Talking about Science
Why? Who?

Giorgio Chiarelli
INFN Pisa
giorgio.chiarelli@pi.infn.it
June 13-17, 2022

Why do we talk to the outside world?

Answer to external request

Answer to internal request
(need to be known/recognized)

- What do you do? What is your job?
- "What is your mather/father's job?"

Social responsibility

- We live in communities (and need their support)

External support (resources...)

- This one is not new: already in XVII century (public support and financing)

Beware

- Outreaching is not mandatory, and is not *built in* the structure of *any* research (let alone the scientific one)

Do we know how science works?

Science, according to R.K.Merton (1942) follows a set of rules: **CUDOS**:

C*ommunism*

U*niversalism*

D*isinterestedness*

O*rganized* ***S****kepticism*

Communism prescribes that knowledge does not belong to the individual scientist, but to the whole community

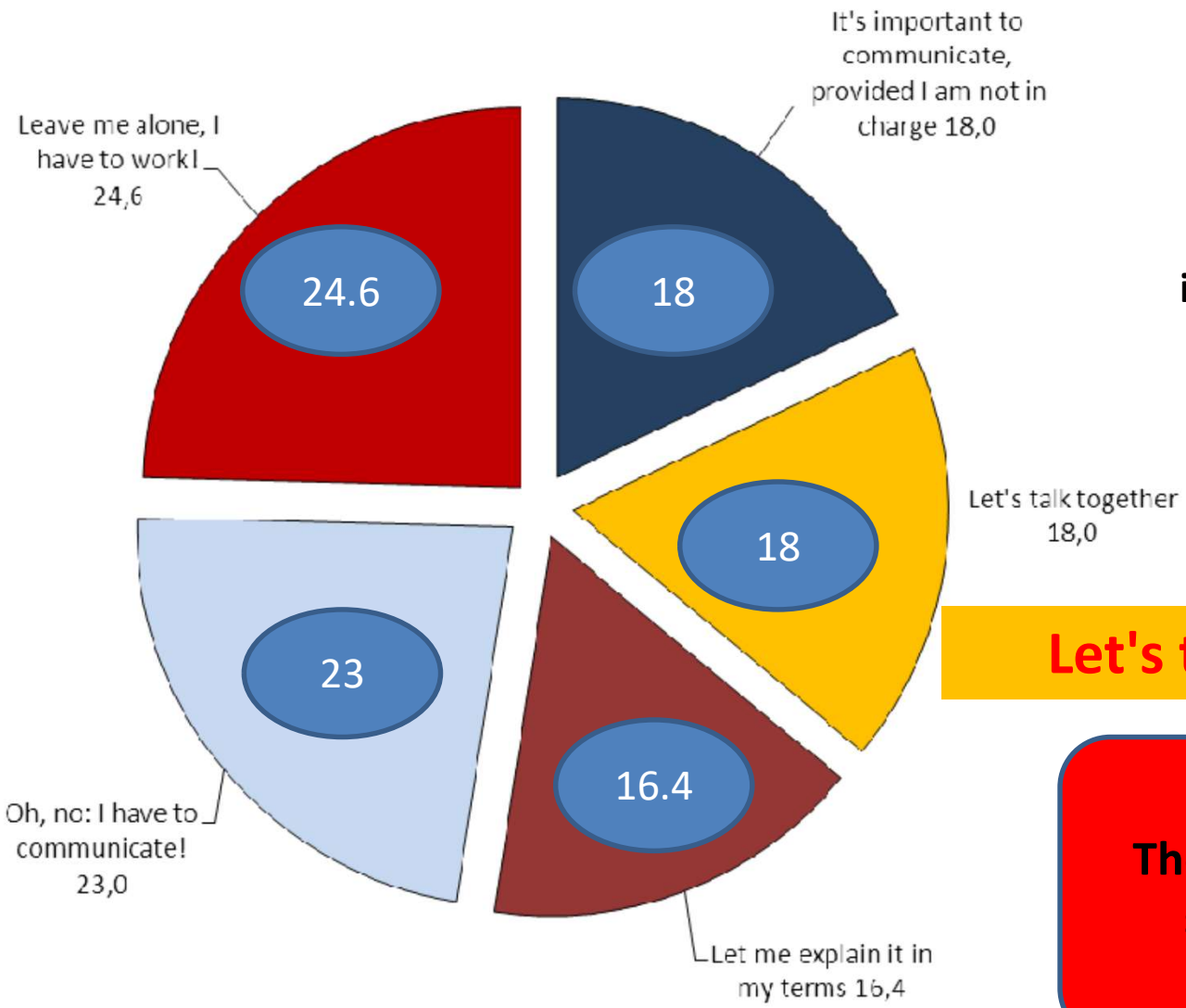
Universalism...Science belongs to everybody...

- There is no mention of interaction with the outside worlds,

This implies that:

- You need to convince researchers to interact

"Public" & "researchers" Bucchi, 2014



Leave me alone, I ought to work: 24.6%

Oh My God, I must communicate!: 23%

Communication is important, but I cannot do it: 18%

Let me explain in my terms: 16.4%

Let's talk together!: 18%

These figures undescore a serious cultural issue

Where do we come from?
From *Turris Eburnea* to *Citizen Science*

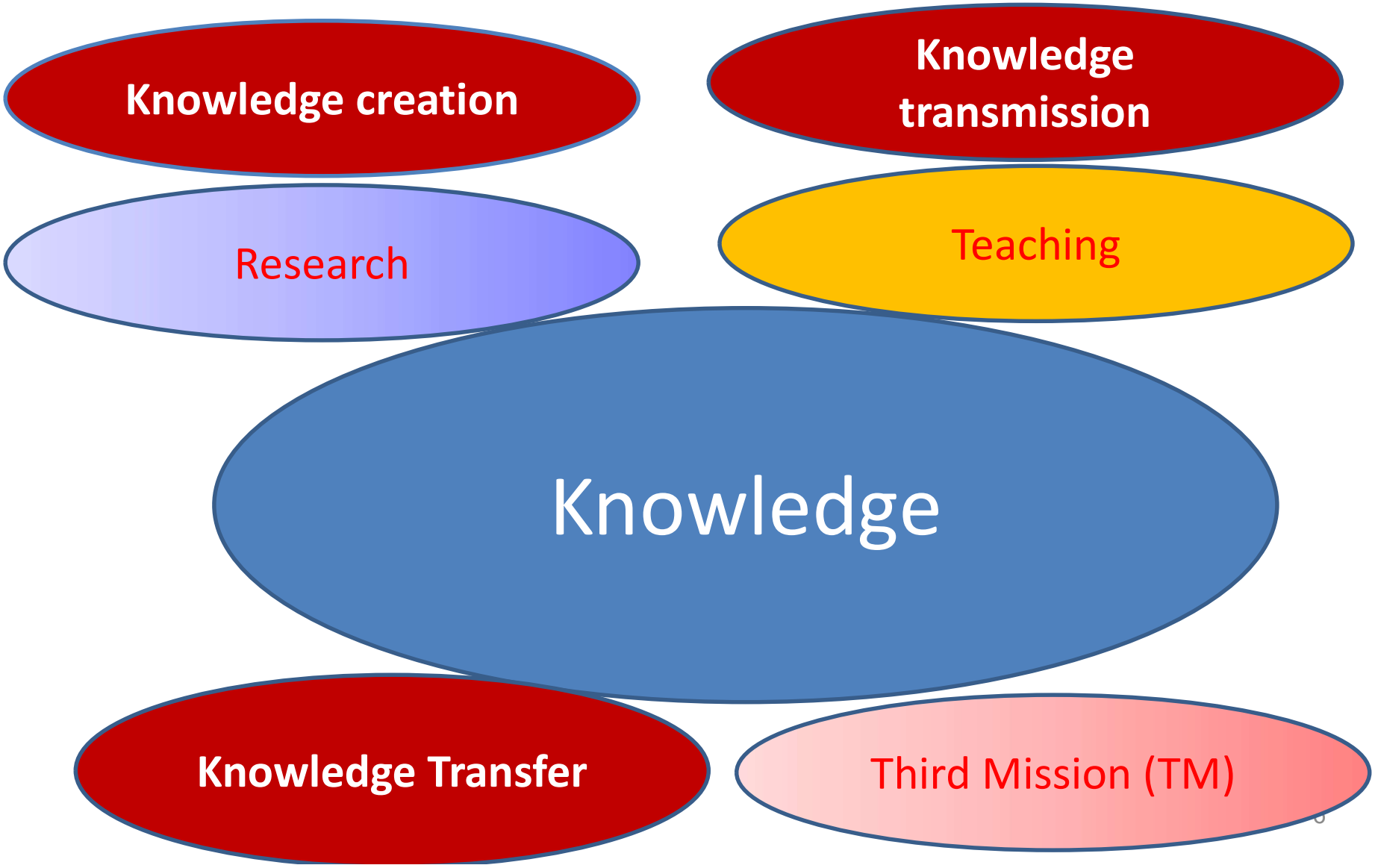
How did we go from *Turris Eburnea* to *Public Engagement?*

- Curvy path, diffent roads, different countries have different history

- Its is utterly important to set actions/choices in the correct historical perspective

Now let's see how and why we did this journey

Some definitions



Universities and their mission(s)

The Humboldtian model was imagined for an elitè university, based on

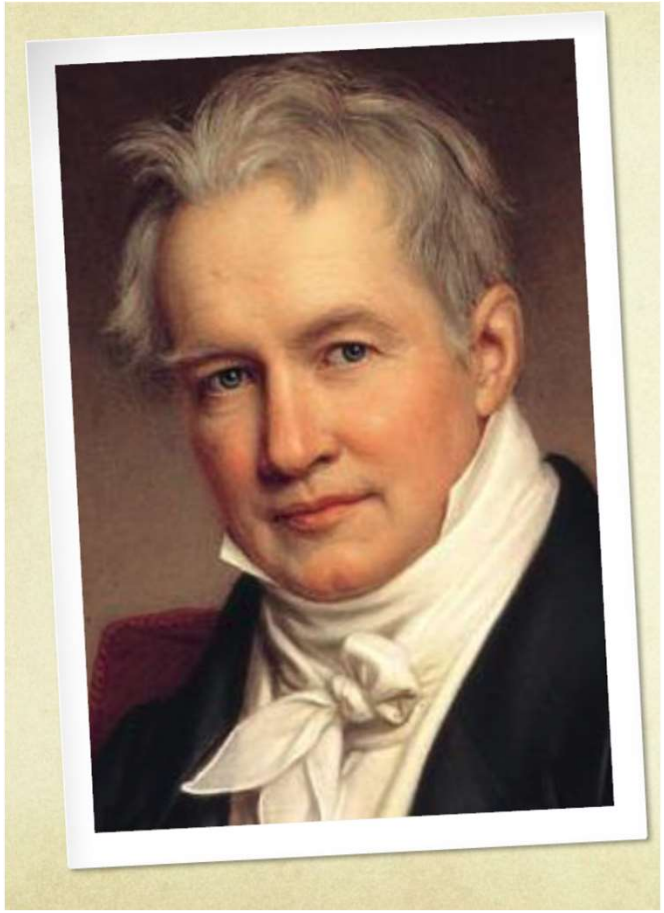
- Education (teaching)
- Research

It dates back to 1810 and exercised its impact well outside Germany

- There was no room for "market oriented" mission
- Its crisis started in the last decades of the XX century

The emerging role of Third Mission is strictly linked to a change in the role of Higher Education Institutions wrt this model

- Anglosaxon world has its own tradition
  - Will come back to this point



Wilhelm von Humboldt

Is it something new?

Second half of the XIX century is the golden age of diffusion of science

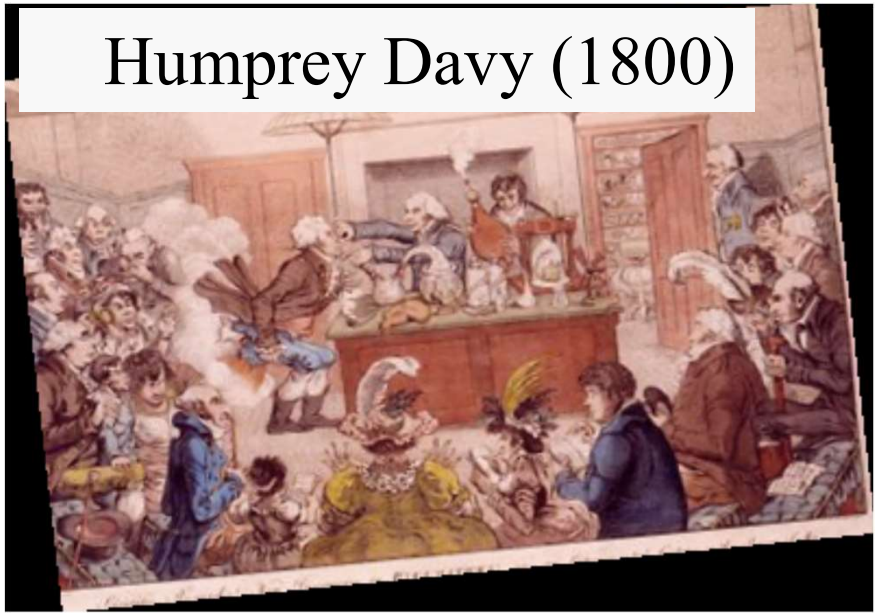
- In UK *Nature*
- In Italy *La Natura*

Back then, popularization of results was part of the scientists' job

- Charles Darwin
- James Clerk Maxwell

In Italy

- Lessona, Mantegazza



But then the XX century arrived..

Where do we (scientists) come from?
The Age of Extremes (The short Century)

WWI was the first "modern war" in which science had a strong impact on warfare. Just a few items:

- Radiotransmission
- X-ray
- Planes
- High power explosives
- Poison gases
- ...

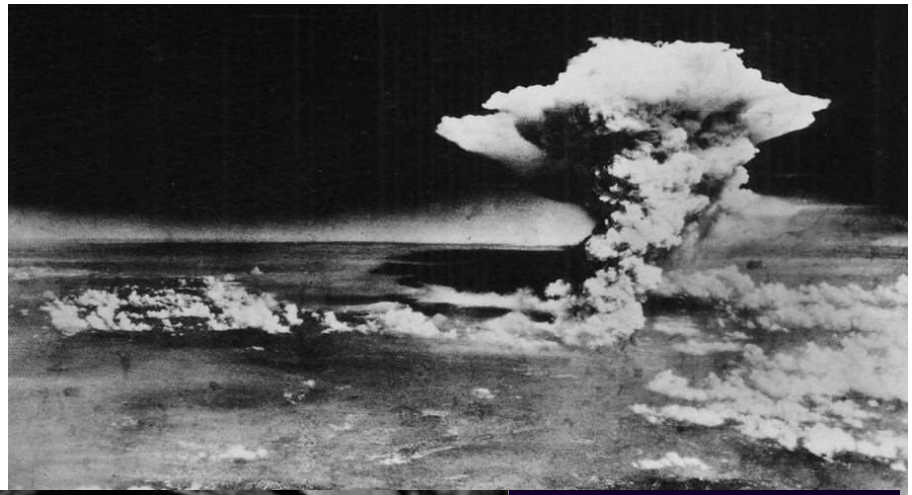
WWII marked by

- Radar
- pennicilline
- Planes
- missiles
- Bomb
- ...

Cold War

- ...

In WWI strong links between academic world and military



Paradigm of the «endless frontier»

In July 1945 Vannevar Bush wrote a fundamental report for President F.D.Roosevelt:

- *Science, the endless Frontier*
  - It set the relationship between science and society through the Cold War
    - URSS dissolved in 1992

Paradigm:

- «give us funds and we will give you power and wealth»

In the '80-'90 of the '900, model crisis:

- Society asks for (an almost) direct "return"

Knowledge Transfer in an historical perspective

Request to give "something back" had a first push by the economic crisis of the '70s

- first legislation on patenting (Bayh-Doyle Act, USA, 1980)
- "a lot of know-how was somewhere in academia"

This push went global with the end of the Cold War

- Beware: a lot of technlogical developments were not accessible to civil research/industrial sector
  - Rad-hard electronics, SiPM (to mention something familiar)

There are many ways to "give something back", but you need to *demonstrate* the impact of your research on society

Knowlegde Transfer is born!

- Beware of myths:
  - CERN Knowledge Transfer Office dates back to 1999

Economics of Science

Science, big or small, needs money, people, and time

- With money you can buy equipment but you need (skilled) people to advance in knowledge
- You can buy time with money (hiring more people). In any case you need to feed the skilled people.
  - If you are not convinced, take a look at Galileo's letters to Medici after the discovery of Jupiter's satellites..

Big science was born in Los Alamos

- Scientists discovered how to get an infinite amount of money

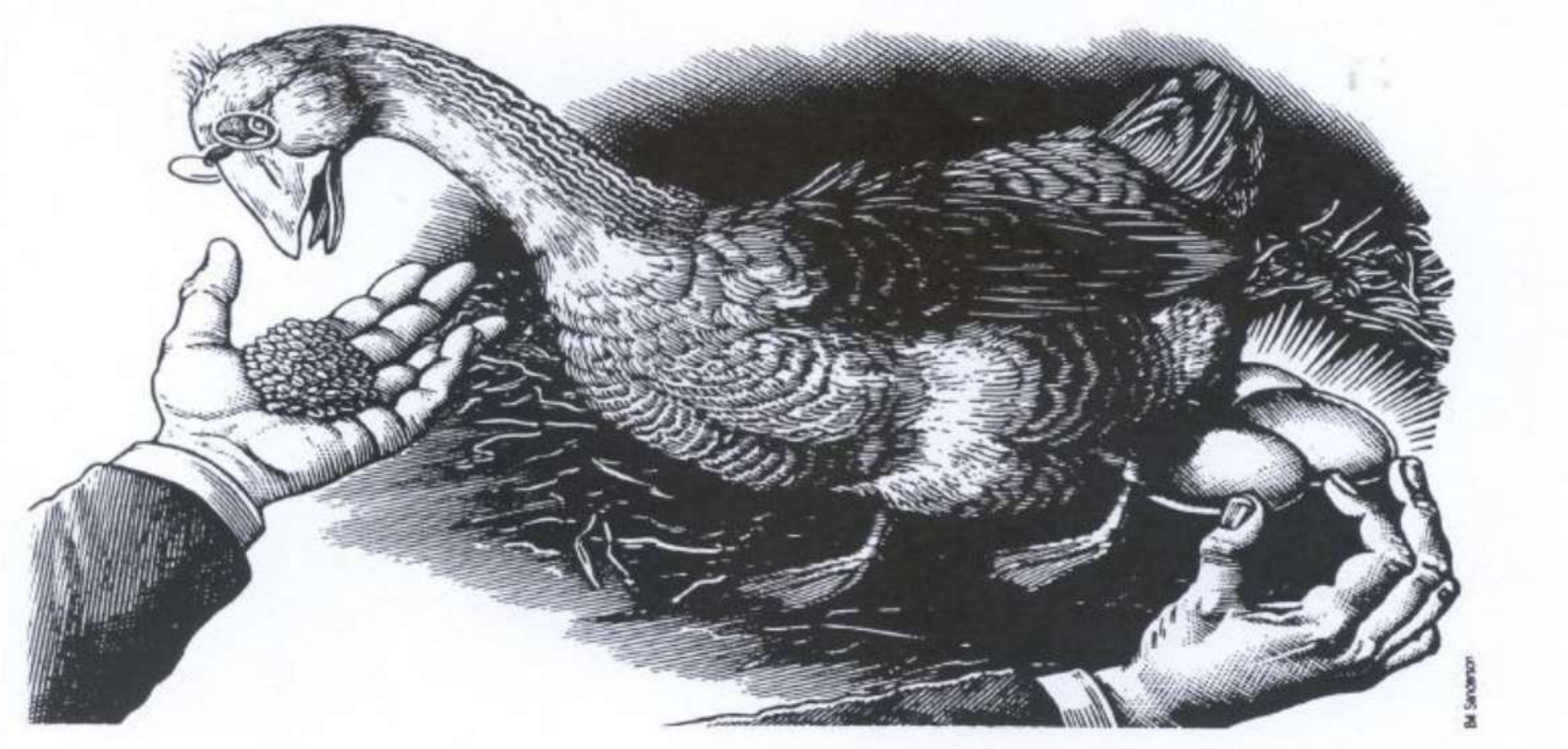
Nowadays big science is not anymore limited to physics.

Another "big science" is space

- NASA has the biggest budget for "non-military" (dual use)

Genoma project *is* Big Science

Vision of science...



Science, The Endless Frontier (Vannevar Bush Report, 1945)-- the goose with the golden eggs

New Scientist, 99 (21 April 1983), 142

This has been the paradigm after WWII, until the end of the Cold War. Passing of this vision, is the basis of emerging new, and different requests to scientists, and to the HEI system at large

The rise of the *Public Understanding of Science*

Early '80's: in UK neoliberism recipes (*Thatcherism*) hit hard on research

- Funding cuts (CERN), brain drain, drop in enrollment...

The answer:

- Royal Society report (*Bodmer Report*), in 1985 set the paradigm of the *Public Understanding of Science*
  - Lack of knowledge in the public creates lack of support
    - Also known as "deficit model"
  - The best investment is "..to educate the public on the value of research"
    - If you can do it early on you will target the future leaders
- Mind you: first mention of *Public Understanding of Science*
  - Nature, April 3, 1943 (yes!), courtesy of F. Scianitti

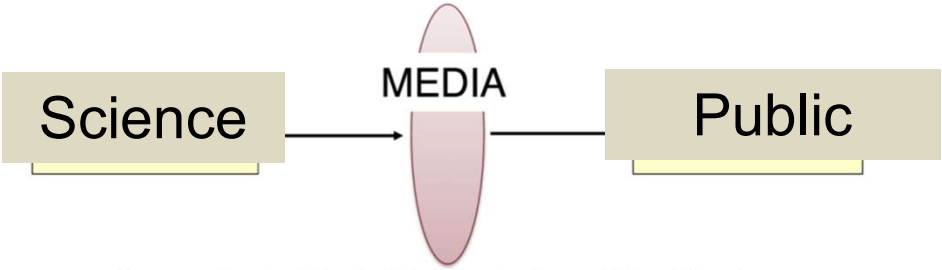
Public Understanding of Science (PUS): achievements and crisis

In the 20 years since 1985, the *deficit model* (PUS) becomes the paradigm of the relationship between science and society:

- Countless resources invested in filling the "knowledge gap"
  - "top-down" approach

This approach follows a linear model of interaction

- Simple and appealing
- ...but limited effectivness



La concezione tradizionale della comunicazione pubblica della scienza

...this paradigm came under fire about '00

- Facts:
  - Modest achievements
  - We realized that scientists are one of the (many) social players
- Rise of *citizen science*
  - AIDS: role of activists in understanding the pandemia
  - Several post-Chernobyl accident (1986) studies (eg. radiation levels related to the eco-system)

Time for change

2002: *Science* publishes a short note"from *Public Understanding of Science* to *Public Engagement in Science and Technology" (PEST):*

- ".. It is no longer enough for science communicators to "*simply educate the public*"... *(Secretary of Science, Lord D. Sainsbury)*
  - Be open to discussion, take part in *hot* debates,
- *Engage* meant as "committment" but also "participation"

The (widely used) definition is:

- *Public Engagement* is
  «the interaction of experts with non-experts»

The definition is broad and correct

- Interaction is a "two-way",
  "expert" today is "non-expert" tomorrow

The role of experts or "Whom is trusted by Italian citizens?"

	Credible/Very Credible			Not credible/very little			Don't know/Don't Answer		
	2012	2016	2020	2012	2016	2020	2012	2016	2020
Web sites of Research Institutes	69.5	73.9	72.8	29.3	23.8	26.9	1.2	2.3	8.9
Science Popular Journals	72.2	78.2	75.1	23.1	15.2	17.3	4.7	6.6	7.6
Researchers' Public Talks	72.4	78.8	84.6	23.2	16.5	11.9	4.4	4.7	3.5
TV Science Specialized Broadcast	66.4	72.9	74.7	20.8	17.0	21.6	12.8	10.0	3.7
Researchers' Blog	63.1	65.5	61.4	40.4	27.6	28.3	4.4	6.3	6.5
Scientific Pages in Newspapers	55.2	66.1	65.2	40.4	27.6	28.3	4.4	6.3	6.5
Specialized Radio broadacast	48.1	67.0	67.3	29.3	23.8	18.3	3.0	1.0	1.2

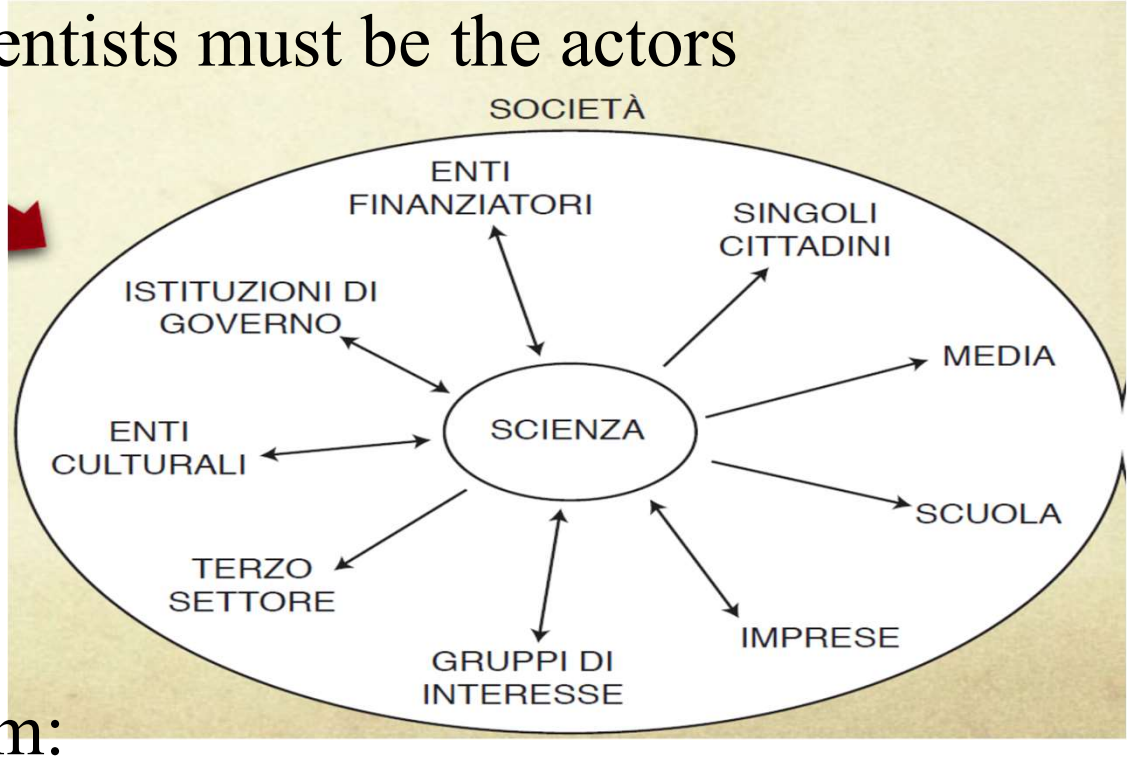
Biennal survey (since 2010) by *Observa, Science in Society*

Role of the Web 2.0 revolution

This data imply that scientists must be the actors

- Change of model, change of role

Internet 2.0 is a turning point.



There is a new paradigm:

- Information is available to everyone
- Direct approach to original fonts
  - 1-to-1 (or "business to consumer")
- Public wants to directly interact with researchers

Responsible Research and Innovation

Big success (now gone) of scientists' blogs is an example

- Higgs Boson madness is another one

At the same time, at political level, you realize that science is called (sometime!) not only to provide information but also to make choices:

- There are several interesting studies on nuclear accidents at Sellafield, UK. I am waiting for one on the Xylella case in Italy
- Growing awareness that "without scientific knowledge, you are not a citizen, but a vassal" *(Lamberto Maffei, 2019)*
  - This kind of comments were taken down...**before** March 2020...
- COVID19 brought these issues to the general public

Society (whom we belong) is calling for a

- Responsible Research and Innovation (RRI)
  - European Union Commission: "Science With And For Society"
  - Reasearchers are asked to be part in a two way interaction with the different social players

Beware: we are not talking only of individuals, is a duty for the whole research world

Food for thoughts-I

Public?

- There is no such thing as <u>a public</u>
  - Students
    - Elementary, Middle/High Schools, Pre-schol, university
  - Teachers (see above)
  - Politicians (national/local)
  - Civil Servants (all level, roles)
  - Journalists
  - Opinion-maker (influencer?)
  - Entrepreneurs (commerce, manifacturing etc.)
- There are *publics*
  - Even scientists are one of them

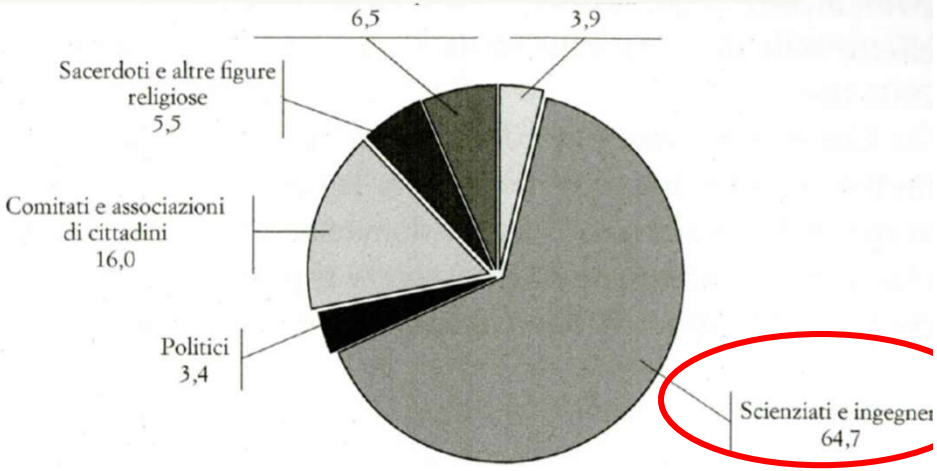
Tools?

- ~~*"one size fits all"*~~
- Different tools and languages
  - Traditional Media
  - Social
    - To each one her/his own
- Science Fairs...
- Seminars
- Science Cafè/Ape
- New media
- Web provides instruments, but also creates new situations
  - We have no choice: transform issues (eg. fake news) into opportunities

Food for thoughts II: Know your public!

Observa Science in Society publish an annual report

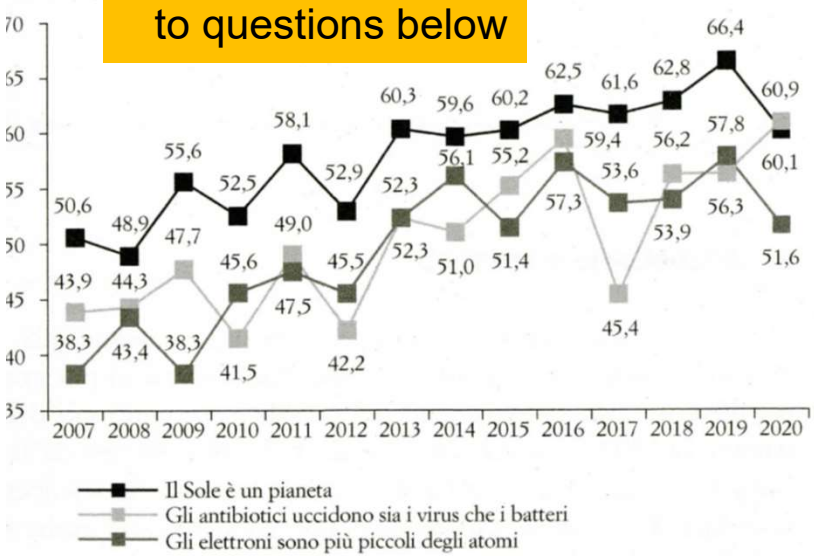
- Biennal survey on science image



Credibility of different figures

You can find useful data to avoid con[illegible]s

% of right answers to questions below



Consistent framework: scientists are credible wrt other public figures.

Growing request to *directly* access scientists to ask questions/talk

"Science Communication 2.0"

Direct relationship between the *science producer* and the *science user*

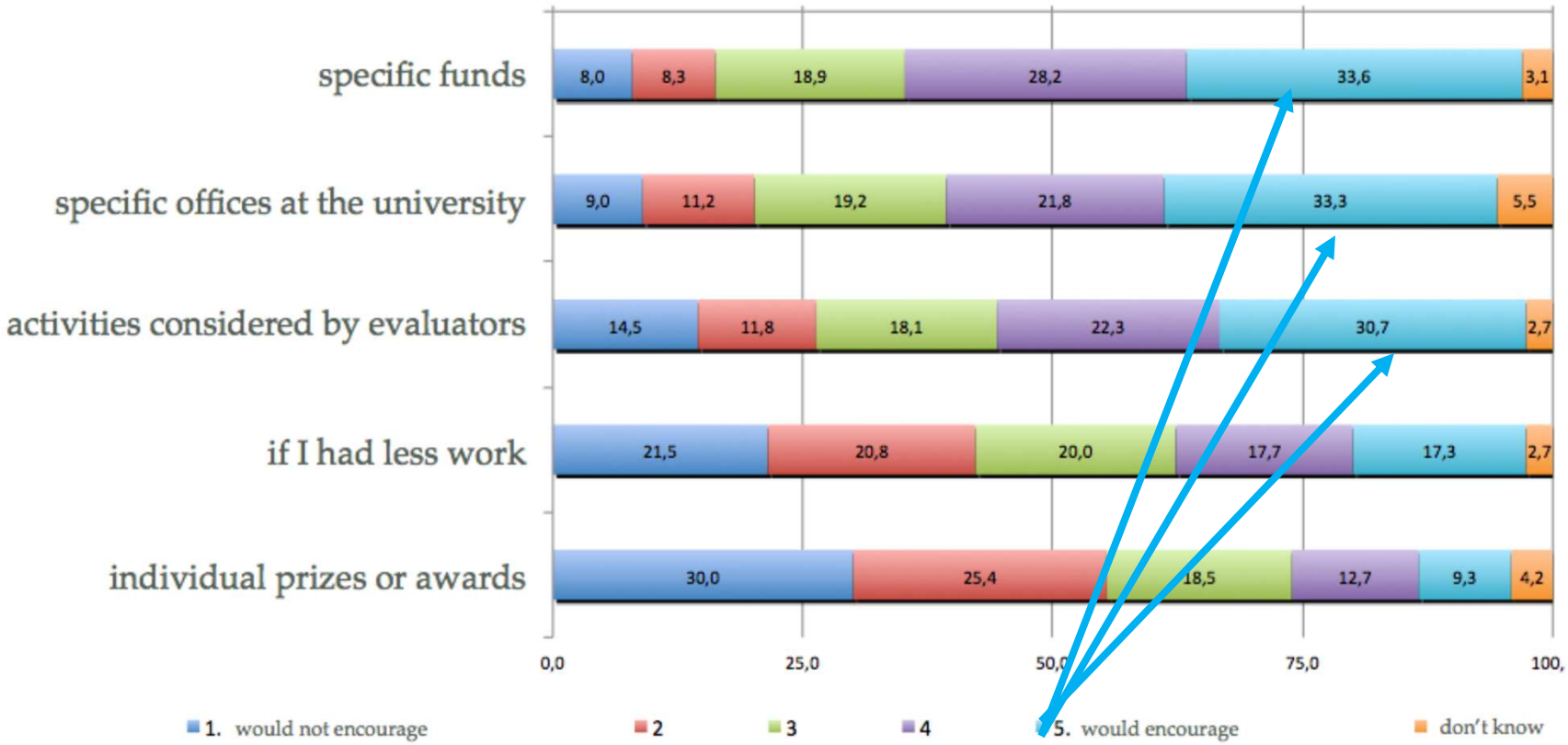
No mediation!

We must be the main player!

Know your needs: What do researchers want?

Remember: it is a voluntary activity

- Help researchers in doing it!



Font: research project *ISAAC, Agorà della Scienza (Turin)*

COVID19

2020 was a point of no return.
Remember, a pandemia happens once in a century or so:

- CDC, epidemiologist, virologist, vaccinations, double blind, placebo, molecolar tests, antigenic tests, spike protein, virus, coronavirus, spagnola, herd immunity...

Public role of scientists surfaced in all its aspects. We all saw the limit of a "top-down" communication.

- We physicists were just more knowledgeable than average citizen on statistics
  - What about virology?
- Were you upset by the information pandemia?
  - Cacophonia of languages

TAB. 2. *Scienziati visibili (%; 2018: n=985)*

	Non so chi sia	L'ho sentito/a nominare	Ho letto/visto sue interviste	Sono interessato/a a tutto ciò che lo/a riguarda
Carlo Rubbia	35,6	35,0	24,1	5,3
Stephen Hawking	43,0	22,2	24,5	10,3
Ilaria Capua	60,0	30,2	9,0	0,8
Fabiola Gianotti	60,5	26,7	11,6	1,2
Marica Branchesi	71,9	20,5	6,8	0,8
Craig Venter	78,3	14,9	6,0	0,8

Future?

Underlying the issue of *Public Engagement* is the problem of <u>research impact</u>

- The making of science is not a linear process

Your (our) challenge is to tell this fascinating story!

To preserve quality as a cornerstone of research evaluation and impact assessment, Science Europe developed and champions the following principles and actions:

- The importance of knowledge creation and the wide range of values and options that research brings to society should be emphasised.
- Many different pathways exist that connect research and its applications. As a result, no single impact assessment practice can ever fully capture the value of research and there is no one-size-fits-all practice.
- The notion of impact should be broadened. Flexible approaches to assessing it should be adopted, ensuring methodological diversity and appropriateness.
- Processes that reinforce mutual trust between researchers and society have to be supported.
- Processes that recognise the impact of international collaboration should be put in place.

Statement by ***Science Europe*** (https://www.scienceeurope.org/)

Deal with reality.
Not all places are alike

University of Cambridge is the **3M European Champion**

- UoC Has an history of relations with the region and a special focus on the Cambrdigeshire county
  - «This seems to be an aspect related to the role played by the University within the social and economic life of the region, but also related to a ***peculiar AngloSaxon sense of community*** that perceives ***the efforts made by public institutions*** for Community engagement ***as an ordinary activit***y»
- In Cambridge there is the freedom for individuals to come with proposals and freely pursue their 3M passions

This path to 3M is strongly linked to UoC history:

- In the medieval charter of several English universities (Oxford, Cambridge), the development of the county was part of the academic mission

This example was inherited, for example, by the *Engaged Universities*,
born in the aftermath of the US Civil War (1861-1865)

- Land in exchange for social-economic development through education

One more example, the "Taxpayers's $"

A few days ago the new Head of DoE Office of Science was sworn in

U.S. DEPARTMENT OF ENERGY | Office of Science

Message from the Director

Dear colleagues,

It is an honor to introduce myself to the Office of Science laboratory community. I'm ready and excited to pour my energy into making sure that we continue to be the world class, powerhouse science agency we have always been, and the steward of the research crown jewels that our labs represent. My first and foundational goal is to support, enable, and advocate for the work you all do to realize our shared vision: to

Asmeret Asefaw Berhe being sworn-in as Director of the Office of Science on May 19, 2022.

"...We have a responsibility to equitably **serve the diverse communities of taxpayers that make our scientific careers possible** and support our love of scientific research. It is my hope that we can make a tangible difference to not just advance science, but to also develop the scientific workforce of tomorrow and communicate our science and its value to society..."

Summary

The traditional mission of Higher Education Institutions is now complemented by

- An active role as a social actor
- A request for accountability of use of resources and choices

Push for change is related to the request from society to improve quality of life

- This definition covers much broader aspects than just economics, therefore nobody in research can (should) retract from this role

Not only the Ivory Tower has gone long ago

- Now citizens want empowerment

Get Involved!

Additional Material

Backup

Readings:

On the historical perspective, some useful readings:

- Vannevar Bush: *Science, the Endless Frontier,* Washington, July 1945
- R.K.Merton *The Sociology of Science,* Chicago 1942, 1973
- Barbara Holland*, Toward a Definition and Characterization of the Engaged Campus,* Metropolitan Universities 2(3), 20-29

On Science and the Cold War there is a very large literature, this book has a wide coverage of different aspects:

- N.Oreske e J.Krige: *Science and Technology in the Globl Cold War,* MIT Press, 2014

On the Public Engagement:

- *Science in Society: a Challenging Frontier* www.esf.org
- HEFCE, *Beacons for Public Engagement*, HEFCE 2006/49, webarchive.nationalarchives.gov.uk
- https://www.publicengagement.ac.uk (this is a site of the National Coordination Center for Public Engagement)
- C. Owen et al. ***Responsible research and innovation: From science in society to science for society, with society***; in Science and Public Policy 39 (2012) pp. 751–760, doi:10.1093/scipol/scs093

An excellent example of "community empowerment":

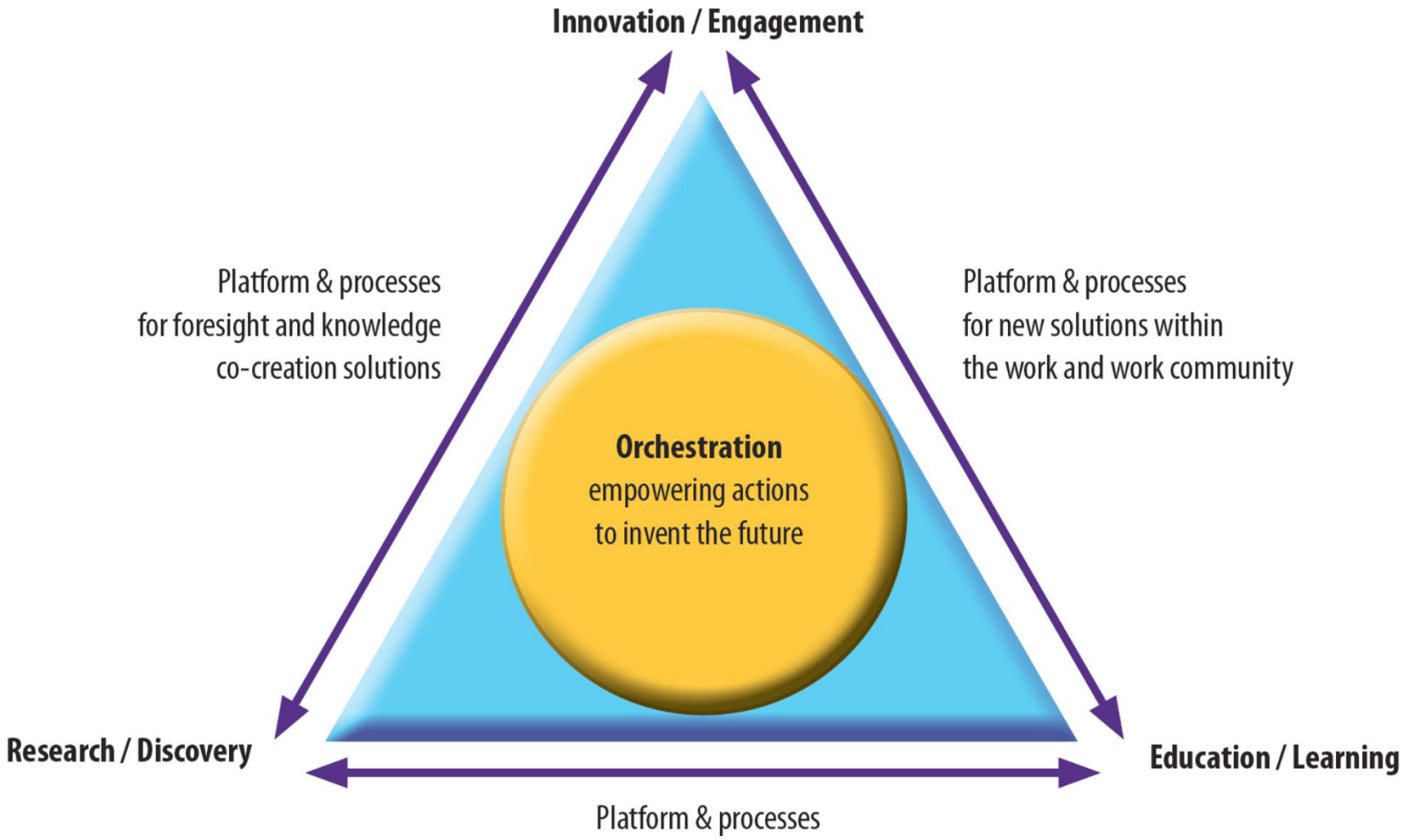
- https://www.fermilabcommunity.org/

The *triangle of knowledge* and the impact:

- Marku Markula, *The Knowledge Triangle Renewing the University* Culture, in *The Knowledge Triangle*, Pia Lappaneine, Marku Markula eds, 2013
- https://www.scienceeurope.org/our-resources/position-statement-on-a-new-vision-for-more-meaningful-research-impact-assessment/ Position statement from Science Europe on Research Impact

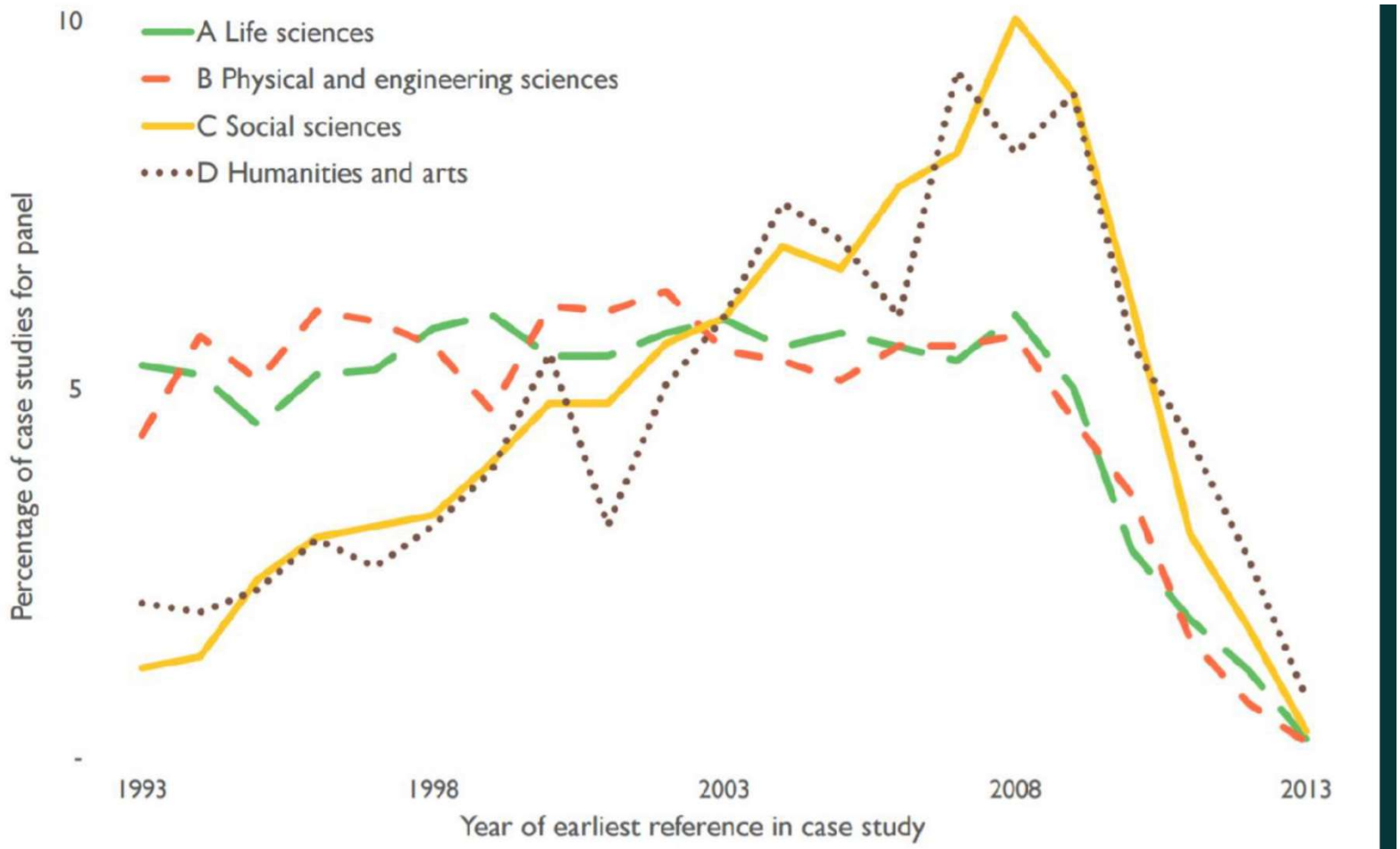
OCSE view of impact

Knowledge Triangle



Time lags

Time lags between first relevant "pubblication" and the moment in which it had impact



Source: Digital Science (2016): Publication patterns in research underpinning impact in REF2014
https://is.gd/hefce_dsreport2016

From Steven Hill (Hefce): *Research impact and its assessment: lessons from the UK Research Excellence Framework,*

Talk at *Open Evaluation Conference,* Vienna, 24 November 2016