

Economics and Policy of Innovation

Academic year 2015/2016

Lecture 1: February 22nd, 2016

Dr Claudio Cozza

DEAMS – University of Trieste

Preliminary information

Lectures by Dr Claudio Cozza and Prof Vittorio Torbianelli

Timetable: Monday 2-5pm (Aula Mappe Antiche, via Tigor) &
Wednesday 1-4pm (Aula Magna, via Tigor)

Tutoring time: Tuesday 4-6pm (room 208, via Università 1)

Textbook: Oxford Handbook of Innovation

Modality of exam: oral, with possibility of written exams and/or group works during the course (depending on the number of students)

Outline

- Introduction to Innovation
- Innovation in the making
- The systemic nature of innovation
- How innovation differs
- Innovation and performance

The exam will be on the textbook. Powerpoint presentations and classes will help in understanding the subject (DO NOT substitute the textbook!)

Introduction to Innovation

(Chapter 1)

Very (too?) often you hear and read about Innovation...

THE WORLD'S 50 MOST INNOVATIVE COMPANIES



Welcome to our annual guide to the businesses that matter most, the ones whose innovations are having an impact across their industries and our culture. Click a company name to view the entry, or **determine your own ranking** of the top four companies using a series of quizzes, games, and brainteasers.

1 Apple

For walking the talk

2 Facebook

For 800 million reasons to share

3 Google

For expanding its hit lineup

4 Amazon

For playing the long game

5 Square

For making magic out of the mercantile

6 Twitter

For amplifying the global dialogue

7 Occupy Movement

For embodying all the traits that make a Fast Company

8 Tencent

For fueling China's Internet boom--and boldly moving West

9 Life Technologies

For speeding up genetic sequencing

BUILDING NEW BUSINESS
IN ESTABLISHED ORGANIZATIONS
JULY 8-13, 2012

> APPLY NOW

HARVARD
BUSINESS
SCHOOL

EXECUTIVE EDUCATION

ADVERTISEMENT

Top 10 BY INDUSTRY

FINANCE

01 / Square

06 / SecondMarket

02 / Starbucks

07 / American Express

03 / Kickstarter

08 / Dwolla

04 / PayPal

09 / Simple

05 / Y Combinator

10 / StockTwits

WEB/INTERNET



MUSIC



MOBILE



What is Innovation?

... something newly introduced...

... the introduction of new ideas, goods, services, and practices which are intended to be useful...

... the use of a new technology, item, or process to change what goods and services are provided, the way they are produced, or the way they are distributed...

... the conversion of new knowledge into economic and social benefits – now acknowledged to take place as the result of complex long-term interactions between many players in an innovation system...

What does it mean “being innovative”...

... for a firm?

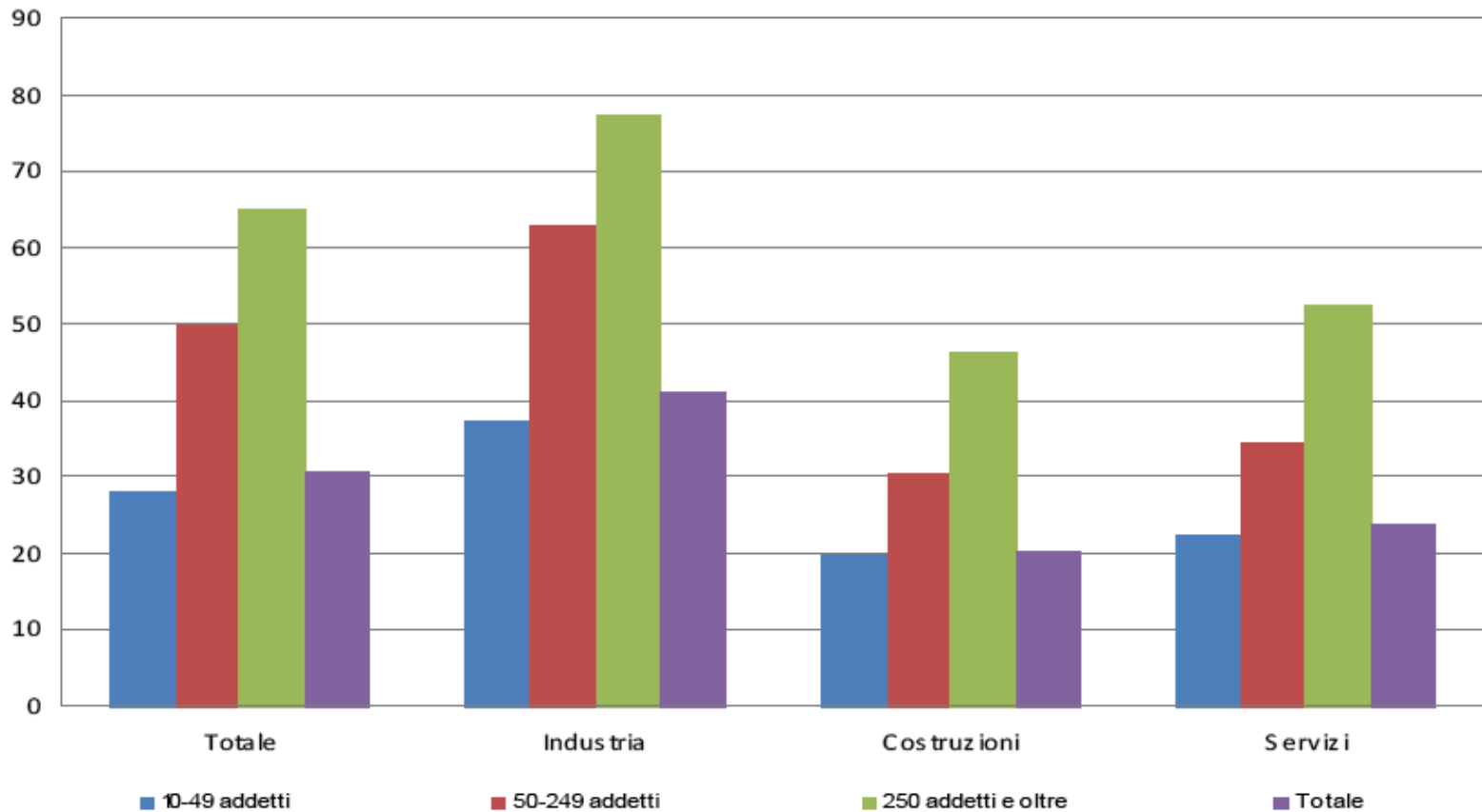
... for a country?

... for a sector?

... over time?

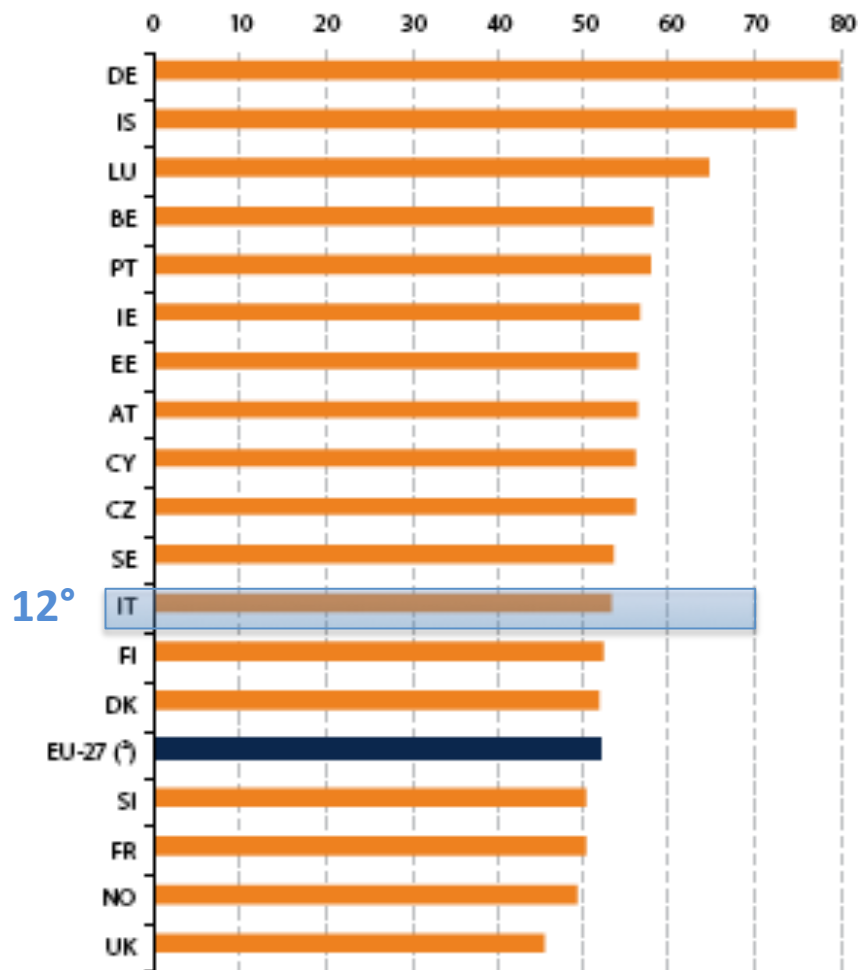
Italian version of the Community Innovation Survey (CIS)

Figura 1 - Imprese innovatrici per macrosetto e classe di addetti - Anni 2006-2008
(in percentuale del totale)



European data from the Community Innovation Survey (CIS)

Figure 5.1: Enterprises with innovation activity, 2008⁽¹⁾
(%)



Some preliminary (operational) definitions

Science: it is the development of *abstract knowledge*, not “finalised” → it can be considered a public good, with the aim of making results publicly known

Technology: it is the “finalisation” of scientific knowledge → it can be considered a more “private” good, used to make profits and increase market shares...

... But it can be more generically considered the “social relation” of resources within the firm → “how” firms produce

Technics: operationalization of science and technology in specific projects, machinery, processes, products...

Invention: a new idea, that has not been created technically, yet → it might even NOT lead to an innovation (flying machines by Leonardo da Vinci)

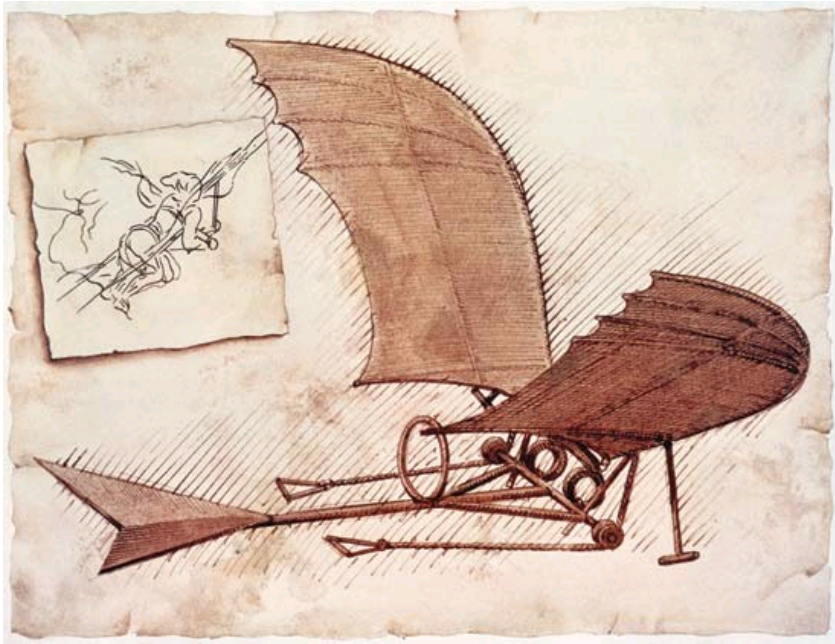
Innovation: implementation of the invention through a new product or a new production process, and its commercialisation

Innovation Diffusion: adoption of an innovation by users (other firms or final consumers)

Schumpeter Mark I and Mark II

Joseph Schumpeter (1883-1950) can be considered as the main innovation scholar in economic history:

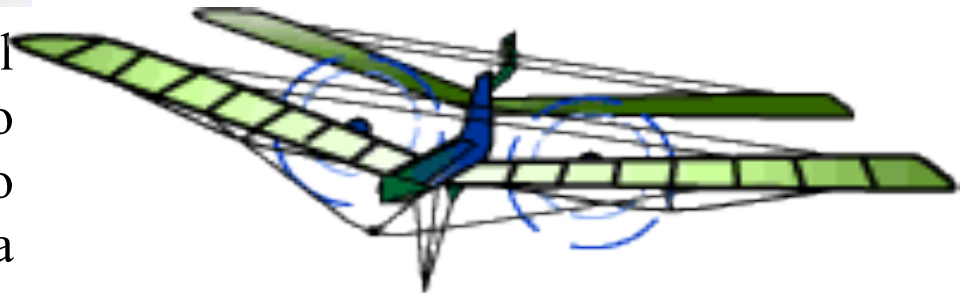
- For Schumpeter, innovation is the key driver of industrial change and economic development;
- He clearly distinguishes between **invention** and **innovation**;
- He changes his analytical view throughout his life, in parallel with the economic changes occurred between the end of the XIX and the first half of the XX century.



Leonardo da Vinci made the first real studies of flight in the 1480's. He had over 100 drawings that illustrated his theories on flight.

The **Ornithopter flying machine** was never actually created. It was a design that Leonardo da Vinci created to show how man could fly. The modern day helicopter is based on this concept.

Langley's Aerodrome Samuel Langley was an astronomer, who realized that power was needed to help man fly. He built a model of a plane, which he called an aerodrome, that included a **steam-powered engine**. In 1891, his model flew for 3/4s of a mile before running out of fuel. Langley received a \$50,000 grant to build a full sized aerodrome.

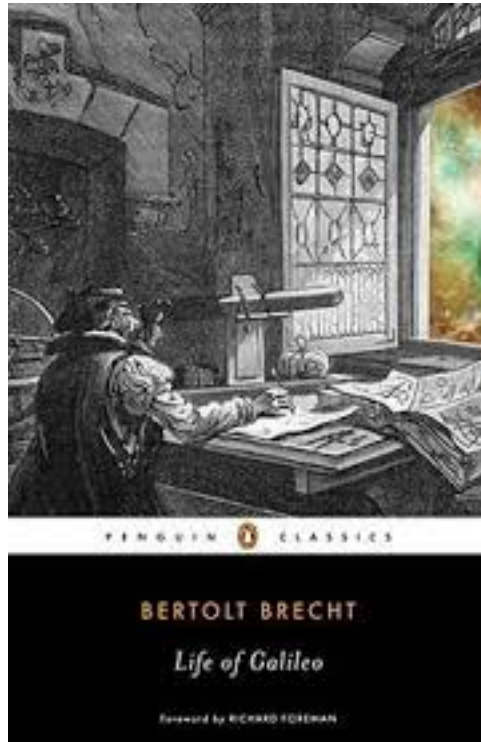


Langley
Aerodrome



Wright Brothers
Kitty Hawk Flyer

Another example!



Innovative firm (we will focus on it in Lecture 2): “a firm introducing successfully on the market, or in its production process, product or service or process innovations” (C.I.S. definition).

Innovation can therefore be defined according to its nature:

- **Technological**: product/service or process innovation
- **Non-technological**: organisational or marketing innovation

Or according to its intensity:

- **Incremental** (today, a new smartphone) or **radical** (the first PC 30 years ago), until real “technological revolutions” (as it has been informatics over the last century)

Incremental innovations are by far more frequent and are considered of higher impact, as compared to radical innovations...

... which are indeed more easily remembered...

Telephone (1861)

Lamp (1883)

Television (1929)

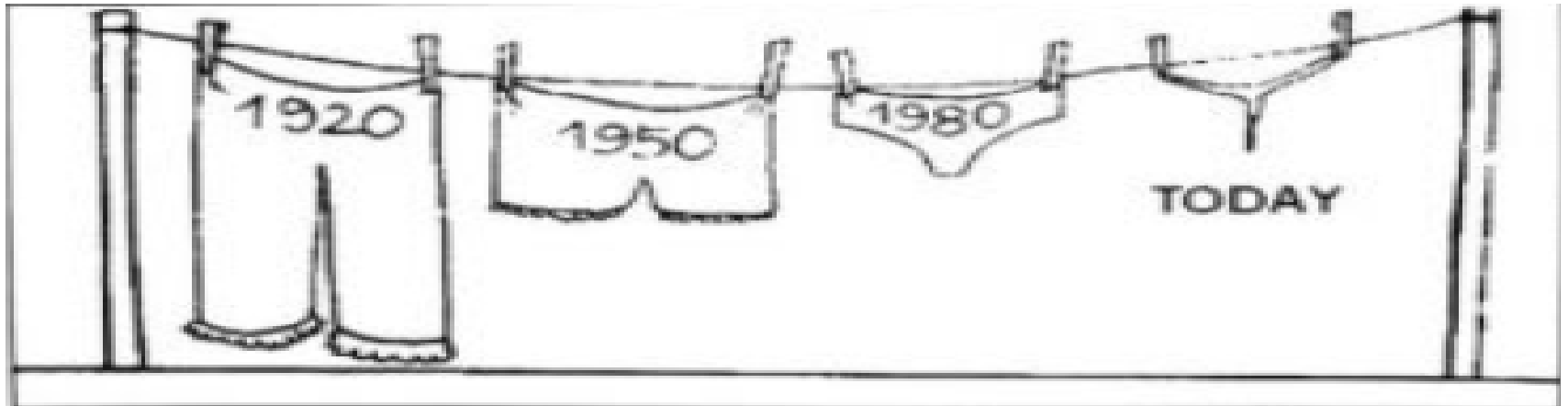
Computer (1946)

Compact Disc (1979)

Mobile phone (1983)

And so on...

Incremental innovations...



Imitation

If an innovation is introduced by another subject, we have **imitation**:

- Firm A is **innovative** as it is the first one to introduce an innovation on the market (e.g. the first mobile phone, produced by Motorola) → **Innovation new to the market!**
- Firm B is innovative in the sense that it introduces for the first time a new product of its own, but that product is already existing on the market → **Innovation new to the firm**, but it is an **imitation for the market** (Nokia enters the mobile phone market at the beginning of the 1990s, while in 1865 it was producing wood → then at the beginning of the XIX Century it was producing rubber → then rubber phone cables, and only then it entered the telecommunications market) [we will see in other lectures this example of Industry Evolution]

A simple (or simplistic) idea of the innovation process

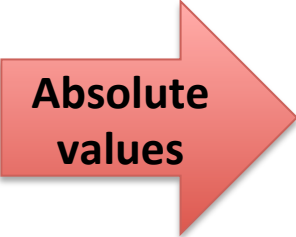
INPUT → INNOVATION PROCESS → OUTPUT

INPUT = Research and development (R&D) or other forms of innovation expenditure (purchase of machineries, patents, licenses etc.).

Innovation expenditure, by type, C.I.S. 2004:

COUNTRY	R&D	Machinery	Patents/ licenses
France	85%	13%	2%
Netherlands	75%	22%	3%
Italy	39%	53%	8%
Portugal	22%	71%	7%

We know Italy is lacking behind...



**Absolute
values**

SPESA PER R&S INTRA MUROS (VALORI IN MILIONI DI EURO)

Spesa per R&S intra- muros (totale)	19.209
Rapporto sul PIL (valore %)	1,26%



%

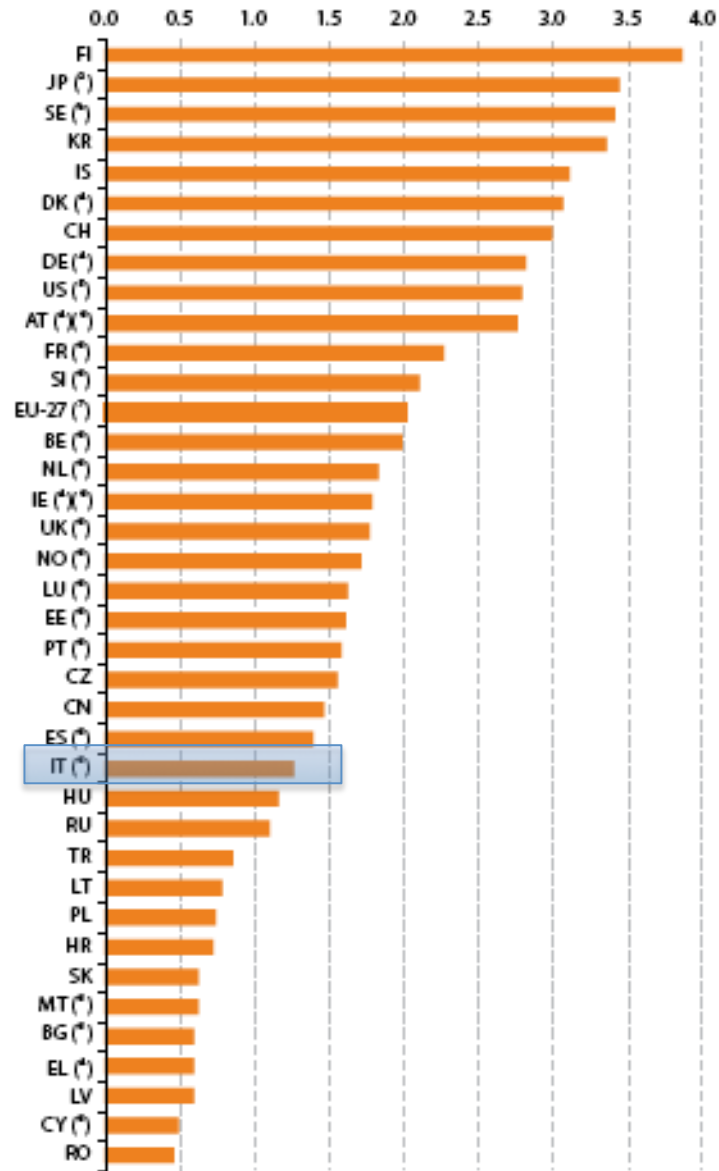
SPESA PER R&S INTRA MUROS PER SETTORE ISTITUZIONALE (VALORI IN MILIONI DI EURO)

Imprese	10.238
Università	5.812
Istituzioni pubbliche	2.525
Istituzioni non profit	634

ADDETTI ALLA R&S INTRA-MUROS PER SETTORE ISTITUZIONALE (UNITÀ ESPRESSE IN EQUIVALENTI TEMPO PIENO) – TOTALE ADDETTI

Imprese	109.768
Università	74.949
Istituzioni pubbliche	33.540
Istituzioni non profit	8.027

Figure 2.2: R&D intensity (R&D expenditure as % of GDP), 2010(?) (% of GDP)



Ranking of Italian companies' R&D, 2010

Italy			number of companies for calculation	55	
1	Finmeccanica	16	Aerospace & defence (271)	7522	1.967,00
2	Fiat	17	Automobiles & parts (335)	3410	1.936,00
3	Telecom Italia	41	Fixed line telecommunications (653)	6420	698,00
4	Intesa Sanpaolo	83	Banks (835)	6511	252,00
5	UniCredit	88	Banks (835)	6511	233,28
6	Eni	91	Oil & gas producers (53)	1110	221,00
7	Pirelli	131	Automobiles & parts (335)	2511	150,00
8	Chiesi Farmaceutici	137	Pharmaceuticals (4577)	2441	146,00
9	PRADA	192	Personal goods (376)	1824	100,91
10	Enel	210	Electricity (753)	4011	89,00
11	Sorin	235	Health care equipment & services (453)	3310	75,04
12	Recordati	246	Pharmaceuticals (4577)	2441	68,84
13	IMMSI	257	Automobiles & parts (335)	3410	62,90
14	Prysmian	276	Electrical components & equipment (2733)	3162	56,00
15	Lottomatica	278	Travel & leisure (575)	9271	54,80
16	Italtel	297	Telecommunications equipment (9578)	3220	49,90
17	Fincantieri	330	Commercial vehicles & trucks (2753)	3550	44,37
18	Terna	338	Electricity (753)	4011	42,40
19	Danieli	339	Industrial machinery (2757)	2924	42,27
20	Avio	349	Aerospace & defence (271)	3530	40,61
21	De'Longhi	357	Household goods & home construction (372)	3663	37,70
22	Poste Italiane	381	Industrial transportation (277)	6412	33,71
23	Benetton	393	Personal goods (376)	1824	32,00
24	COFIDE	402	General industrials (272)	7487	30,22
25	IMA Industria Macchine Automatiche	404	Industrial machinery (2757)	2924	30,08
26	Barilla	435	Food producers (357)	1589	26,91
27	Datalogic	439	Electronic equipment (2737)	3210	25,97
28	Carraro	499	Automobiles & parts (335)	3430	20,59
29	DiaSorin	501	Pharmaceuticals (4577)	2441	20,47
30	Same Deutz-Fahr	505	Commercial vehicles & trucks (2753)	3550	19,97
31	Geox	574	Personal goods (376)	1930	15,69
32	Atlantia	586	Industrial transportation (277)	6340	15,26

Definitions of R&D

Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

R&D can be broken down in:

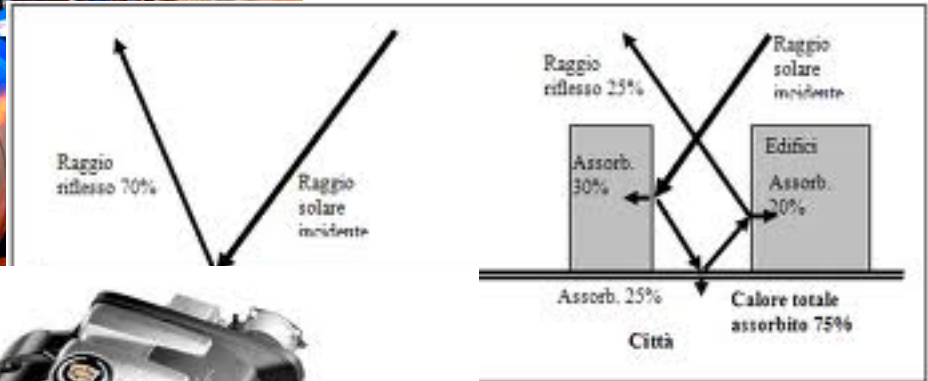
Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

Applied research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

Experimental development is systematic work, drawing on knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed.



Basic Research



Applied Research



Experimental Development

An example for Social Sciences

A theoretical study on the determinants of regional economic growth is **basic research.**

The same study aimed at providing empirical evidence, to support the strategies and policies of a regional government, is **applied research.**

The development of operational models, based on previous empirical evidence, aimed at reducing disparities across regions is **experimental development.**

Finally, the Innovation Output...

OUTPUT = patents, publications and scientific citations, trademarks, technological export → we will study them in details

Both INPUT and OUTPUT Innovation indicators help in qualifying the performance of firms, countries, regions and sectors.

To conclude, the most important question:

*Why are you here, attending this
lecture?*

... apart from being obliged to take University
exams...

Motivations to study the Economics and Policy of Innovation

Economic growth and structural change

Industrial dynamics

Firm strategy

Economic policy

Motivation: economic growth

Economic growth has been faster and stronger than ever, over the last 200 years

A pivotal role has been played by technology, in the linkage between the stage of development (of countries, sectors, firms...) and the level of innovative activities

Diversities (across countries, sectors, firms...): who is *catching-up* and who is *lagging behind*?

Motivation: industrial dynamics

Who is more innovative? Large firms or single entrepreneurs (start-ups)?

Entry and exit of new venture

Diffusion of innovations

Motivation: firm strategy

R&D management

Appropriability strategies

Adoption of innovations

Technology transfer

Motivation: economic policy

Funding of basic vs. applied research

Linkages between R&D and innovation

IPR policy

Competition policies