Role of Scientific Innovations in Economic Development

Dr Rajendra Dobhal
Director General
Uttarakhand State Council for Science & Technology
Jhajra, Dehradun
Uttarakhand
“The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man.”

(George Bernard Shaw, 1856–1950)
Invention vs. Innovation

New ideas

Invention
- Implementation and enablement

Innovation
- Commercialization
Innovation

There is a way to it better - find it

Thomas A Edison
**Types of Innovation**

- **Incremental Innovation (improving)**
  - Existing products or services
  - Only short term improvements
  - Clear benefit to customers
  - Rapid implementation

- **Breakthrough Innovation (radical)**
  - Radical effect on the division
  - New user solution
  - Paradigm shift
  - Attractive potential and source for further improvement

- **Strategic Innovation**
  - High Development effort
  - Active marketing
  - High level of investment
  - Advantages to customers
Breakthrough/Radical Innovation

Development of new product
From walkman to ipod..
Incremental Innovation

Improvement of existing product

- Cortex µP
- Led backlight capacitive screen
- 5 MP camera
- Dual Core A5 µP
- Retina Display screen
- 8 MP camera
Walter Hunt

W R Grace and Company

Earned billion $

15 $

owed

400 $

sold

Commercialized
5 Amazing Scientific Innovations

ideas that changed the world
MOBILE TECHNOLOGY

iPhone technology (still a giant) vs. Nokia technology (a former giant)

Falls to the floor

Break the screen

Falls to the floor

Break the floor

Widespread success: 2007–11

Apple achieved widespread success with its iPhone, iPod Touch and iPad products, which introduced innovations in mobile phones, portable music players and personal computers.
Early History

**iPhone**
- **1971**: Jobs designed games for Atari computer Co.
- **1976**: Steve Jobs founded Apple Co. with the money he got by having sold his car.
- **1984**: Apple introduced the Macintosh computer.
- **1985**: Jobs resigned and left Apple computer Co.

**Nokia**
- **1979**: Nokia created a radio telephone company.
- **1981**: Launch of the Nordic Mobile Telephone service, the world's first international cellular network.
- **1982**: Nokia introduced the first car phone.
- **1987**: Nokia introduced the Mobira Cityman, the first handheld mobile phone.
Recent History

**Iphone**

- **2001**: Jobs unveiled the revolutionary iPod
- **2003**: Steve Jobs unveiled the iPod mini
- **2007**: Jobs launched the iPhone I-touch screen
- **2008**: Apple launched iPhone 3G
- **Oct-2011**: Jobs died in his house surrounded by his family.

**Nokia**

- **2000**: Nokia launched a phone capable of reading emails on internet (7110)
- **2002**: Nokia launched its first video capture phone, the Nokia 3650. It also launched its first 3G phone, the Nokia 6650
- **2005**: Nokia sold its billionth telephone –model 1110-
- **Dec-2011**: Nokia closed its last mobiles factory in Finland
Innovations in Semi-conductor
SEMICONDUCTORS
the foundation of modern technology

TELECOMMUNICATIONS

77 billion apps
expected to be downloaded by 2025
By 2020
the number of smartphone users will be 5 bil

AUTOMOBILE

30-40% of new vehicles in 5 years will be connected

COMPUTING

By 2020, there will be 50 billion networked devices

HEALTHCARE

Wearable Devices
will reach $30 billion by 2020

SMART ENERGY

$400 billion

$30 billion
3-D Printers

‘Revolutionary’
Machine makes 3-D objects from drawings

Associate Professor Joe Beaman shows some three-dimensional plastic models made by the ‘selective laser centering’ device developed by Carl Deckard, left.
Evolution of 3D Printing

1984 - Birth of 3D Printing
1988 - 3D printing technology was made available to public
1996 - Nearly 8 years later the term 3D printer was first used
2006 - The first self replicating 3D printer was developed
2014 - Manufacturing of basic necessities

APPLICATIONS

- Medical
- Fashion & Retail
- Food
- Games & Entertainment
- Defense & Space
- Pop Culture
- Industries
World’s first 3D-printed office building

Building Constructed in 17 Days
GRAPHENE

- Isolated in 2004 by two researchers at The University of Manchester, Prof Andre Geim and Prof Kostya Novoselov.
- In 2010 won the Nobel Prize in Physics for their pioneering work.
- World’s first 2D crystal
- Thinnest ever material and transparent
- Ultra-light yet immensely tough
- 200 times stronger than steel, but incredibly flexible superb conductor and can act as a perfect barrier
Applications of Graphene

- High speed Transistor
  - RFIC, Sensor
- Conductive ink
  - EMI screen ink
- Flexible Display
  - Touch Panel
- Semiconductor
- Ink & paste
- TCO
- Barrier
- Chemical sensors
- Solar cell, Battery
  - Supercapacitor
- Energy
- Heat spreader
- Composites
- LED lighting
- Automobile
  - Airplane components
The Ring Pull

revolutionised the commercial food and drink industry

When: 1963
Where: Dayton, Ohio
Why: It enabled dramatic growth in the soft drinks market
How: The idea for the ring pull came about while Ermal Cleon Fraze was having a picnic and couldn’t open his beer can after forgetting his opener
Who: Ermal Cleon Fraze
Fact: After it bought the licence for the new ring pull design in 1963, Pittsburgh’s Iron City Brewing Company’s sales increased by 233% in a year
UPCOMING INNOVATIONS
Innovations in food cooking

• Israeli start-up Goji
• A solid state radio frequency oven.
• Cook different types of food in single go

cook a fish frozen inside a block of ice without melting it.
ULTA CHATA

Captures rain water during the monsoon

harvest and filter up to 100,000 litres

provides potable quality drinking water through an inbuilt filter

solar energy for the rest of the year.

maximum solar capacity of 1.5KW.

programmable lighting options

a mobile charge unit, thereby making it a completely self-sustaining installation for the outdoors.
## Where does India Stand?

The Global Innovation Index (GII)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Economy</th>
<th>Index</th>
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INNOVATIONS THAT IMPACTED INDIAN ECONOMY
Indian Pharmaceutical Industry

**GENERIC DRUGS**

- 70% of market share
- Supply 20% of global generic medicines

Largest provider of generic drugs globally

Cost of production

Significantly lower than US

Half of Europe

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<th>Generic cost</th>
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Innovation in techniques of producing goods which reduces cost, increases rate of production and reduces defect rates.
Positioning of India as a leading space faring nation.

- Launching of 104 satellites at one go
- Attractiveness as partner in commercial sector
- Credentials in global governance
- National security
- Ability to sit at high tables
- Sizeable share of the “$300 billion global market.”
Thank you