



**FUSION
FOR
ENERGY**

Challenges in Big Science Procurement: the ITER Experience

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Holland@CERN, 31/5/2016



Outline



- 1. The ITER project**
- 2. ITER relevance to EU industry**
- 3. Big Science procurement and industry**
- 4. Challenges in connecting**
- 5. Big Science cooperation as a tool**



Video
“ITER in 5 Minutes”



The ITER site now

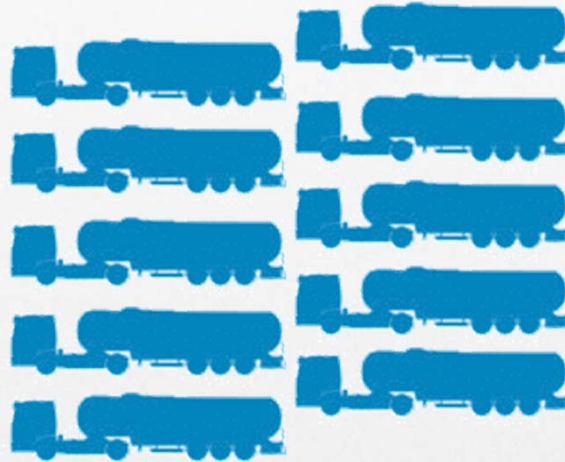




Why is Europe interested in fusion?

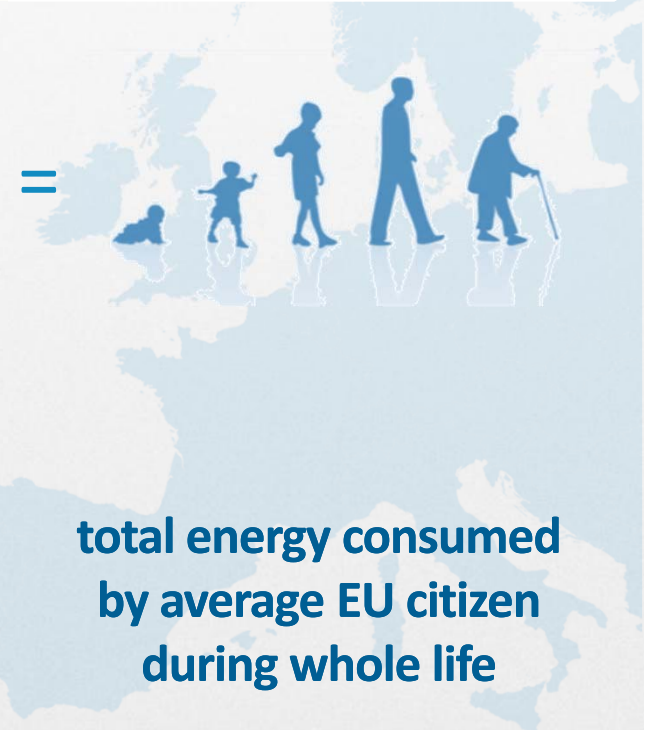


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Earth contains enough fusion fuel to last until the end of life on the planet



280 liters of Earth crust
(50 g lithium)

+ 400 liters of water
(12 g deuterium)

300 t of oil

**total energy consumed
by average EU citizen
during whole life**

ITER main actors in Europe



ITER Organization

- ▶ ITER integration and operation team for ITER
- ▶ 7 parties
- ▶ Headquarter: Cadarache, France
- ▶ Staff: 500+
- ▶ Budget to 2020: ~2.6 billion EUR



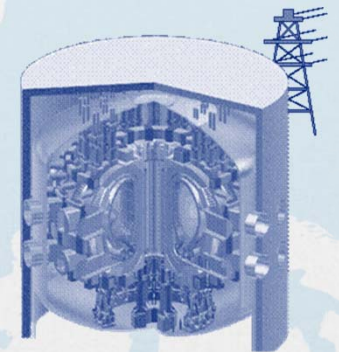
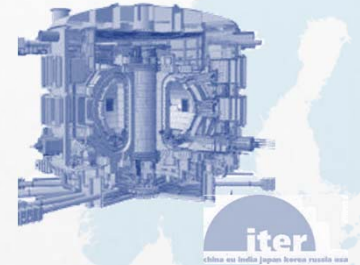
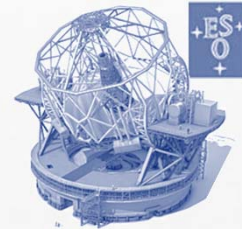
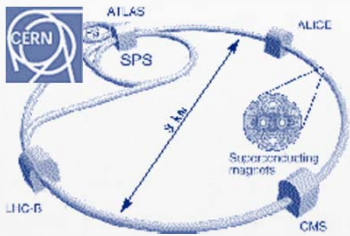
Fusion for Energy

- ▶ European domestic agency for ITER, procuring and delivering 45% of ITER components
- ▶ 29 member states (EU28 + CH)
- ▶ Headquarter: Barcelona, Spain
- ▶ Staff: 450+
- ▶ Budget to 2020: ~7.4 billion EUR





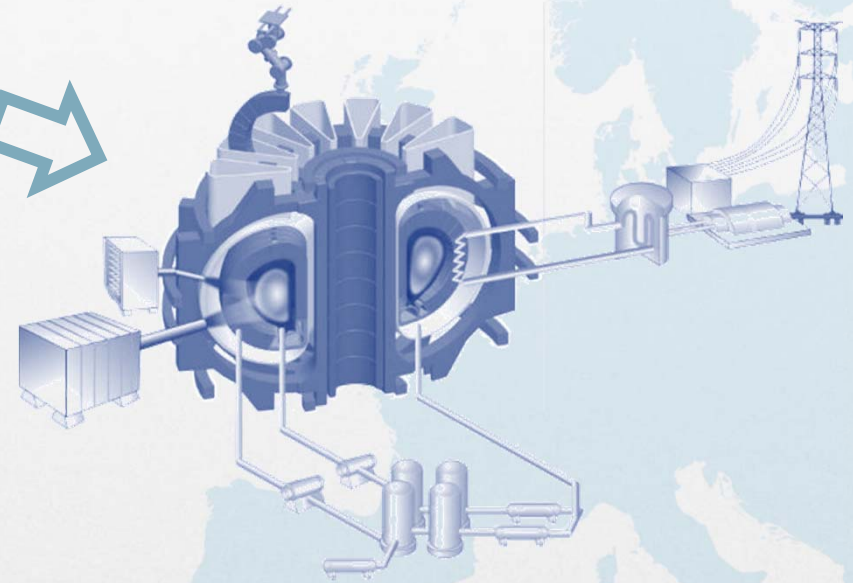
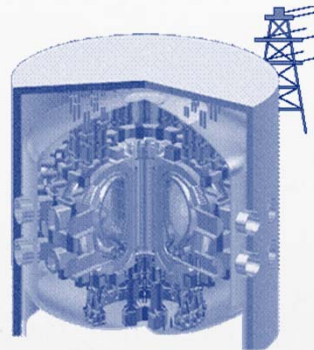
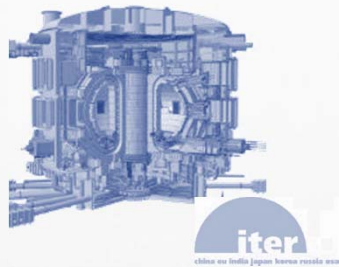
S&T projects with a difference



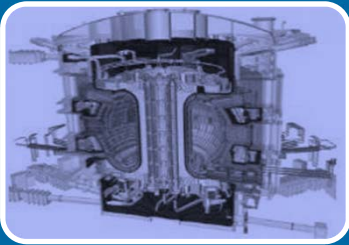
ITER is a step along a longer path



Towards commercial power-plants

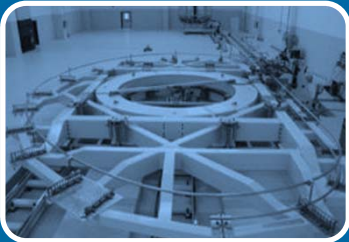


ITER is also about industry and supply chain



First Objective (Priority)

Deliver the European contributions to ITER and the Broader Approach within the agreed budget and schedule making best use of the industrial and research potential and capabilities of all F4E members, in line with competition rules



Second Objective

Broaden the European industrial base for fusion technology for the long-term development of fusion as a future energy source and to ensure a strong and competitive European industrial participation in the future fusion market

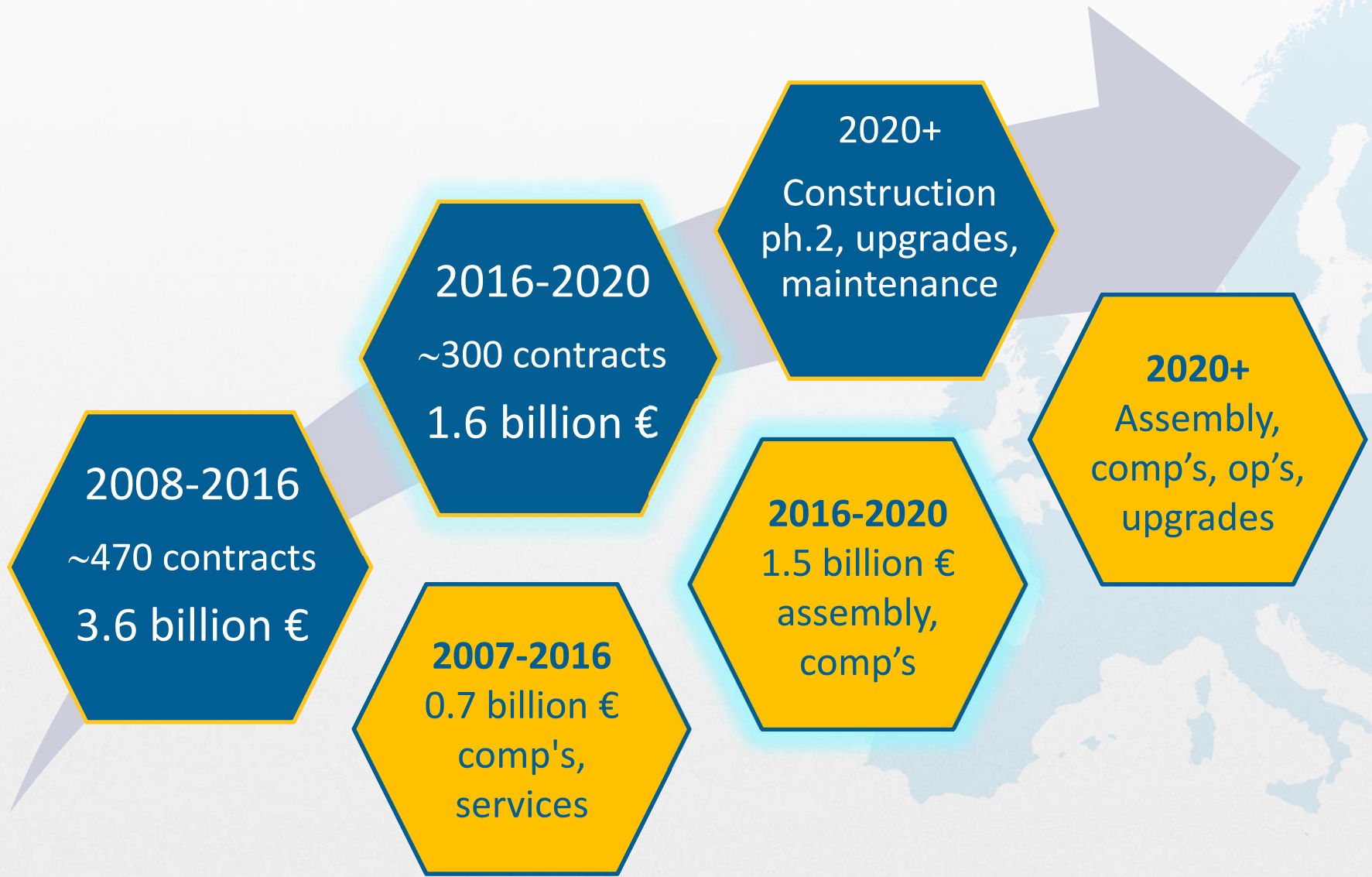


Third Objective

Foster European innovation and competitiveness in key emerging technologies to further the development of the Innovation Union and its impact at the international level.

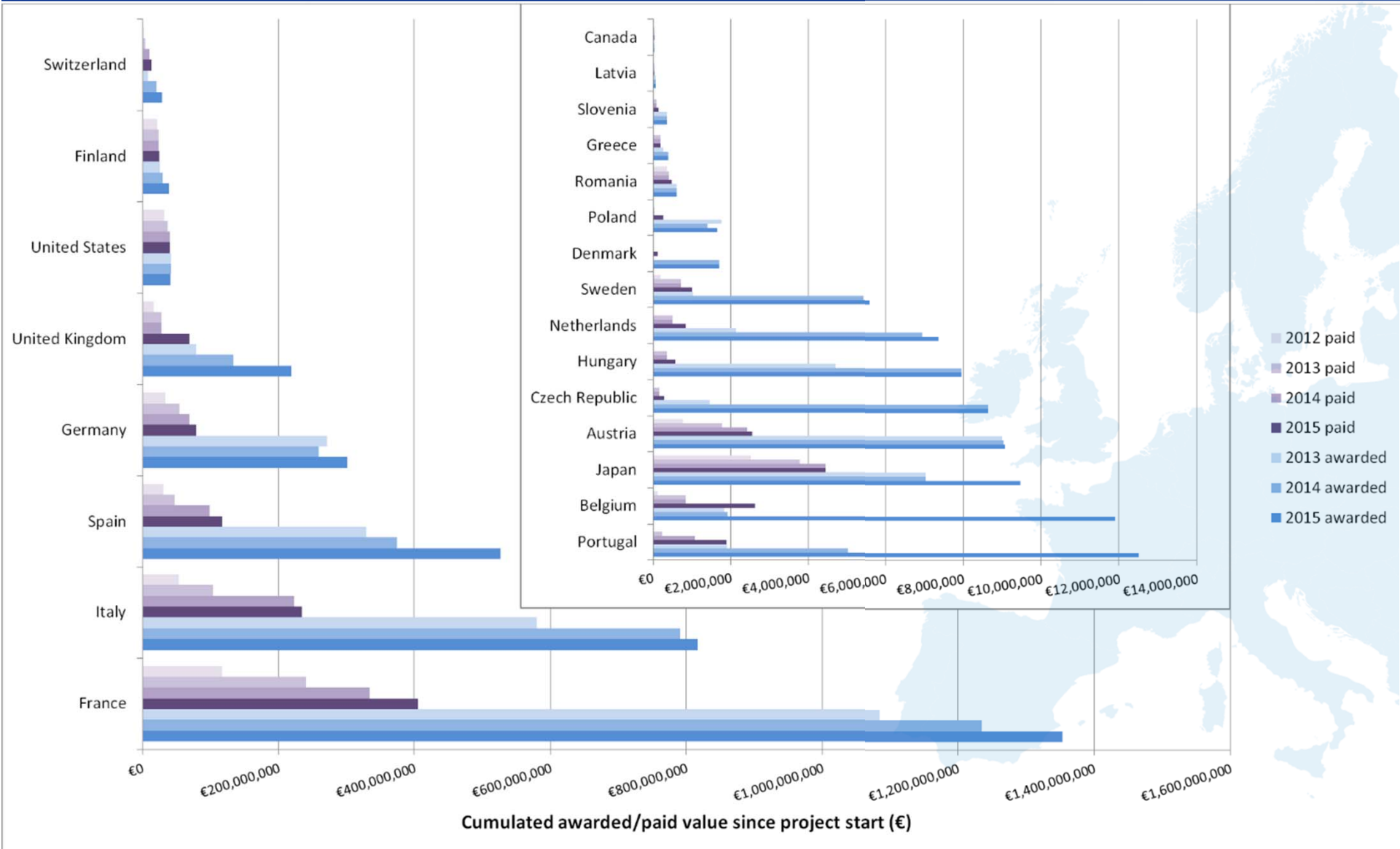


ITER matters to EU business

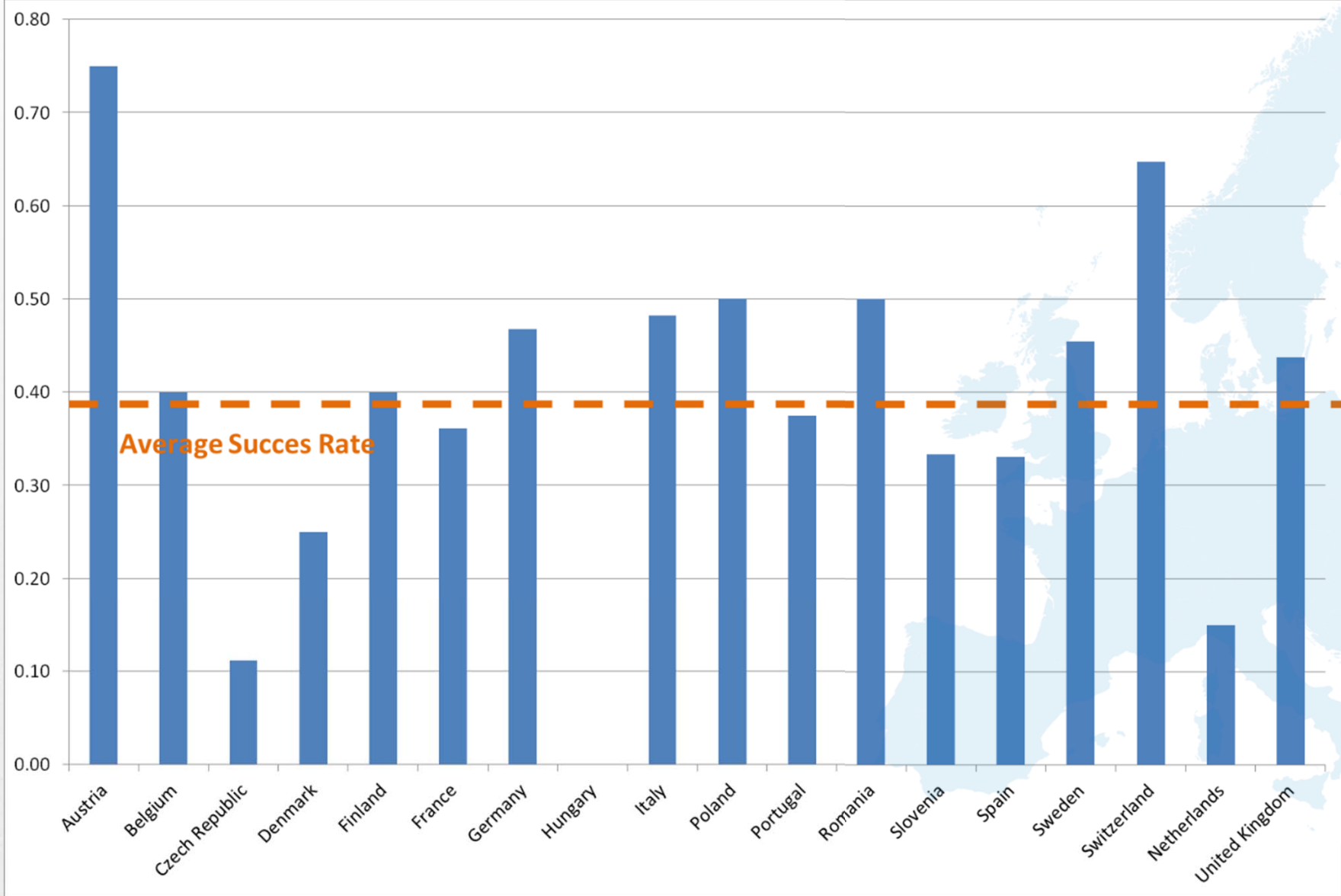




ITER EU business 2008-2015



ITER EU business 2008-2015





big science definition

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About 96,200,000 results (0.44 seconds)

big science

noun informal

scientific research that is expensive and involves large teams of scientists.



21 July 1961, Volume 134, Number 3473

SCIENCE

Impact of Large-Scale Science on the United States

Big science is here to stay, but we have yet to make the hard financial and educational choices it imposes.

Alvin M. Weinberg

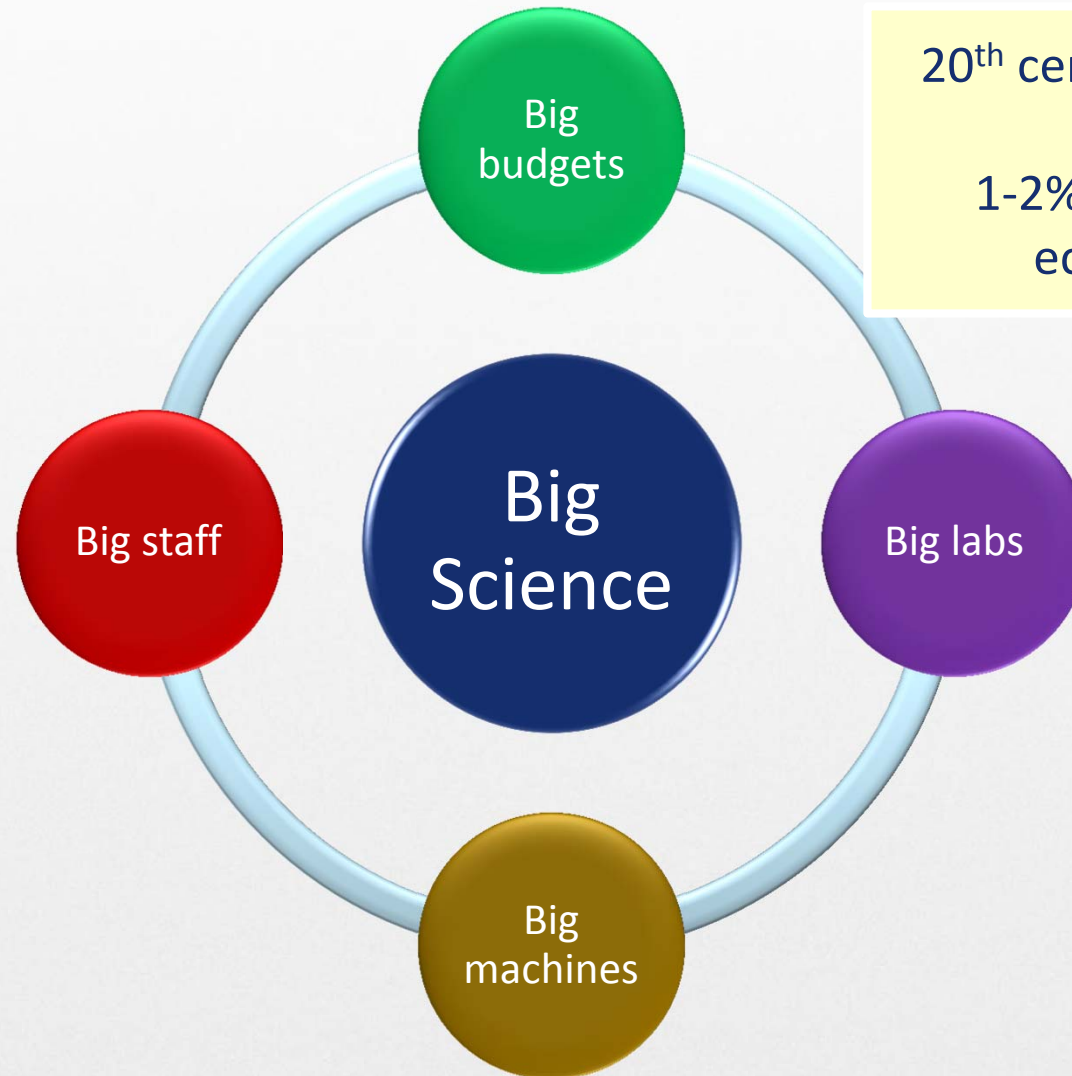
Throughout history, societies have expressed their aspirations in large-scale, monumental enterprises which, though not necessary for the survival of the

and the motivations of the church builders and the pyramid builders. We build our monuments in the name of scientific truth, they built theirs in the name of

Is Big Science Ruining Science?

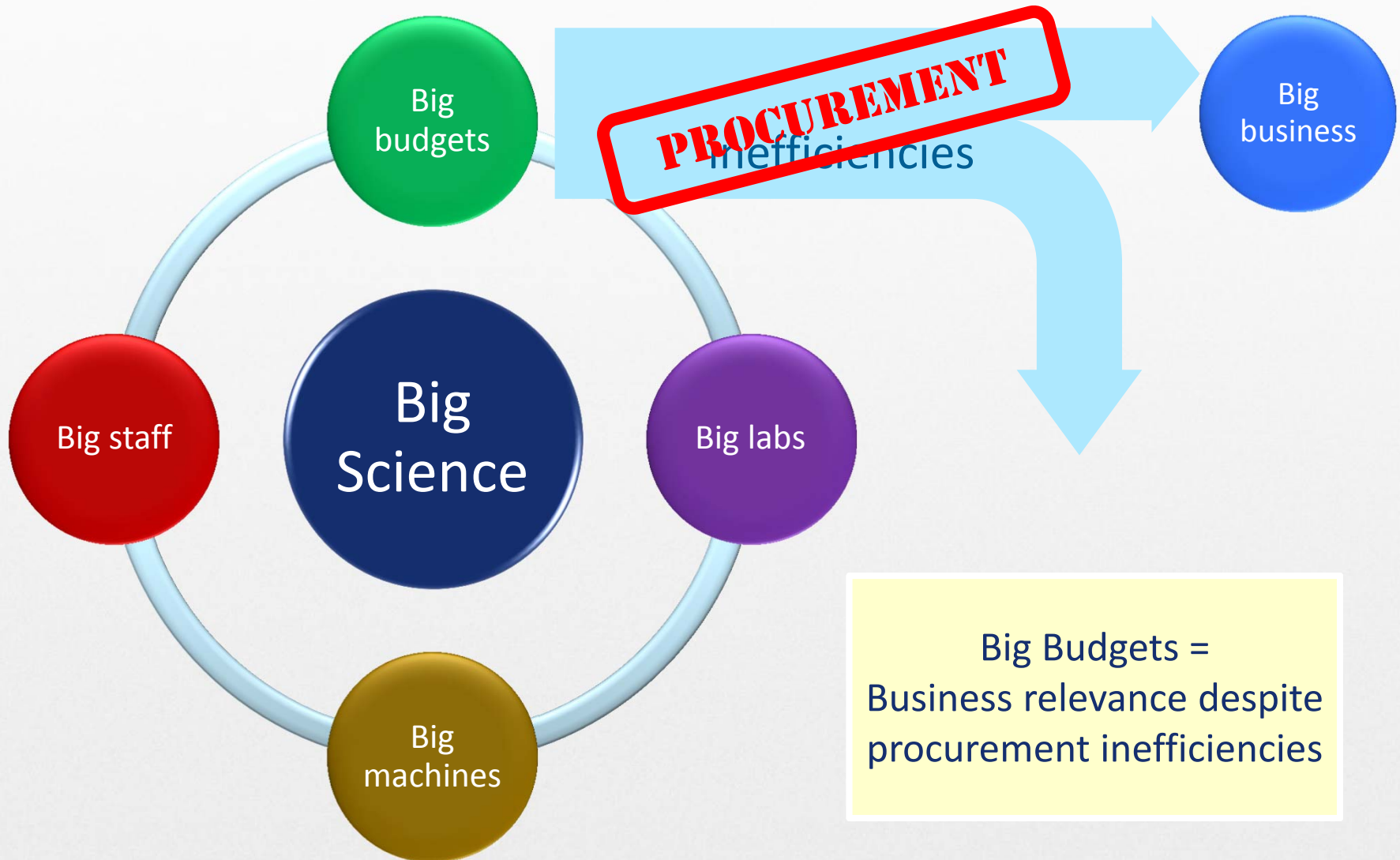
The English astronomer Fred Hoyle recently set off a lively controversy by arguing against the United Kingdom's going into large-scale space research. His argument, which applies to much of Big Science, is twofold: first, that the intrinsic scientific interest of space research is not worth the money and manpower that goes into it and certainly does not justify spending more on it than on any other branch of science; and second, that wherever science is fed by too *much* money, it becomes fat and lazy. He claims to see evidence that the tight intellectual discipline necessary for science is, especially in America, being loosened. I shall touch later upon Hoyle's first point: Is Big Science giving us our money's worth? For the moment I want to discuss his

Big Science: the original paradigm



20th century Big Science budgets = 1-2% of underlying economy size

Big Science: the original paradigm



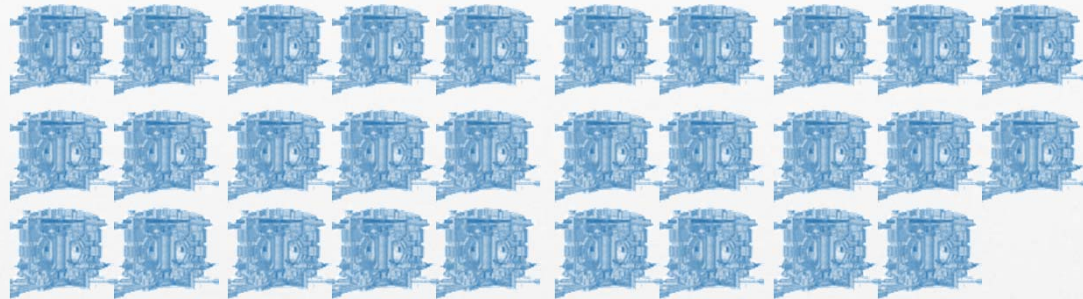


Big budgets?

Compared to present economy (company profits)



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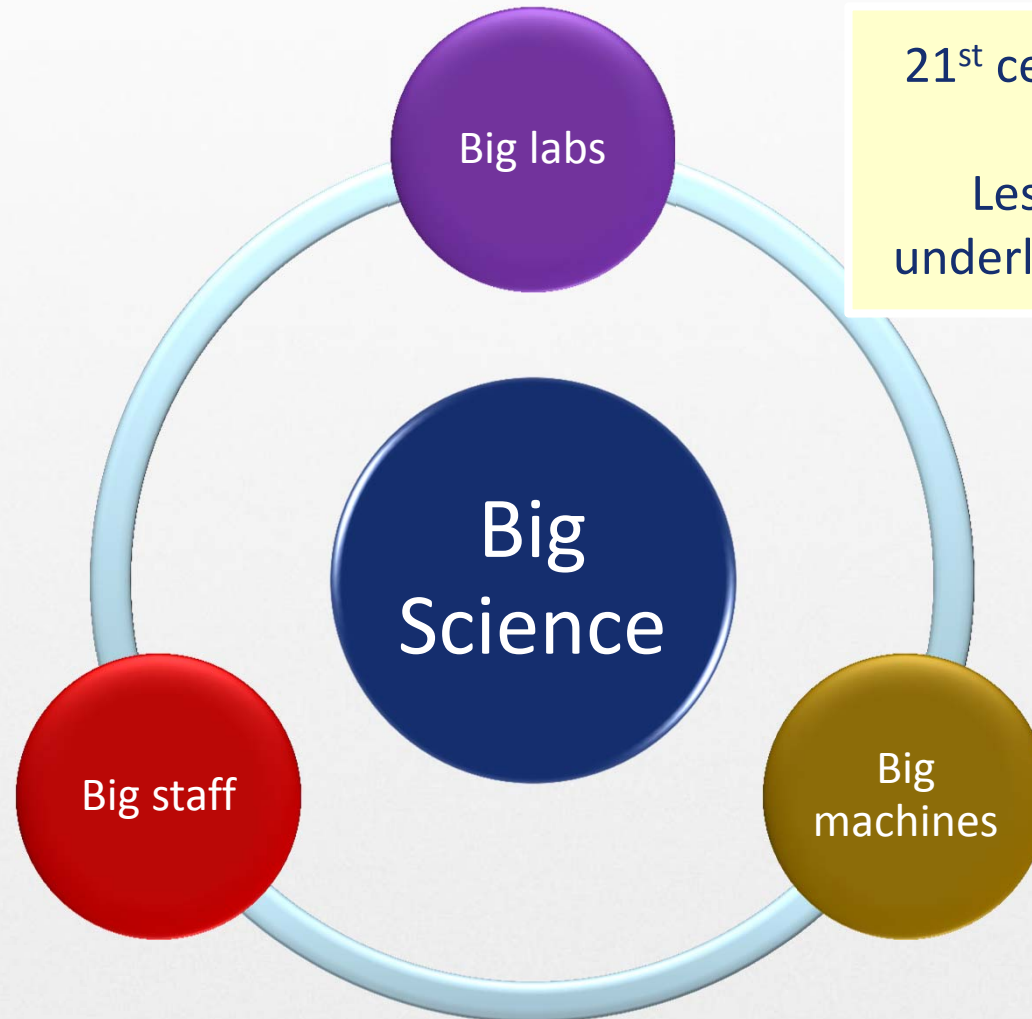
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Big Science: the present context



21st century Big Science budgets =
Less than 0.1% of
underlying economy size

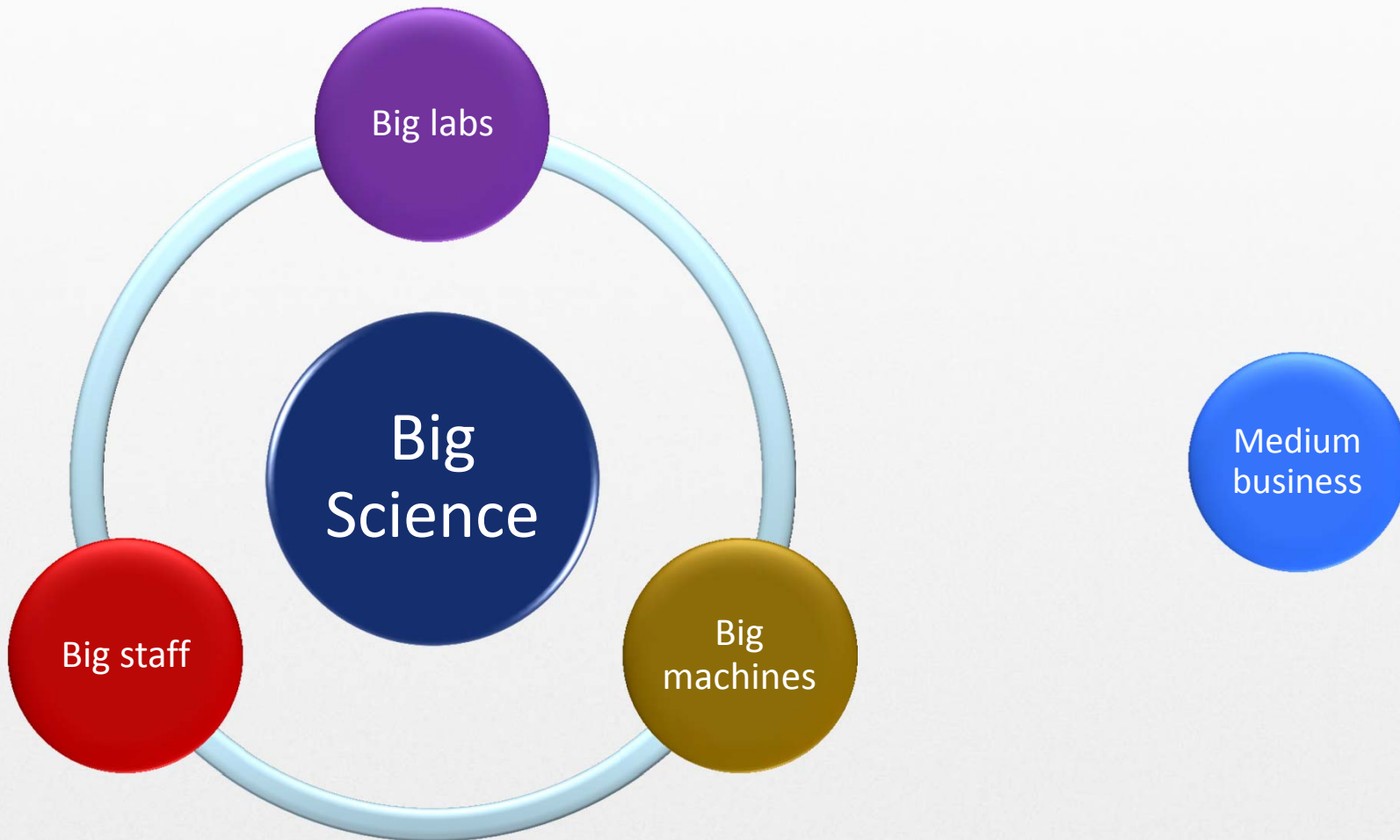
Big Science, big business?

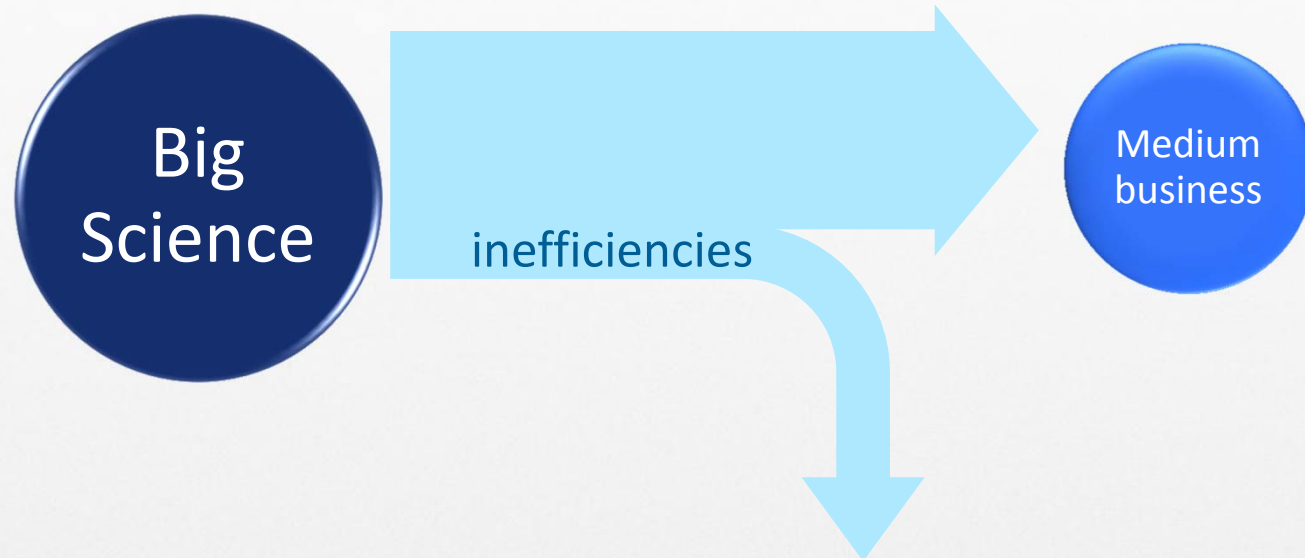


	Total research investment, 2014 (billion €)	Estimate for infrastructure, 2014 (billion €)
European Union	191	8
United States	298	12
Rest of the World	423	16
<i>Total</i>	<i>912</i>	<i>36</i>

Source: *Vejen til en Big Science industri i Danmark*, September 2014

Big Science: the present context





Need to reduce
procurement
inefficiencies to maintain
business relevance

Inefficiencies: the ITER EU experience



8 years, ~500 tenders, 1200+ offers



- ▶ The time variability in projects procurement volume and technology needs



- ▶ The gap between companies' interest in projects and skills/resources to perform



- ▶ The competition among projects for production capacity and human resources



definition of business

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About 656,000,000 results (0.37 seconds)

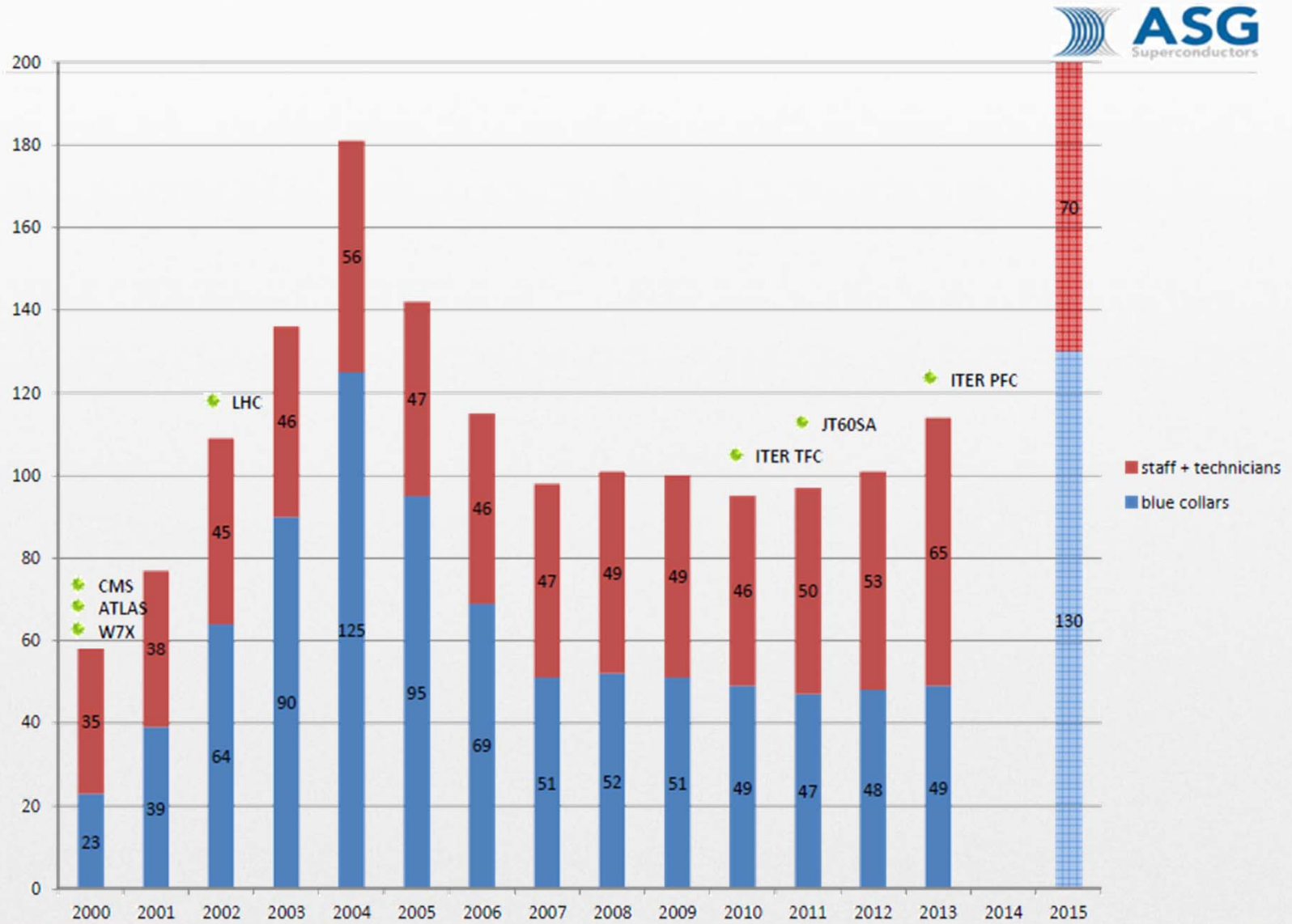
business

/ˈbɪznəs/

noun

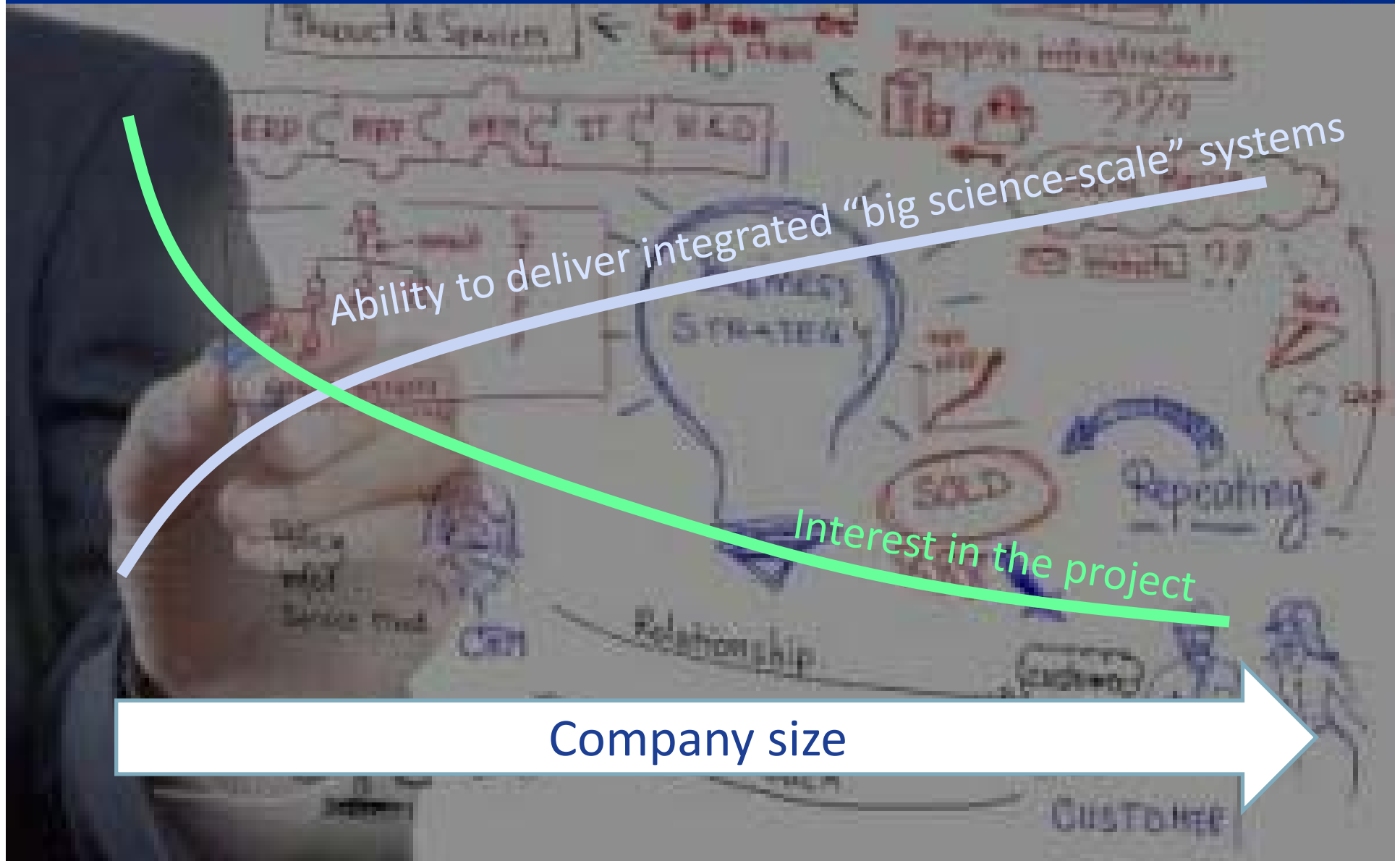
1. a person's **regular occupation**, profession, or trade.
"experts who typically conduct their business over the Internet"
synonyms: [work](#), [line of work](#), [line](#), [occupation](#), [profession](#), [career](#), [employment](#),
[job](#), [day job](#), [position](#), [pursuit](#), [vocation](#), [calling](#), [field](#), [sphere](#), [walk of life](#), [trade](#), [craft](#); [More](#)
2. commercial activity.
"firms who want to do business with Japan"
synonyms: [trade](#), [trading](#), [commerce](#), [buying and selling](#), [dealing](#), [traffic](#),
[trafficking](#), [marketing](#), [merchandising](#), [bargaining](#); [More](#)

Variability





Capability gap



Stories of (recurrent) success



Product-centric

Components
Big Science as any other
business



Technology-centric

Sub-systems
Big Science as springboard
into mainstream



Skill-centric

Pooling capabilities to deliver
systems
Big Science as core business

Stories of (recurrent) success



Product-centric

Components
Big Science as any other
business

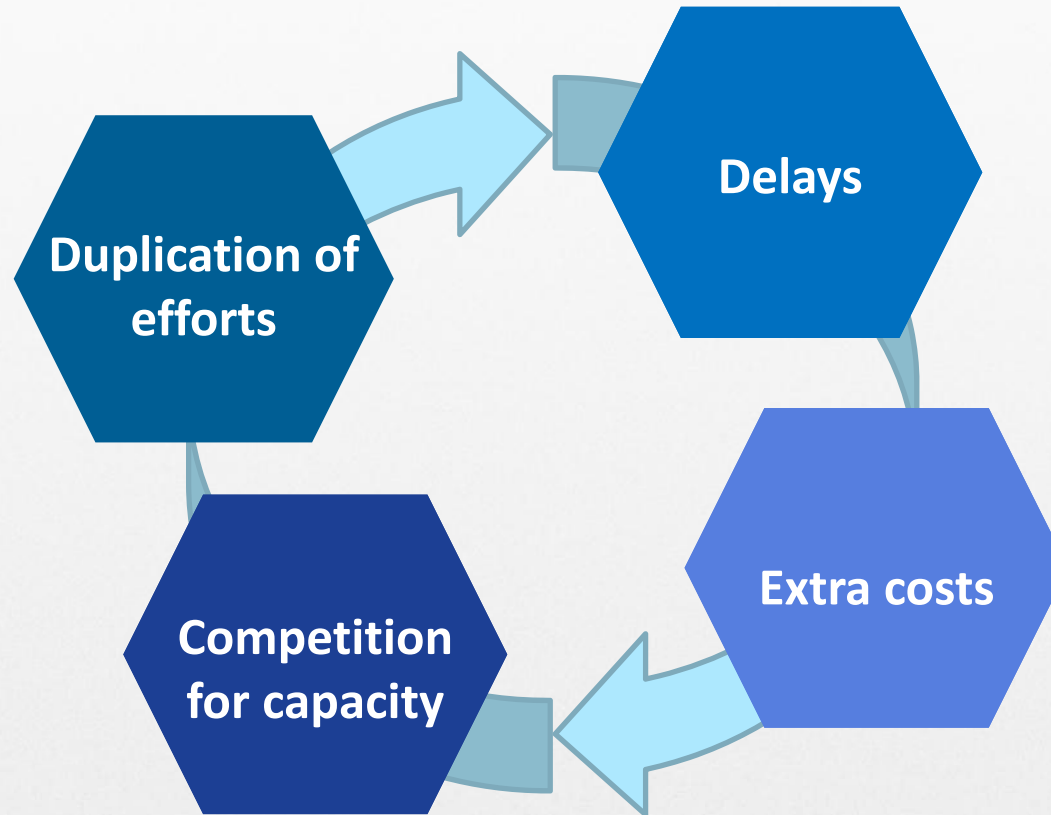
Technology-centric

Sub-systems
Big Science as springboard
into mainstream

Skill-centric

Pooling capabilities to deliver
systems
Big Science as core business

Competition among projects





Less inefficiency, more appeal





Projects are appealing ...





... but the whole is more interesting

Communication

Dissemination

Standardization

Cooperation





Conclusions

- **ITER = Big Science project of global relevance + opportunity for EU industry**
- **Interaction between Big Science and industry must evolve, adapt to new scenario**
- **Collaboration, exchanges between Big Science = important to support healthy (and necessary) connection to industry**



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