LECTURE 8 – 02/10/25

Types of learning:

- Learning through dedicated activities
- Learning by doing
- Learning by using

Learning curves: the more the company produces in terms of cumulative output, the more the average cost decreases. Companies learn to do things by doing things.

(Possible exam question): Why in some cases we have a slower but continuous process of decreasing cost and in other cases we just one quick decrease?

Talking about solar modules we can observe a fantastic learning curve. As long as you install capacity in solar system, we can observe a terrific decrease in costs. You increase the cumulative output of module, and you obtain a decrease in costs.

What is the exact source of the unit cost reduction?

It's just the increasing of cumulative output driving this reduction?

Policy implication: scaling up production will generate automatically a decrease in unit cost which will generate a decrease in price and larger adoption

At which level should we conceptualize learning? Workers' increasing skills? Incremental changes to technology? Organizational changes? A combination of the three?

Alternative and additional explanation (reverse causality):

- Applied R&D at the firm level
- The improvement of basic science
- Increasing technological spillovers
- Standard economies of scale (standardization, specialization)
- Price elasticity matters
  - Policy implication: a decrease in unit cost which will generate a decrease in price and with large price elasticity will scale up

LEARNING BY USING

There are two types of Learning by Using?

1. "Pure" LbU (disembodied)
   Understanding of performance of components/materials within complex systems
   Understanding of relationship between environment/way-of-using of capital goods and their physical obsolescence
   Information can be produced only by prolonged utilization and lead to new utilization practices→increase of productivity/reduction of operating costs
2. "Embodied" LbU → product innovations
   Typical of industrial design, machine tools and other capital goods
   Ergonomics, usability

In which situations I'm expecting to find LbU important?

Aviation, energy production, telecom, computer networks and software

The key factors are:

- Systemic complexity
- Reliability as key problem

In pure LbU, AI-powered systems analyze real-time operational data to detect patterns and optimize performance—information that is unforeseeable through conventional scientific models.

In embodied LbU, AI accelerates product innovation by supporting generative design and topology optimization in additive manufacturing.

LEAD USERS

Users in general are firms or individual consumers that expect to benefit from using a product or a service. Lead users are ahead of the majority of users with respect to the main market trend, they also have benefits from a solution to the needs they have encountered.

In some way the topic of lead users is related to learning by using, the company learns from the experience of lead users.

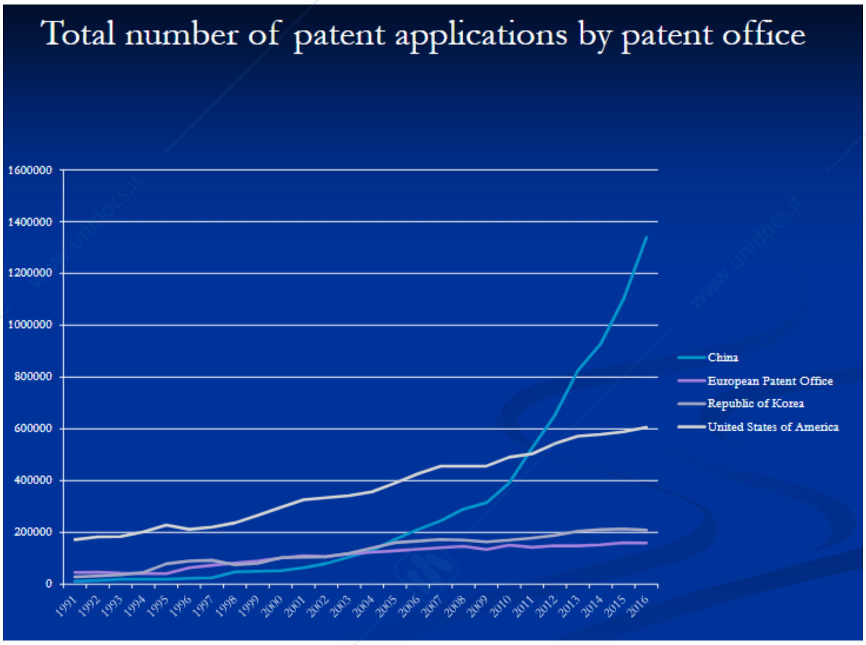
OTHER SOURCES OF INNOVATION

- Design: by changing even just one little thing you can discover something new that you would never think about

- Chance: sometimes people innovate by luck
- Failures: a lot of terrific products were initially a completely failure, or totally a different thing.

LECTURE 9 – 06/10/25

ECONOMICS OF PATENTS

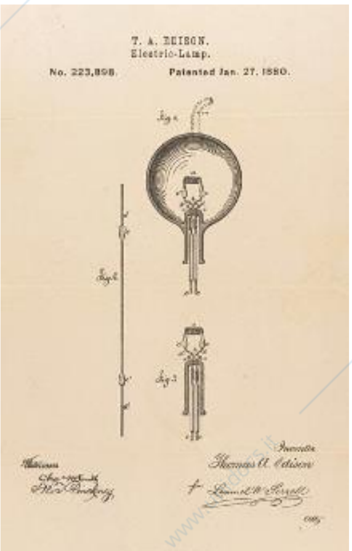


Patents are generally produced at national level.

Patents are everywhere and are used in different ways. In 2016 USA had 600.000 applications, in the meantime China had 1.600.000 applications.

There is an international agreement (PCT – patent cooperation treaty) that allows inventors to seek patent protection for their inventions simultaneously in multiple countries by filing a single "international" patent application. The PCT is managed by the World Intellectual Property Organization (WIPO) and has 158 contracting states.

On average, 60% of the patents are granted after, always on average, 3 or 4 years.



On January 27, 1880, Thomas Edison received the historic patent embodying the principles of his incandescent lamp that paved the way for the universal domestic use of electric light. It was a huge invention that had one single patent. Nowadays, one single product can have many patents, protecting different single parts.

A lot of products have many patents because of the complexity of it, just think about a phone or any other electronic device, it's composed by hundreds of different parts: display, battery, memory, audio, video, circuits and so on.

During the pandemic there was an historical waiver (a block on the patent) on COVID vaccines in the US that caused many critics. During the pandemic the National Institute of Health and Moderna were in a bitter dispute over who deserves credit for inventing the central component of the company's powerful coronavirus vaccine.

WHAT IS A PATENT?

A patent gives the patent holder a monopoly right (in a specific country) to exploit the invention commercially for a maximum of 20 years, in one or more selected countries, subject to the payment of regular renewal fees. In return for the right to exploit the invention, the details of how it works are published via the patent application (disclosure) .

Patentability conditions:

- Utility, practical use or utility (industrial applicability, useful)
- Novelty, new characteristics, unknown in the body of existing knowledge in its technical field (prior art)
- An inventive step, non-obvious invention must be not obvious to a person with average knowledge of the technical field.

Related key issues:

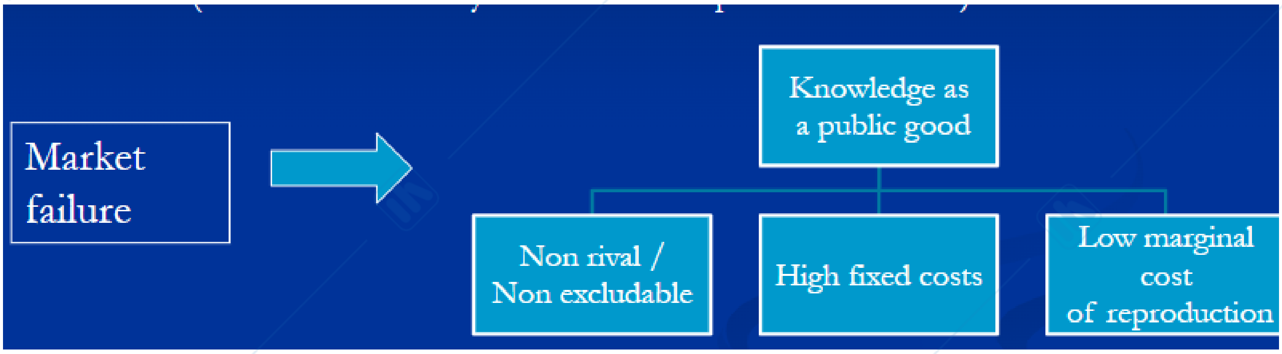
- Utility: very important in chemistry and biotech.
    - Products (molecules) are created, uses take time to be discovered
    - From "specific benefit in the current available form" to "plausible speculation about how to use the invention"
- Novelty (and non-obviousness)
    - "Inventive step in EU"
    - It changes with the quickly progressing field
    - Discoveries of new properties of an old product are not patentable
- Disclosure: written description of the structure of the products to allow to make use of it (not just description of the functions)

WHICH IS THE ECONOMIC JUSTIFICATION OF THE PATENT SYSTEM?

We must evaluate the costs and the benefits.

One general, but important, point is the fact that the IPR systems were not created by some rational, consistent social welfare maximising public agency. The role of the economists is to provide a framework for identifying the major problems of allocative efficiency and the distributional issues that are at stake.

The objective of the policy is the creation and diffusion of new and useful knowledge

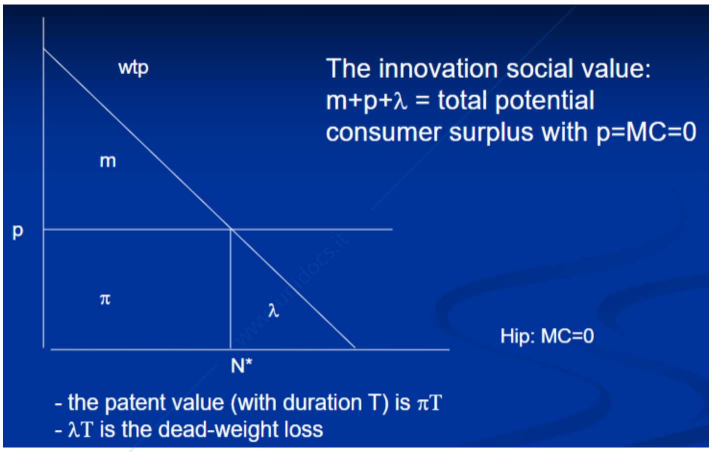


Possible solution to the public good problem:

- Subsidies
- Direct participation in production and distribution of the good
- Regulated private monopoly
- Property rights

We must build a framework that allow us to understand whether the patent system works or not. Which is the optimal scope of patent protection?

- The classic view is the microeconomic one. Here we have a demand curve which represent the willingness to pay. Below the demand cure we have all the potential situations in which consumers meet a surplus. The area below the demand curve is called Total Social Area of the Innovation in terms of the total willingness to pay of the consumer.



Key assumption of the classic view:

- Welfare enhancement: IPRs encourage innovation, providing monopoly right protection for T years.
- Welfare damage: IPRs stifle competition, high monopoly price and deadweight loss
- Patent design affects substitutability and is aimed at balancing these trade offs:

- Strong systems create more incentives
- Weak systems create more access and diffusion

Key assumption of the contemporary theory:

- It has a stronger focus on commercialisation and development of inventions
- Access to financial markets
- Patent at a early stage of the innovation process
- The patent is necessary for any licensing to occur
- Two issues:
    - Does appropriability (and development financing) require that companies and exclusive licensing to develop university inventions?
    - Can patents taken out on the further inventing that is involved in the development work? (otherwise, no need to patent the original invention)
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LECTURE 10 – 07/10/25

APPROPRIABILITY MECHANISM

Which are different ways in which companies try to make profit out of innovation?

Yesterday we talked about patents and Intellectual Property Rights; but it's true and evident that these are not the only ways that companies can take to make profit out of innovation.

Secrecy can be a strategy; an example can be the recipe of Coca Cola. Secrecy it's important and it's in some way similar to the patent mechanism. In some contract we can find the obligation of secrecy. Secrecy is protected by law and typically patents and secrecy are two faces of the same coin. When you protect patent, you want to protect also the secrecy.

Let's try to go beyond legal system and think about other mechanisms that allow companies to make profit out of their innovation. A company can have the First mover advantage that can lead to some profit. Lead time and first move advantage are strictly linked. Two important elements for lead time are time and reputation, as if you keep innovating and you keep on staying ahead with good products, you have the reputation of the one that is doing good things all the time, and this helps also to make fundraising for additional innovation. Reputation is very much linked to the construction of a brand and to the use of another form of intellectual property, which is trademark.

WE HAVE TO MAKE A DISTINTION BETWEEN LEAD TIME AND FIRST MOVER ADVANTAGES

Lead time is a mechanism of appropriability that can be attributed to a first, or a second mover. We must think about under which conditions lead time can be effective.

When full imitation is unlikely, we do not need patents. Full imitation is unlikely because of:

- Knowledge necessary to the innovative process is lost when the innovation is reached, the imitator has to rebuild it
- Reverse engineering allow one to know what are the component not why they have been designed in that way
- Imitation requires costly research: less costly than research-for-innovation, but still increasing with sophistication of innovation to be imitated

Lead-time exploits the existence of "natural delays of innovation", due to:

- Lack of attention: recent innovations go unnoticed and anyway early attempts of acquisition of information on them tend to fail→ necessity of visible/acclaimed success
- It is especially true of smaller, yet-to-known firms (large, successful ones are monitored by press and rivals)

Lead time may be successful depending on two other factors: know-how and tacit knowledge. Tacit knowledge for achieving the innovative idea and for the realization of the innovative idea.

Lead time brings to the table:

- Reputation: effects on consumers/users/financiers → can be turned into "brand" by trademark claims
- Continuous innovation: flow of incremental innovation; it exploits cumulativeness of the knowledge
- Learning curve: decrease in cost of production due to cumulative output

With the lead time we can find some static barriers to entry:

- Indivisibilities and economies of scale (minimum best scale) in manufacturing
- Managerial know-how and knowledge of the market
- Channels of distribution

POSSIBILE DOMANDA DI ESAME: WHAT IS LEAD TIME AS AN APPROPRIABILITY MECHANISM?

FIRST-MOVER ADVANTAGES AND DISADVANTAGES

Being a first mover can confer additional advantages of:

- Brand loyalty and technological leadership
- Pre-emption of scale assets (natural resources, manufacturing capability, human capital)

- Exploiting buyer switching costs (frequent flyer systems, iPhone/mac interaction, etc.)
- Reaping increasing returns advantages (Intel-IBM)

However, first movers often bear disadvantages too:

- High research and development expenses
- Immature enabling technologies and complements

Netflix established in 1997, Netflix is the first online DVD rental service, offering flat-rate rental-by-mail and online streaming to customers in the US. What happened then? Blockbuster busted, Netflix represented 61% of movies downloaded or streamed in the US by 2010 and is still number one.

THE TEECE MODEL: COMPLEMENTARY ASSETS

Complementary assets are upstream or downstream assets that are used to develop, produce or distribute an innovative new product or service → degree of availability and importance. If you innovate you need a set of complementary assets to bring the innovation to the market, as could be distributional channel, maintenance service.

Things you can do:

- Manufacturing capabilities
- Sales and service expertise
- Capture customer knowledge

Things you own:

- Brand name
- Distribution channel
- Customer relationships

Tetley is a market leader and the originator of the round teabag. Advertising was based around a better cup of tea that would result from bags where the tea could circulate better. Tetley knew that competitors would try and copy, it hired consultants to develop a new manufacturing line for round teabags. When new product was introduced competitors were unable to obtain similar manufacturing equipment and Tetley maintained its lead.

The Teece Model:

1) Complementary assets and soft-soap:
Firms find it hard to capture the value of their innovations if complementary assets are easily available (The first liquid soap product. Minnetonka, a small manufacturing company, succeeded in protecting its new product Softsoap against giant P&G by purchasing pump manufacturers' total annual production – 100 million pumps!
θ Without access to the pumps, competitors could not launch a rival product for nearly two years, thus giving Softsoap the lead time it needed to establish itself.)
2) Appropriability regime:
   a. Weak regime: environment is not easy to protect asset (value capture more difficult)


   b. Strong regime: environment facilitates protecting an asset (value capture more likely)



The likelihood of preventing imitation varies from one innovation to another