Technology, Innovation, and Entrepreneurship

SUJIT BANERJEE

DIRECTOR

DEPTT OF SCIENCE & TECHNOLOGY

Presentation Outline

- Entrepreneurship and Marketing
- The Innovation Process
- Intellectual Property Rights
- University Research and Technology Transfer
- Intellectual Property Rights and Development
- Technology Adoption and Diffusion
- Marketing and Adoption

Entrepreneurship

Entrepreneurs make things happen

- Individuals who take a concept and convert it into a reality. A product, policy or institution.
- Champions of new process -- engines of change.
- Entrepreneurship occurs in all areas of life. In business, academy, government and NGOs.
- Entrepreneurs are everywhere, from Dalal street to Nehru Place.
- Entrepreneurship can be used for good and evil. The Godfather was an entrepreneur that misused his talent.

Entrepreneurs Can Be Encouraged and Promoted

- Openness to new ideas, freedom from investigation of operation, promotion and pay based on merit encourage entrepreneurship.
- Excessive regulation, rigid hierarchy, lack of freedom, and excess control discourage entrepreneurship.

Requirements of Entrepreneurs

- Entrepreneurs need a keen eye to understand economic, social, and scientific realities and the capacity to understand evolutionary processes in the future.
- Need to understand how institutions work, and individuals react in order to introduce activities and products that serve peoples' need and that are sustainable economically and politically.
- Need dedication and commitments and the capacity to overcome failure.

Entrepreneurship and Society

- To encourage entrepreneurship, society should tolerate failure and give people a second chance.
- People need to pay for their mistakes, but if the payment is too high, people will not dare to take risks.
- Effective legal system is essential for positive entrepreneurship

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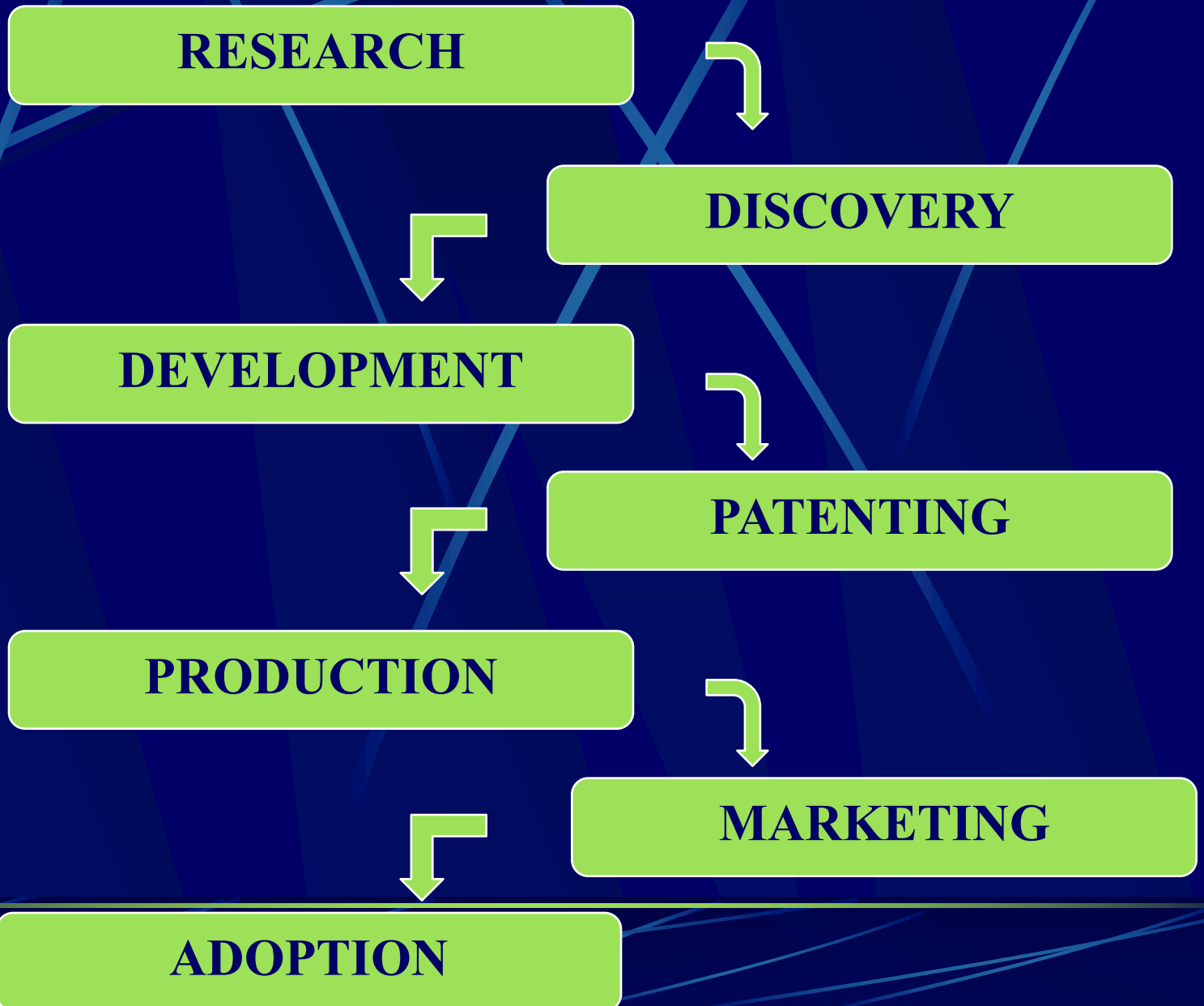
What Are Innovations?

- Innovations are new ways to achieve tasks.
- Types of innovations include:
  - Mechanical—tractors, cars.
  - Chemical—pesticides.
  - Biological—seed varieties.
  - Managerial— Extra pay for work, overtime, ESOP.
  - Institutional— patents, banks, stock markets.
- It is useful to distinguish between process innovations (new biotechnology procedures) and product innovations (Bt Cotton).

The Innovation Process

- An innovation starts as a concept that is refined and developed before application.
- Innovations may be inspired by reality. The innovation process, which leads to useful technology, requires:
  - Research
  - Development (up-scaling, testing)
  - Production
  - Marketing
  - Use
- Experience with a product results in feedback and leads to improved innovations.

The Innovation Process



Technology Adaptation and Appropriateness

- Rarely is the same technological solution optimal everywhere. The value of an innovation depends on socio-economic, climatic, and ecological specifics.
- Important innovative activities adapt technological solutions to specific conditions.
  - Export of technologies across regions without adaptation may lead to negative environmental side effects and waste.
- A technology may have several versions to meet needs and capabilities of various users in a region, e.g., large vs. small farmers' versions of a machinery.
- The establishment of an innovative capability starts with a buildup of capacity to support and adopt innovations and new technologies.

Induced Innovations

- Innovations respond to need and economic conditions. Inventors, Investors, and Researchers put effort into solving burning problems, and that leads to innovations.
  - Labor shortages led to mechanized equipment.
  - Drought conditions led to improved irrigation.
  - Energy crisis led to higher efficiency cars.
- Environmental regulations trigger cleaner technologies.
  - A tax on carbon led to improved stoves and power plants.
  - Concern for pollution led to phasing out of Diesel cars and promotion of hybrid technology.

Types of Innovators

- Most innovations introduced by practitioners. Practitioners are important innovators. They identify a way to meet needs.
- The scientific discoveries of the late 19th century gave rise to science-based innovations (Edison, Bell, Marconi).
- Major companies (IBM, Sony, Bell, Kodak, GM) built their own research labs.
- Public sector labs made important agricultural and environmental discoveries.
- Universities and start-up companies are becoming major sources of new innovations. The ownership of a technology and leadership in its applications move between organizations over time.

Incentives for Innovations

- **Patents**: Awards monopoly rights for 20 years.
  - Patent protection allows publication of research findings that leads to innovations.
  - Patent rights (for certain applications) can be transferred.
  - Patents are valid only where they are registered.
- Copyright protection: Pertains to books, brand names, and the media.
- Trade secrets: Protects against thefts.
- Plant breeders' right: Allows exclusive sales of varieties and allows farmers to reuse seeds.
- Prizes: Awarded to winners of a contest for finding a technical solution to a problem.
- Indigenous knowledge is poorly protected.

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Intellectual Property Rights & Development

- Investments in R&D and new products will be much lower without the expected monopoly gains.
- Local industry and foreign investors benefit from patent protection, as is already the case in India.
- IPR constraints may inhibit domestic companies' ability to develop new products.
- Added IPR knowledge may lead to gains:
  - Production for local markets does not require obtaining rights to patents that are not registered locally.
  - Developing countries can trade access to bio-diversity for access to technology. They can reach special agreements with universities and companies.

Investment in Research: A Key Element of Environmental Policies

- Research enables discovery of basic environmental problems. Without research, not much would have been known about the link between smoking and cancer.
- Research provides better monitoring and management equipment to help identify environmental problems and monitor response.
- Public research enables sustaining development of technologies that may not be economical under existing prices.

Division of Labor

- **Basic research**: Gain more comprehensive knowledge or understanding of the subject under study, without specific applications in mind. Conventionally conducted by universities.
- **Applied research**: Apply knowledge. Often conducted by industries.
- **Educational-Industrial complex**: University research has led to the creation of new firms and even industries, brought old ones down, and, in general, profoundly impacted rates of innovation in the larger economy.

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Stakeholders in the Innovation Process

- Universities, including research scientists, university administrators, and designated officers of technology transfer.
- Entrepreneurs, including start-up companies and venture capitalists.
- Incumbent corporations.
- Potential technology adopters and downstream producers who will use the technology
- Government and Regulators.
- Environmental and other special interest organizations.
- Consumers.

Why Universities Do Not Do What Companies Do and Why Companies Do Not Do What Universities Do

1. **Uncertainity**: Uncertain outcome of basic research.
2. **Inappropriability or 'nonmarketability'**: Some results from basic research are not appropriable, because they occur at such fundamental levels of scientific analysis.
3. **Spillovers**: Some results from basic research can easily spill over to competitors in the same line of business that the results may actually help the competitors more than they help the company that conducted the initial research.

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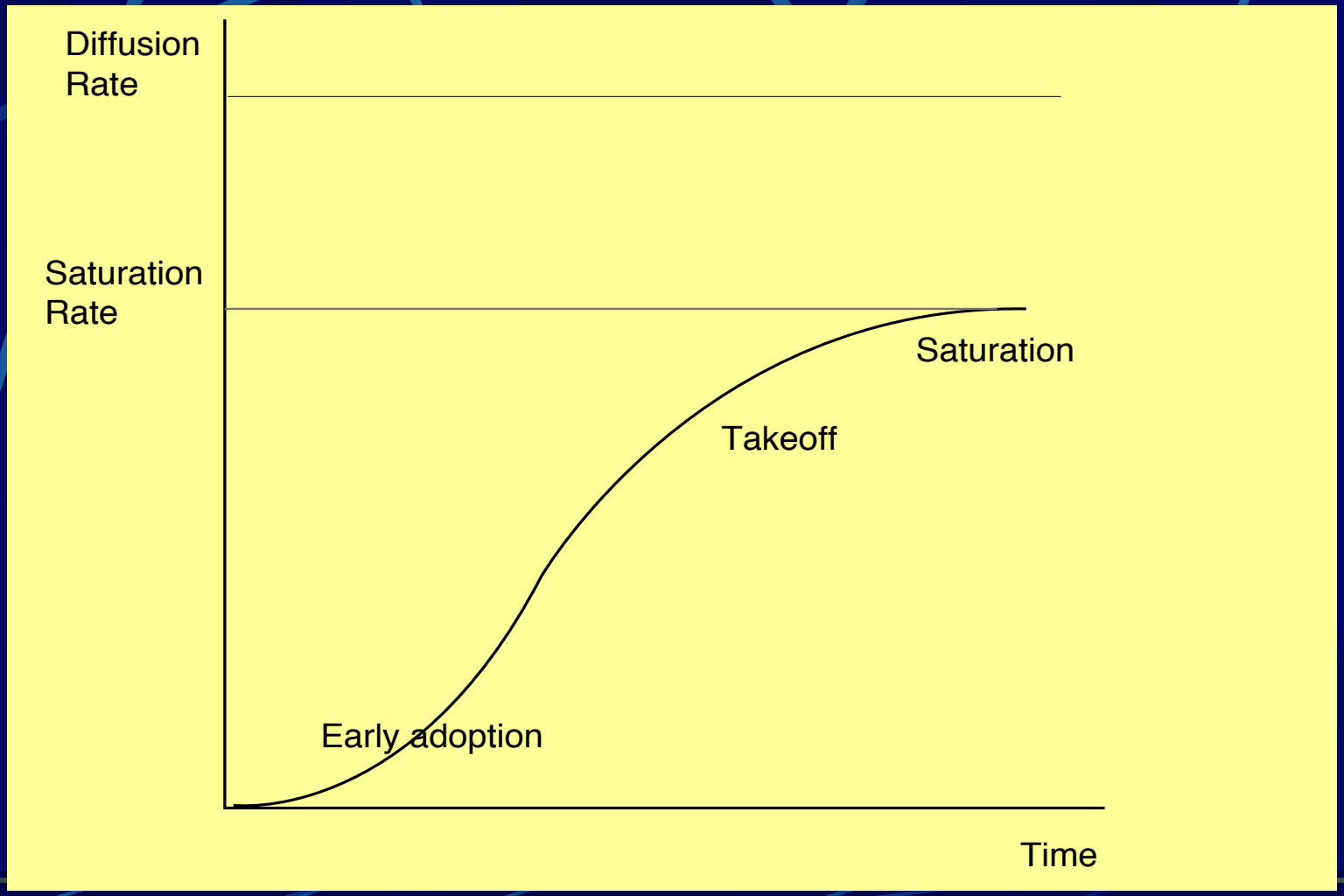
Adoption and Diffusion

- The use of new technologies spreads gradually.
- There is a significant time lag between the time a new innovation is introduced and when it becomes widely used by producers or consumers.
- Diffusion is the aggregate process of product penetration.
  - It is measured by the percentage of potential users who actually adopt a technology.
- Diffusion curves measure aggregate adoption as a function of time. They tend to be S-shaped.
- Adoption is a decision by a specific individual to use a technology. Diffusion is aggregate adoption.

The S-Shaped Diffusion Curve



Stages of Diffusion

- Three stages are identified :
  - Early adopters: More educated, innovative individuals who gain from technology.
  - Followers: The majority of adopters who see its success and want to join in.
  - Laggards: Less-advanced individuals who either do not adopt or adopt very late and may lose because of the technology.

Adoption and Risk

- Impacts of technologies are unknown. Risk considerations slow adoption.
- Policies that reduce risk include
  - Insurance (crop insurance enhances adoption)
  - Diversification.
- An alternative approach: Select the technology with the highest benefit given that it yields minimum required benefits at the worst case scenario. This approach aims to assure sufficient resource during drought.
- Good inventories, banking systems, and asset accumulation possibilities reduce the need for protection against risks.

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Adoption, Credit, Location, and Education

- Lack of credit and high cost of credit are major impediments for adoption.
- Poorer consumers may be more constrained by risk and credit constraints.
- Adoption may be slower at far away locations because of less access to information and sources of technology, higher cost of inputs. In some cases, however, early adopters are at distance locations(if technology reduces transportation costs).
- Adoption requires a high learning cost -more educated individuals tend to be early adopters. When the technology is simple,sometimes less sophisticated individuals adopt first.

Adoption and Policy

- The government may enhance adoption through positive incentives such as:
  - Price support of products produced with technologies.
  - Extension and education.
  - Credit subsidies.
  - Insurance schemes.
- Negative incentives
  - Regulation against existing technologies (pesticide regulation enhances biotechnology).
  - Higher cost of inputs used intensively with existing technologies (water price hikes).
- Key elements of environmental policy are incentives to
  - Induce innovation of greener products.
  - Induce adoption of cleaner products.

Timing of Adoption

- Sometimes it is worthwhile to wait and see and not adopt immediately when benefits of technology exceed costs.
- Cost of technology may decline over time. You should wait if the reduction in technology cost> than the cost of waiting.
- When a technology has uncertain irreversible outcomes- waiting to learn more is prudent.
- Waiting prevent the opportunity of learning and improving a technology- the gains from waiting should be compared to the costs.

Government & Adoption

- Government : Promoting and encouraging adoption of technologies -- MAKE IN INDIA
- Government : Incentives, advertisement and promotional campaigns -- START UP INDIA
- Government : Institutionalizes for education and support of diffusion processes -- IEDCs, TBIs, START UP CENTRES

A NEW ERA BEGINS…..