India: An Innovative Nation

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O Pure Earth, may that we utilize your soil well
For creative production
Without causing you injury or harm
And disturbing any vital element in you
Prithvi Sutra

India and Innovation

- The Innovation chain
  - people, research, and business
    - form complex networks
      - generate
        - new ideas
        - new products
        - new jobs
      - improve
        - existing products and processes
- Does India offer (??)
  - innovation climate
  - innovation environment
  - innovation ecosystem

Encourage risk taking, tolerance towards failures, and generate innovation ecosystem.

Innovation

- **Strengths crucial for innovation**
  - **strong base in science and engineering**
  - **large talent pool – Bachelors, Masters, PhD**
  - **world-class research-led institutions**
  - **free, independent, lateral thinking**
  - **analytical methodology, problem-solving skills**
  - **different mindsets and enterprise**
  - **industry + academia partnership**
  - **vibrant venture capitalists/ angels**

Excellence at every stage of student development leading to innovation.

Innovation

- India's weakness
  - quality variation
    - school, college, professional levels
      - too much pressure from KG onwards
      - cover too much and over-teach
    - no time for absorption
  - lack of communication skills & original thinking
  - rigid university system, curriculum
  - lack of high quality faculty

Emphasize discovery-based learning, open-ended problems, group projects, hobby centre.

India: Education System

- **School level**
  - high student-teacher ratio (~ 70:1 in public schools)
  - no time for absorption and reflection
  - present system encourages hard work & rote learning
    - students well prepared to face local & global competition
    - can hardly innovate
  - private + public partnership, a must
  - more Navodaya schools (~40 students in class)

Modify education system and mindsets of teachers and policy makers.

India: Education System

- **Professional level**
  - from engineering science approach move to systems approach
    - idea to designing workable, affordable solution
    - modern curriculum
    - introduction to design
    - open - ended lab courses
    - strong HASS program
      - leadership, teams, communication skills
    - summer internships
      - *rural*
      - industry
      - research
  - emulate medical education model

Self-learning and life-long learning.

India: PhDs in Engineering

- PhD output per yr
  - *600-700* in India
  - 6000 in USA
  - 6000-9000 in China
- need to produce ~5000 PhDs per yr
  - attractive incentives to BTech, MTech
  - reduction of time to PhD
  - substantially higher remuneration package to PhDs in industry and to faculty
  - state-of-the-art facilities and infrastructure
  - excellent global connectivity
  - intellectual environment

Research-led Teaching Institution.

Quality in Higher Education

We are what we repeatedly do
Excellence then is not an act but a habit

Aristotle

Strive for World-Class Institution.

Pursuit of Excellence: Faculty

- **Quality faculty**
  - **attractive remuneration package**
  - **liberal initial research funding, facilities**
  - **highly motivated research students**
  - **transparent promotion policies**
  - **performance-based incentives**
  - **recognition for teaching, research, service**
  - **flexible sabbatical norms**
  - **state-of-art facilities and infrastructure**
  - **global connectivity**
  - **research environment**
  - **facilitate start-ups by faculty**
  - ***complete autonomy***

Is external motivation necessary?

India's Silicon Valley

- Need to do
  - critical number of research-led institutions
  - focused research programs
  - invention and innovation in academia + Industry
  - value addition for masters & PhD
  - world-class institutions and quality faculty
  - competitive remuneration packages in manufacturing industries
  - emphasis on long-term opportunities in *knowledge* process outsourcing, etc.
  - produce *employable* graduates with superior skill-sets

Vision, policies and implementation

Pursuit of Excellence

- **Young India**
  - **50% < 25 yrs**
  - **35% < 18 yrs**
  - **8% > 70yrs compared to 16-18% in USA, Europe, Japan, China**
  - **~1.5 lakh students for JEE; IITs admit ~4000/yr**
  - **~4.0 lakh for AIEEE**
  - **~70,000 admissions/ yr for engineering degrees**
  - **Large number of poor quality institutions**
  - **100+ IIT and IISc like institutions needed**
  - **richness + reachness to optimize quality faculty and meet aspirations of large number of aspirants**

Invest heavily in knowledge and Innovation.

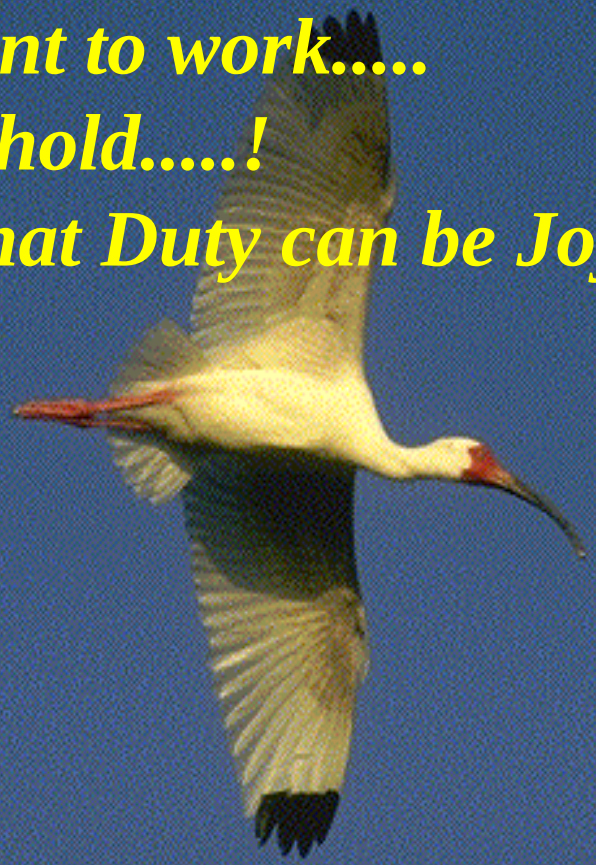
India: An Innovative Nation

Encourage youth to be passionately curious - to question, to think, and to reason their way of understanding

Einstein

Start from the 2-yr olds.

"I slept and dreamt that life was Joy
And then I awoke and realized
That life was Duty
And then I went to work.....
And lo and behold.....!
I discovered that Duty can be Joy!"



Rabindranath Tagore


The Beginning