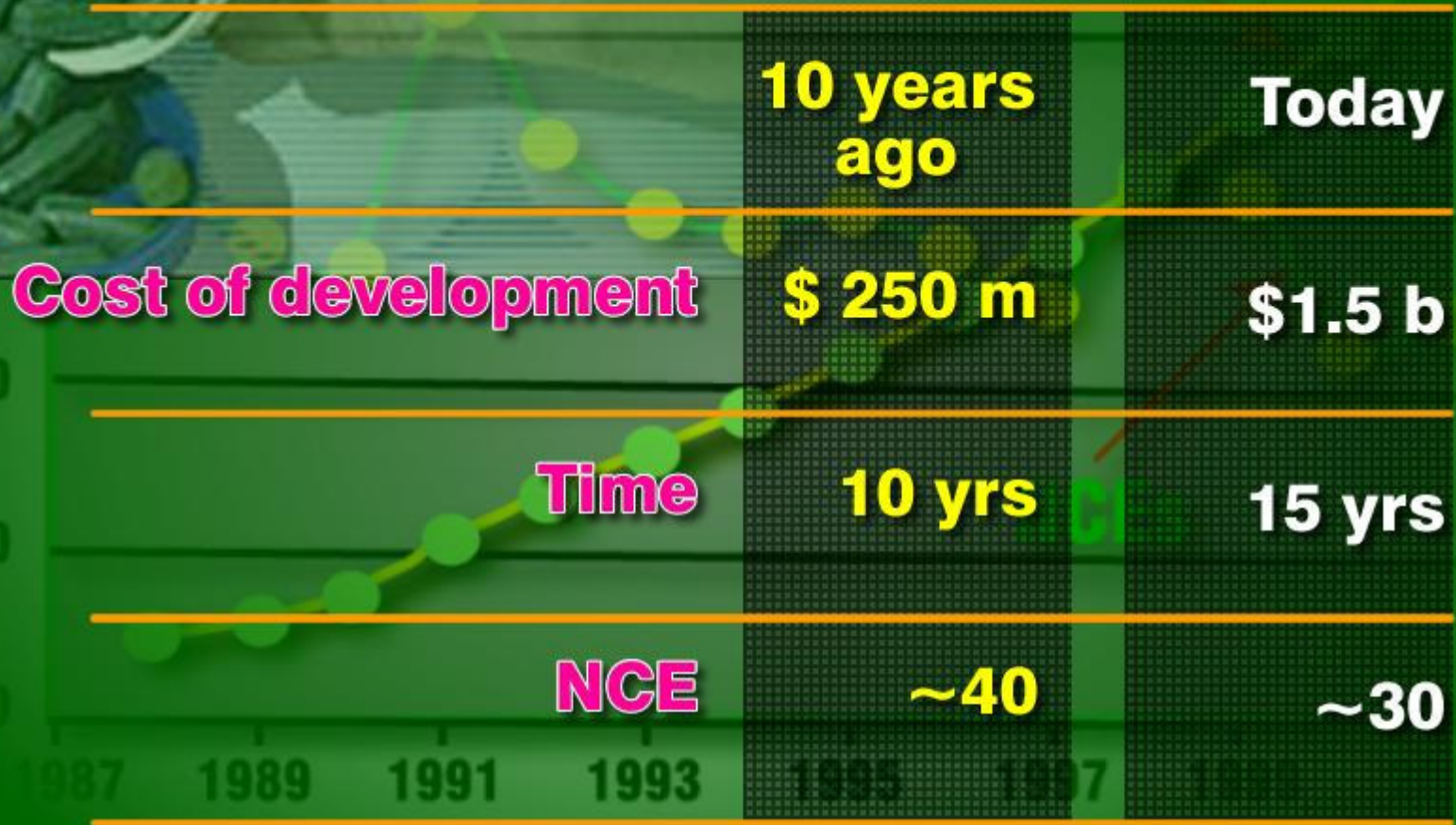
- R A Mashelkar



Medicines for the poor

Available
Affordable
Accessible

Current Drug Development:
Getting Less ~~X~~ from More ~~X~~ for Less ~~X~~



Pharma : Lowering R&D Productivity

PSORIASIS



Before treatment



After treatment

Psoriasis Treatment

Leading US Bio pharmaceutical firm

Antibody injection under the skin

Cost of treatment: \$20000!

Time for Development: 10 years!

Cost of Development: Few hundred million dollars!

Gandhian Engineering:

Getting More
from Less
for More

Psoriasis Treatment

Cost of treatment: ~~\$20,000!~~

\$50?

Time for Development: ~~10 years!~~

5 years?

Cost of Development: ~~Few hundred million dollars!~~

< \$10 mn?

“When you wish to achieve results that have not been achieved before, it is an unwise fancy to think that they can be achieved by using methods that have not been used before.”

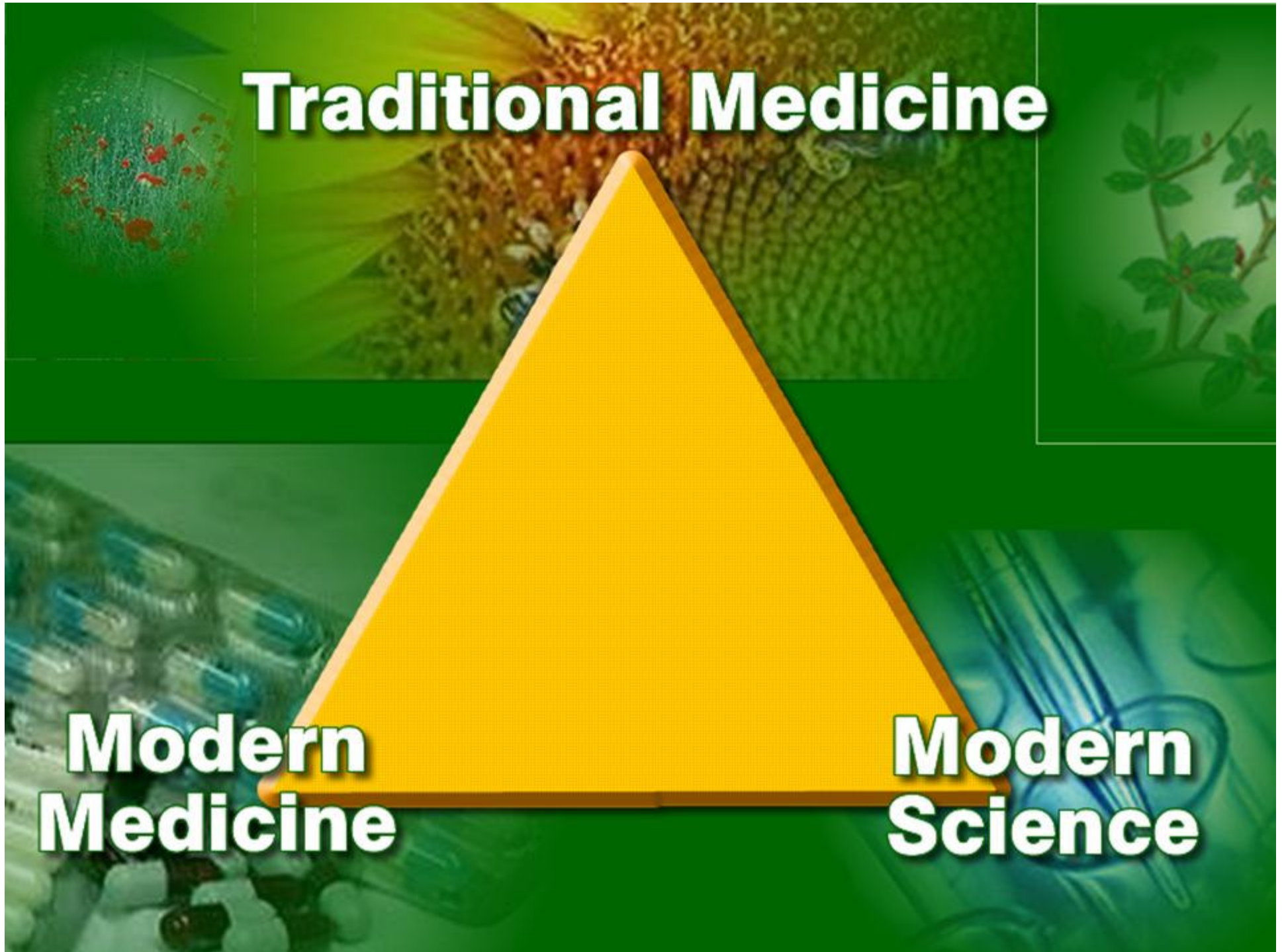
- *Sir Francis Bacon*



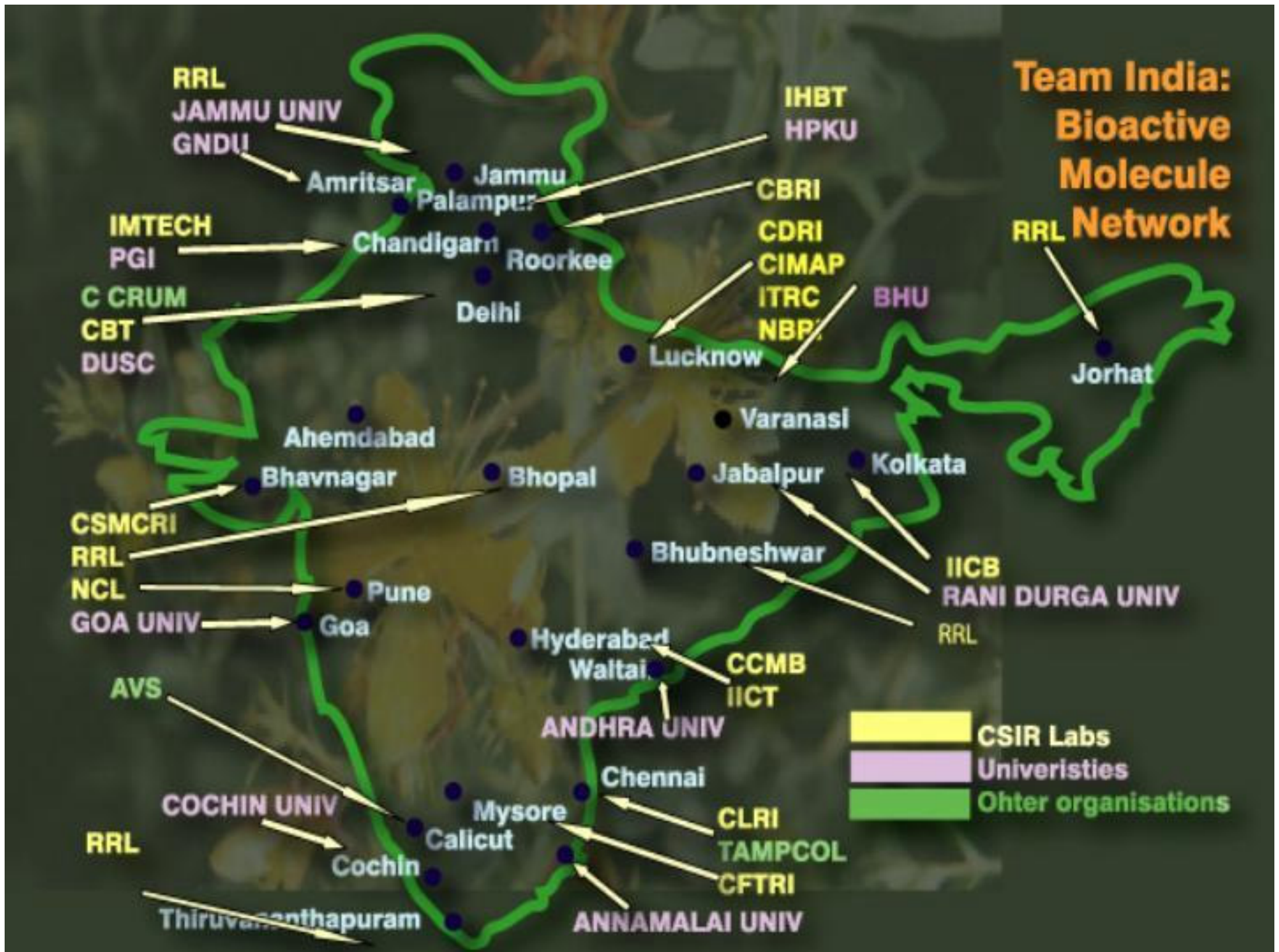
Traditional Medicine

**Modern
Medicine**

**Modern
Science**

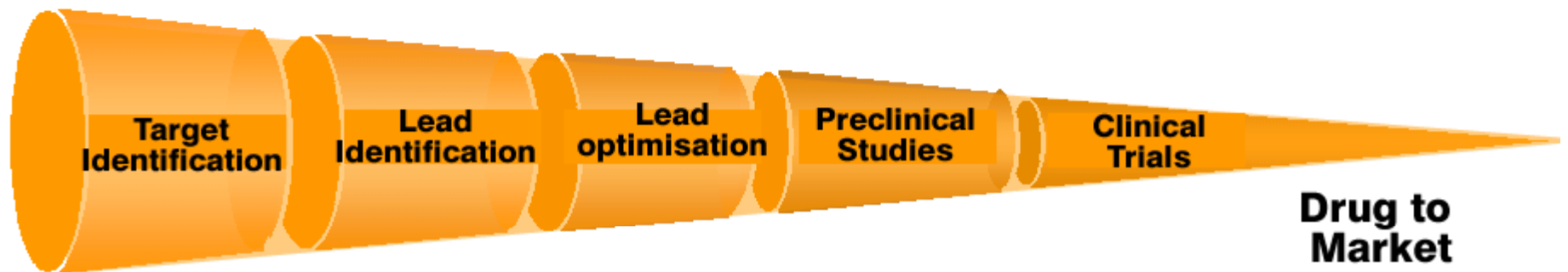


Team India: Bioactive Molecule Network



Standard Drug Discovery Process

(molecule -> mice -> men)



Reverse Pharmacology Process



(men <-mice <- men)

Reverse Pharmacology Approach (CSIR Innovations)

| Drug | Clinical Indication | Industrial Partners |
|---------------------|-------------------------------------|-------------------------------|
| AP9CD | Breast Cancer | Indigene |
| RRLJ-CD-SFE | Psoriasis | Genova Biotech |
| NMITLI-OA-JP | Osteo-arthritis | Cadilla Pharma |
| NMITLI-DM-FN | Type II Diabetes | Sree Dhootpapeswar |
| RRLJ0125-F09 | Hepatocellular Carcinoma | Indigene |
| RJM0035 | Hypertension | |

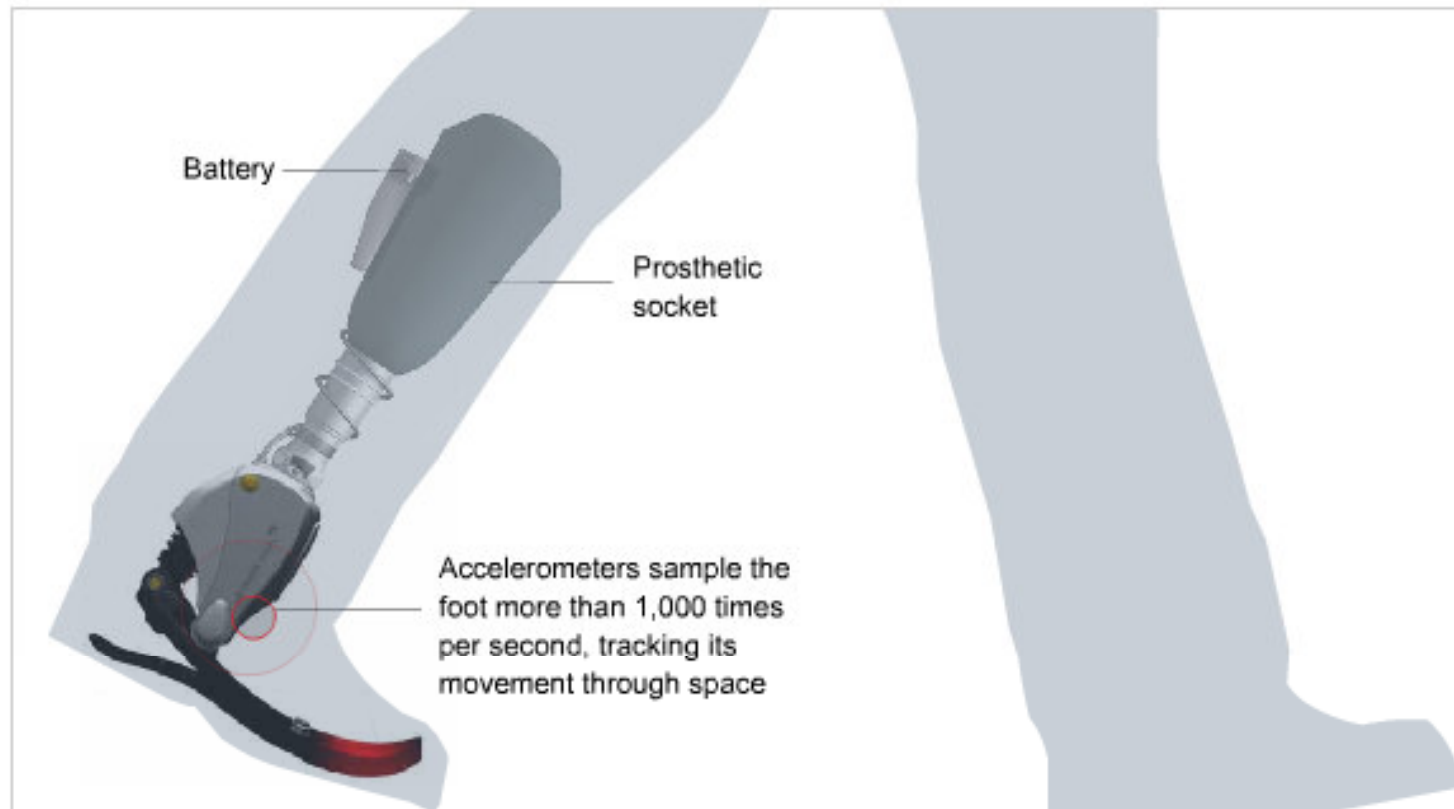
Technologies for the poor

Available

Affordable

Accessible

Appropriate



Cost \$ 12000 to \$18000

4 billion people

Income- Less than \$2 a day

Will take 15 years income to buy
this foot alone!!

TIME

Contents

Heroes of Medicine
A Child's Pain
The Plant Hunter
In Search of Sight
A Dark Inheritance
Too Big a Heart
Seeing the Future

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

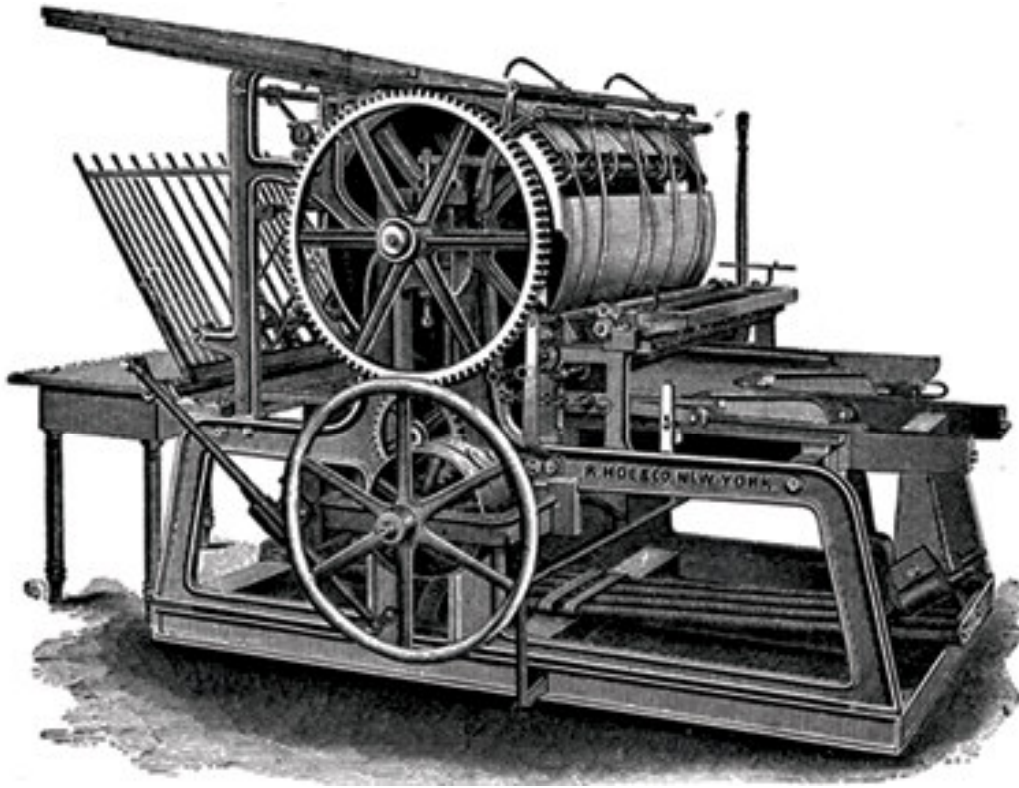


Jaipur Foot Patient

From Printing Press to Google

- More from Less for More
- Movement for Centuries

Democratization of information and knowledge



More- Information
Less- Cost and time
More- Access

The Google Search



[Web](#) [Images](#) [Groups](#) [News](#) [Froogle](#) [Local](#) [Scholar](#) [more »](#)

 [Preferences](#)
[Directory Help](#)

The web organized by topic into categories.

[Arts](#)

[Movies](#), [Music](#), [Television](#),...

[Home](#)

[Consumers](#), [Homeowners](#), [Family](#),...

[Business](#)

[Industries](#), [Finance](#), [Jobs](#),...

[Kids and Teens](#)

[Computers](#), [Entertainment](#), [School](#),...

More – Information and knowledge
Less- Money (actually zero)
For More- Internet penetration,
Google Mobile
By More- Solicit website linkages

The Great Indian Challenge

What can you search
when you can't read?

- Getting More from Less
Illiteracy in India

- 200 Million illiterates
- Illiteracy reducing at 1.3 % per annum
- Around 20 years to clear the backlog

Can we do it in 5 years?

Can we do it in \$2 per person?

Computer Based Functional Literacy

By Kohli led TCS team

(CBFL)

Based on the theories of cognition, language and communication

Emphasizes on learning words rather than alphabets

Method focuses on reading

Getting More From Less **For More**



An illiterate woman can start reading in 6-8 weeks

Cost- Rs 100 per person= \$2.5

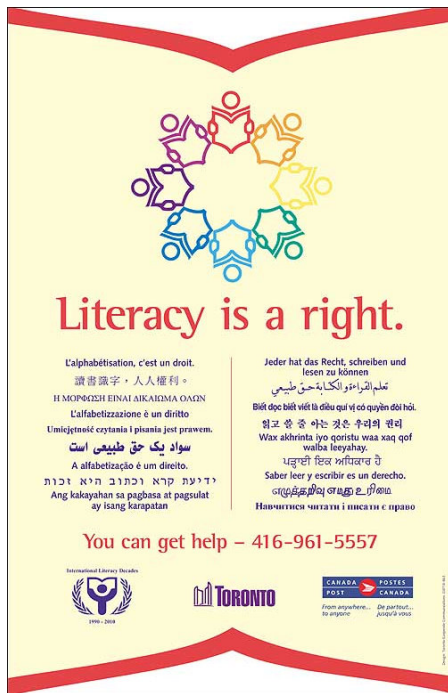
... I did not know how to help my children in their studies

... I had to seek help in getting directions to get about

... now I check their reports, and refuse to sign on them if they are not doing well ...

Getting More From Less **For More**

Possible to make the entire world literate with \$2 billion investment!!!



A poster titled "Literacy is a right." featuring a central graphic of a stylized human figure composed of colorful dots. Below the graphic, the text "Literacy is a right." is written in red. Underneath, there are several lines of text in various languages, including English, French, German, Hebrew, and others, all stating that literacy is a right. At the bottom, there is a contact number "You can get help - 416-961-5557" and logos for the International Literacy Institute, Toronto, and Canada Post.

Literacy is a right.

L'alphabétisation, c'est un droit.
識字權 · 人人權利。
H.M.O.P.G.E.Z.H. E.I.N.A.I. A.I.K.A.I.D.M.A. O.A.G.I.N.
L'alfabetizzazione è un diritto
Umigjetësi është e drejtë e përsosur.
سواد یک حق طبیعی است
A alfabetização é um direito.
ידיעת קרא וכתוב היא זכות
Ang kakayahang sa pagbasa at pagsulat ay isang karapatan

Jeder hat das Recht, schreiben und lesen zu können
تعليم القراء والكتابة حق طبيعي
Bilê d'yo bilê wêlê la d'yo qui wêlê cò woyên d'ôl hâi.
일고 알 줄 아는 것은 우리에 권리
Wax akbrinta iyo qoristu waa xaq qof walba leeyahay.
ਪੜ੍ਹਾਈ ਇੱਕ ਅਧਿਕਾਰ ਹੈ
Saber leer y escribir es un derecho.
படிப்பது எல்லாருக்கும் உரிமை
Навыки чтения и письма — право

You can get help - 416-961-5557

INTERNATIONAL LITERACY INSTITUTE
TORONTO
CANADA POST / POSTES CANADA
From anywhere... De partout...
en anglais / en français / en espagnol



The Great Global Challenge

What can you read when
you can't see?

THE DARK SIDE...

-1.6 billion people in the world have no access to electricity

- 579 million of those reside in India

Which is ~ 50% of India's population!

Ray of Hope- Gandhain Engineering

4 min pedaling= 4 hours of Light!



The Leg
Power

75 watt
Generator

Most Modern and
Efficient Lighting
Devices- LED!

Most Modern Energy
Storage Device- Ultra-
Capacitors!

More from Less

Getting more from each R&D dollar spent

1. Shift R&D from DC to IDC
2. Open Source R&D
3. Holding patents to donating patents
4. Others.....

MORE FROM LESS FOR MORE

.....BY MORE & MORE

- 1.** Using the power of global R&D networks
- 2.** Making the best minds in the world to think of the poor
- 3.** Democratization of Innovation
- 4.** Others.....

GLOBAL RESEARCH ALLIANCE

- CSIRO, Australia
- CSIR, India
- CSIR, South Africa
- FhG, Germany
- TNO, Netherlands
- VTT, Finland
- SIRIM, Malaysia
- DTI, Denmark
- Battelle, USA

Pretoria declaration



PRETORIA DECLARATION

ZERO DRAFT

- o Recognising that more than ever before, huge inequalities in income, innovation, education & access to information & knowledge between the rich & the poor are leading to increasing marginalisation of the poor
- o Recognising that knowledge has the power to ^{fundamentally} transform the lives of the poor, change the traditional path of development & create a better tomorrow for everyone
- o Recognising that in this era of explosion of knowledge & globalisation, the creation of open & global knowledge networks can deliver an enormous value to the society as large
- o Recognising that, ^(inspite of the inherent inequalities & diverts,) we share common values & goals, and also by a strong belief that by sharing we strengthen each other & grow together
- o A Global Research Alliance has been formed this day — to realise the vast synergy & potential of our team of 40,000 strong knowledge workers ~~members~~, who will dedicate themselves to this noble cause of 'global research through global public good'.

- o A Global Research Alliance has been formed this day — to realise the vast synergy & potential of our team of 40,000 strong knowledge workers ~~members~~, who will dedicate themselves to this noble cause of 'global research through global public good'.

GLOBAL RESEARCH ALLIANCE

*Global Knowledge
for
Global Good
through
Global Funding
using
Global Talent*



The Power of GRA

- 60000 scientists from 5 continents
- Diversity
- Scientific credibility
- Collective mandate:
 - Science for **S**olution
 - Technology for **T**ransformation
 - Innovation for **I**mpact



**GLOBAL
RESEARCH
ALLIANCE**

HIV/AIDS Challenge- Tanga Initiative



– GRA-WB initiative

- Basis: Tanzania traditional knowledge!
- Traditional healers and scientists from 5 continents brought together
- Approach based reverse pharmacology for treatment of HIV opportunistic infections



**GLOBAL
RESEARCH
ALLIANCE**

HIV/AIDS Challenge- Tanga Initiative



- Tanga project partners
 - TAWG (Tanzania)
 - NIMR (Tanzania)
 - CSIR (SA)
 - CSIR (India)
 - FhG (Germany)
 - TNO (Netherlands)



**GLOBAL
RESEARCH
ALLIANCE**

Global Indigenous Knowledge and Innovation Partnership (New York- 26 Sept 2008)



Mahatma Gandhi said:

*“Earth provides enough to satisfy every man’s need,
but not every man’s greed”*

MORE FROM LESS

*“I would prize every invention of Science made for
the benefit for all”*

FOR MORE

The Last Century: Will the Civilization Survive the 21st Century?

Blakett Memorial Lecture Indian National Science Academy



Lord Martin Reese, President, Royal Society
New Delhi- 9th Jan 2007

Deep Concerns

- Climate Change
- Global Warming
- Stratospheric Ozone Layer Depletion
- Ravaging of biodiversity by modern society
- Others.....

The Only Solution...

Gandhian Engineering

More From Less For More
.....By More and More.....



Thank You