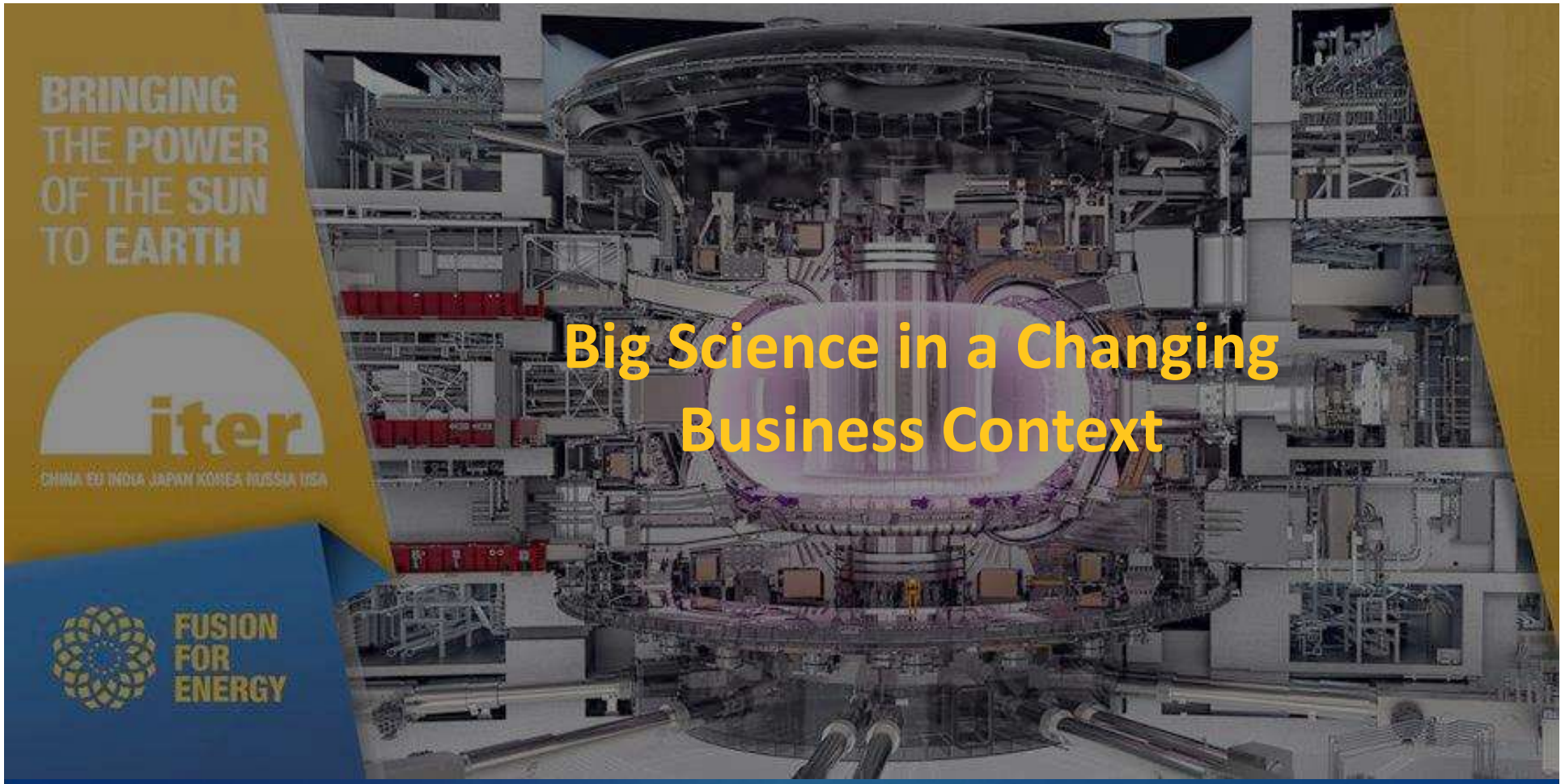

Big Science in a Changing Business Context

Leonardo Biagioni

Head of Contracts and Procurement, F4E

Connecting Strength of Big Science

June 8th, 2017

Key Takeaways

- Large science and technology projects (Big Science) are cornerstone elements of scientific and economic development
- Industry engagement is enabling Big Science, which must therefore position itself correctly in the business space too
- Changes in the economic and social context require Big Science to adapt in order to maintain relevance

Outline

1. Big Science of yesteryears
2. The changing context
3. Challenges for industrial involvement
4. Achieving buy-in

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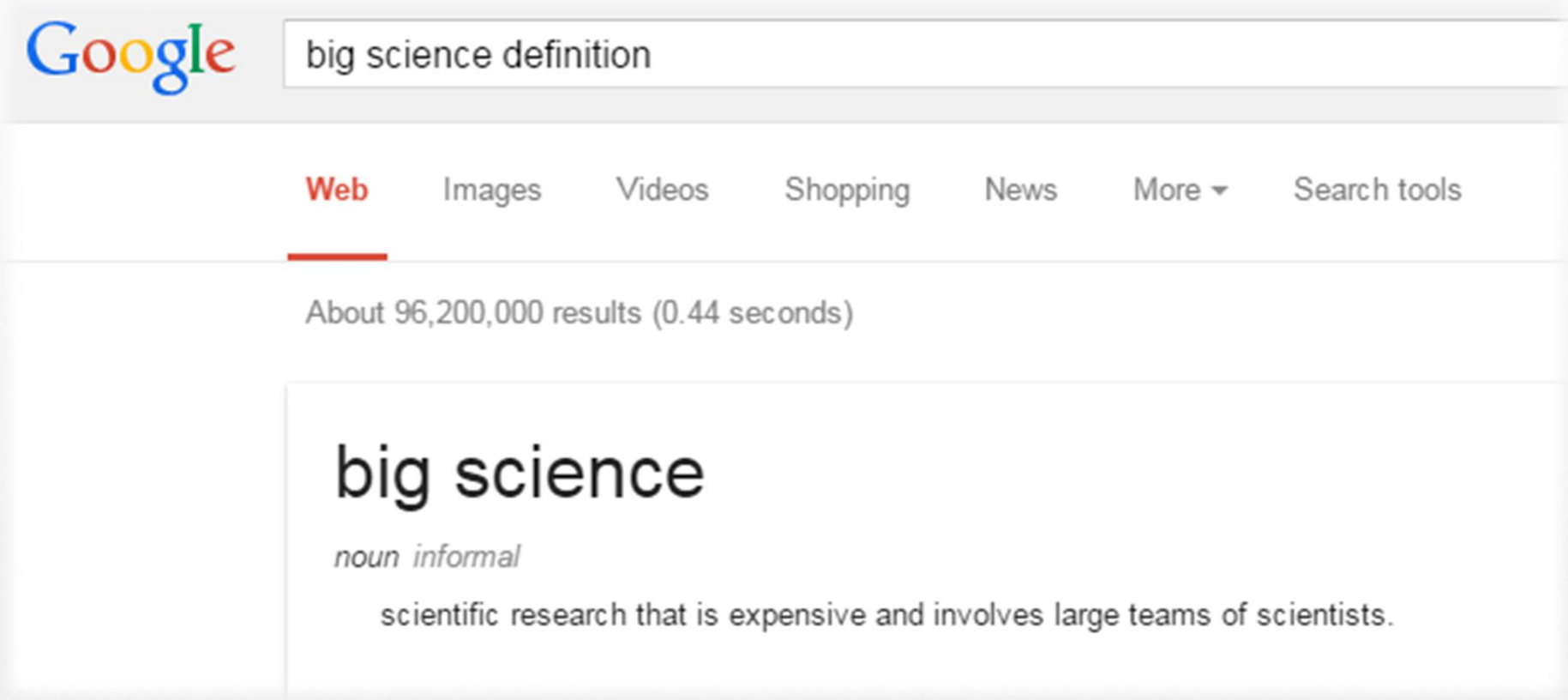
Big Science


Google
big science definition
Web
Images
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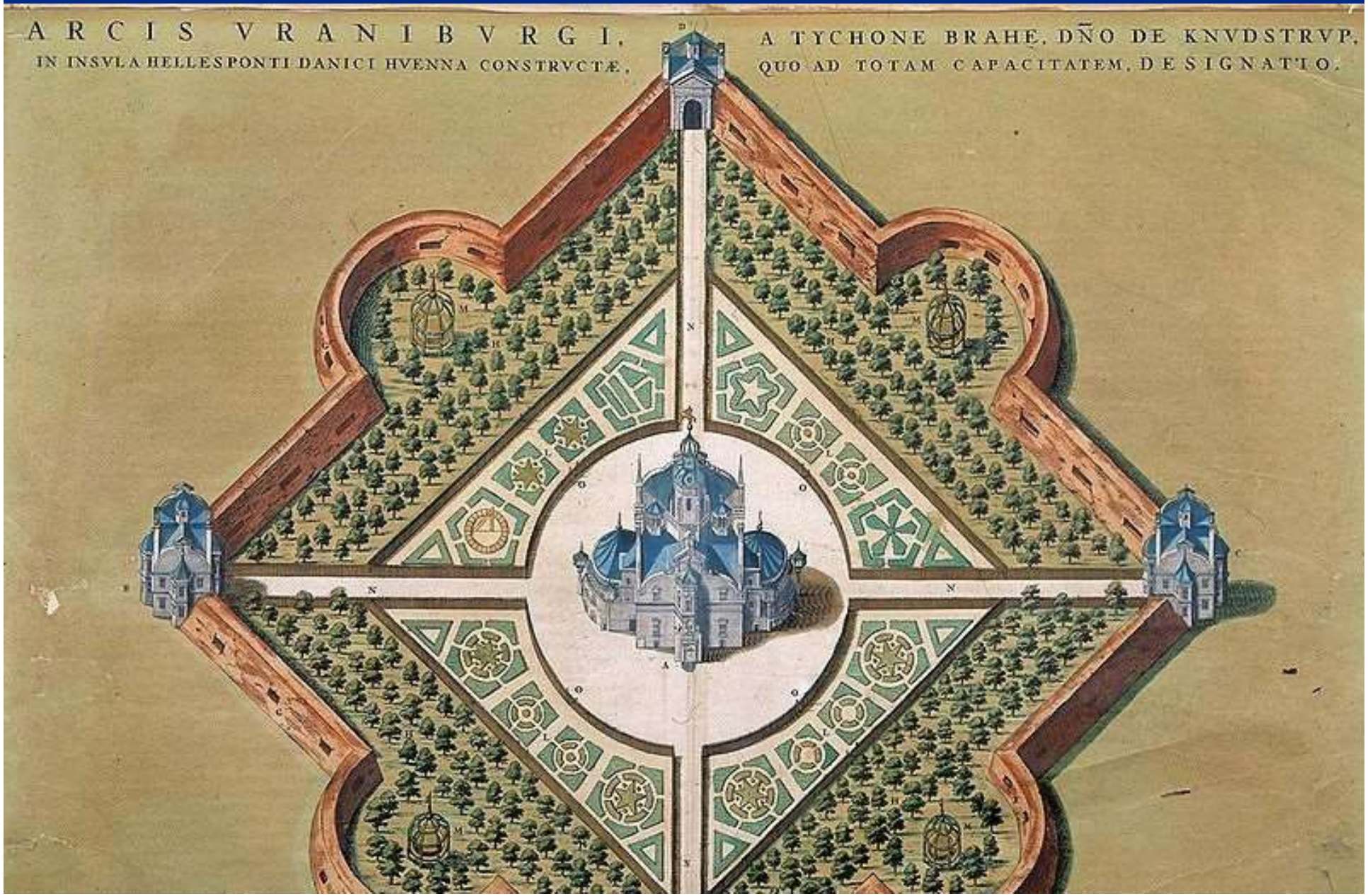
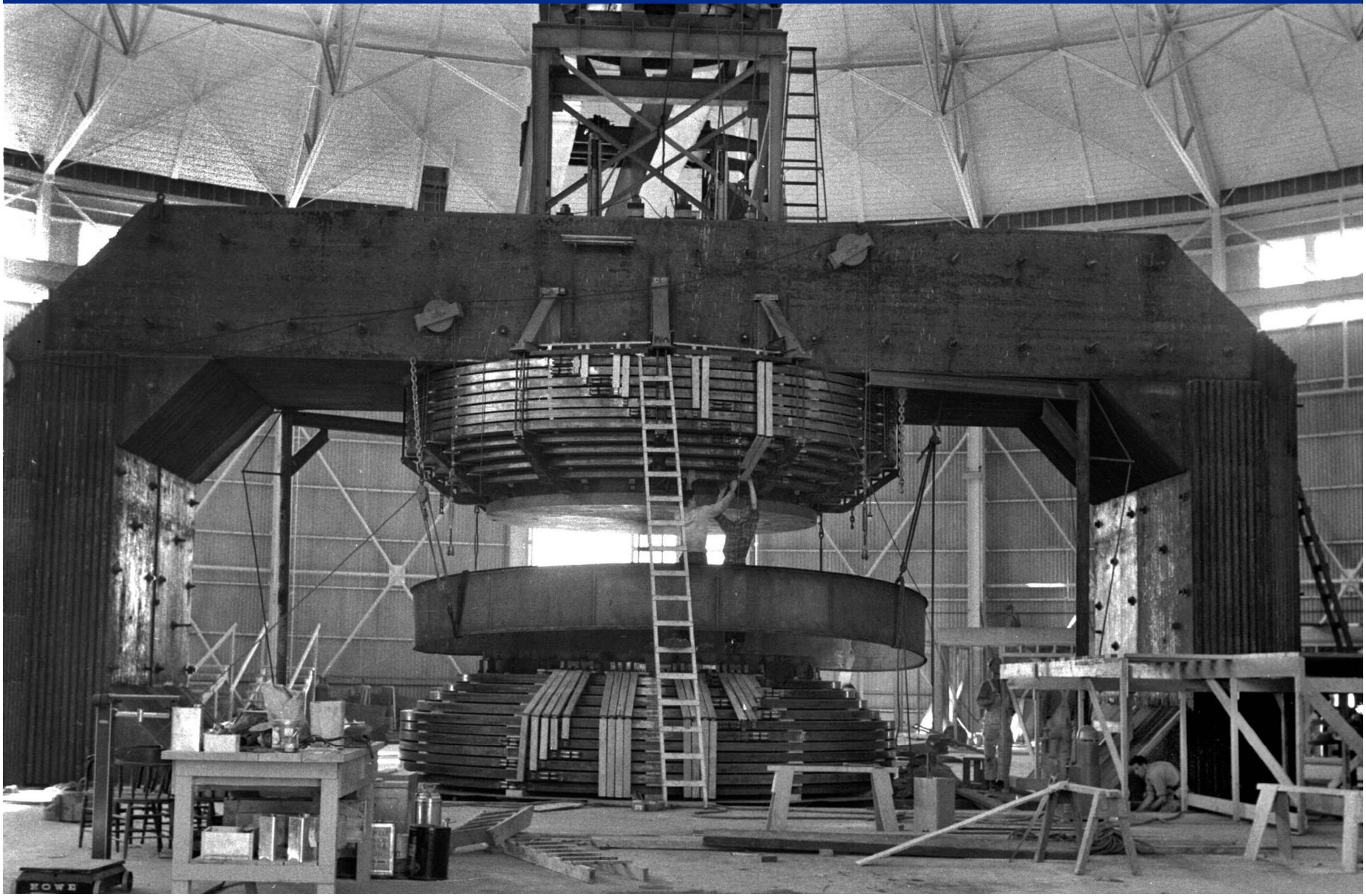
Search tools
About 96,200,000 results (0.44 seconds)
big science
noun informal
scientific research that is expensive and involves large teams of scientists.

Circa 3100 BC

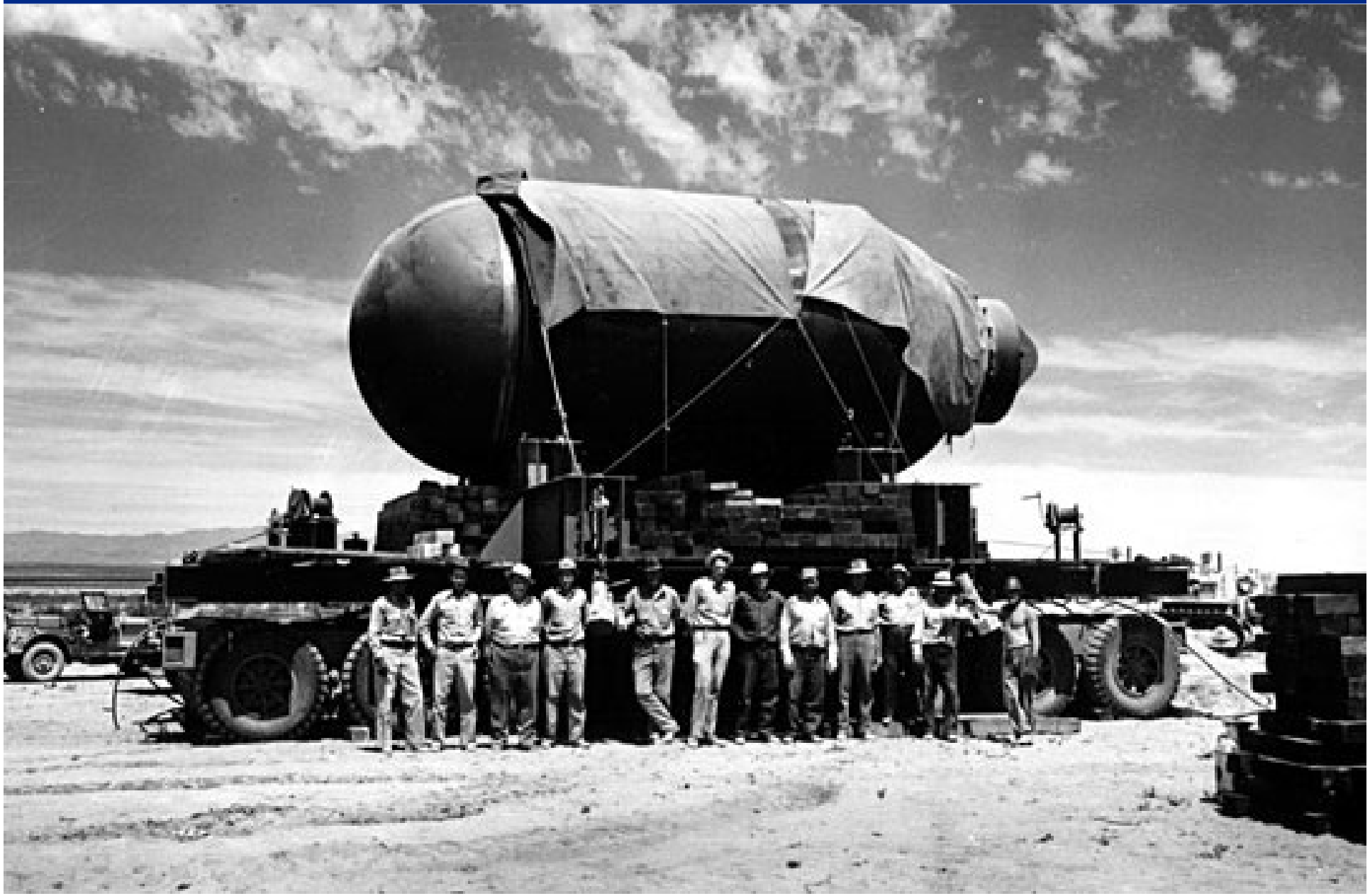
1580 AD


ARCIS VRANIBVRGI,
IN INSVLA HELLESPONTI DANICI HVENNA CONSTRVCTÆ,
A TYCHONE BRAHE, DÑO DE KNVDSTRVP,
QUO AD TOTAM CAPACITATEM, DESIGNATIO.

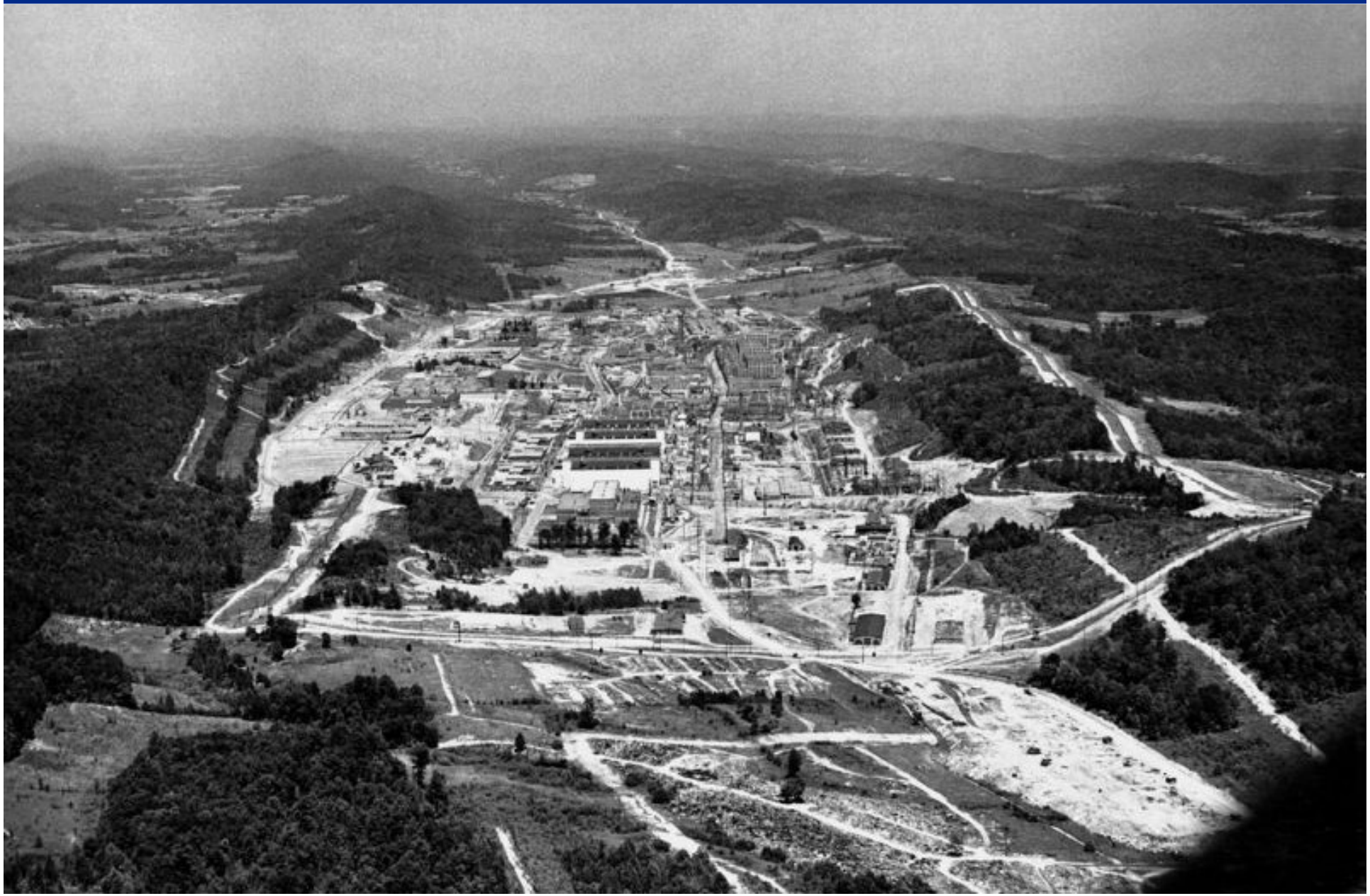
1942 AD



1945 AD

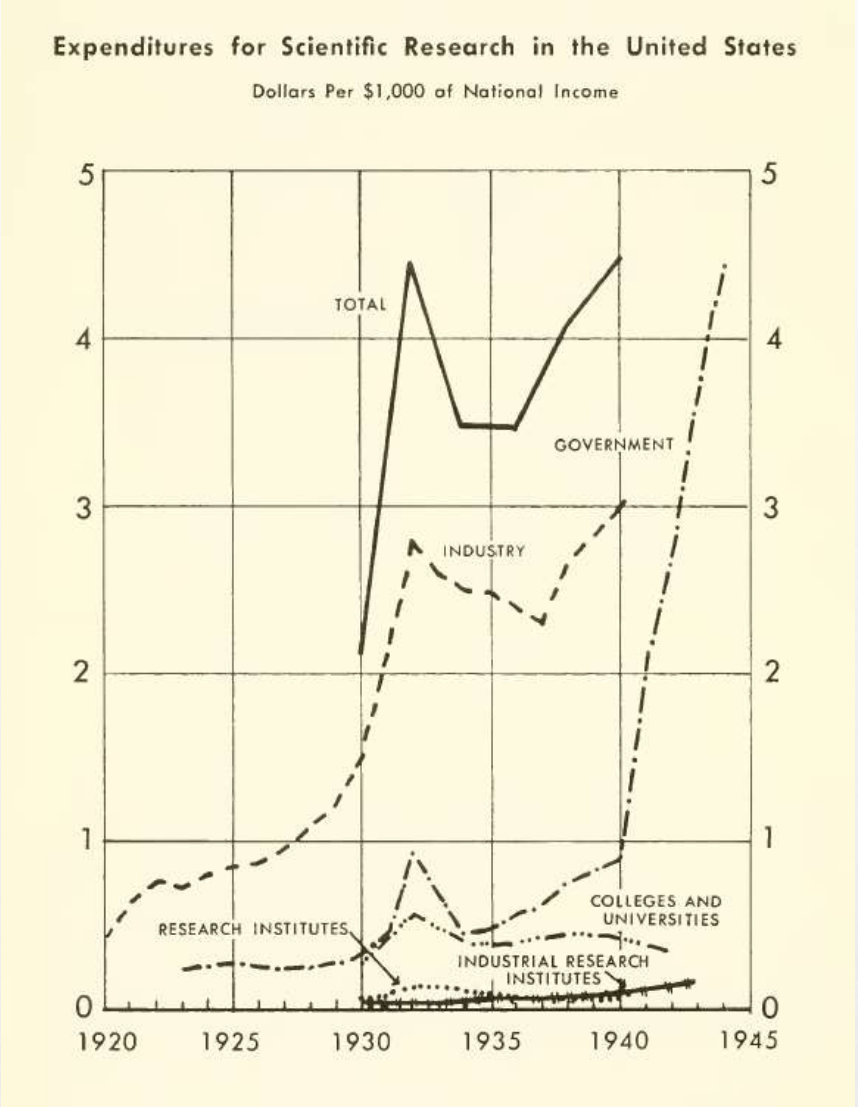


1945 AD



The post-war debate

- Recognition of S&T as growth driver (Roosevelt 1944, Bush 1945)



The post-war debate

- Recognition of S&T as growth driver (Roosevelt 1944, Bush 1945)
- Concern about militarization of Big Science (Eisenhower 1961, Weinberg 1961)

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

The post-war debate

- Recognition of S&T as growth driver (Roosevelt 1944, Bush 1945)
- Concern about militarization of Big Science (Eisenhower 1961, Weinberg 1961)
- New focus on civilian Big Science (Kennedy 1962)

JFK Pledges U.S. Will Be First On Moon

WASHINGTON (AP)—President Kennedy has returned from a two-day tour of major space installations, determined the United States will be first in space and have a man on the moon by 1970.

The President also made clear during the exhaustive inspection tour ending late Wednesday at the McDonnell Aircraft plant in St. Louis, that he intends to press his challenge to Russia to reserve

The post-war debate

- Recognition of S&T as growth driver (Roosevelt 1944, Bush 1945)
- Concern about militarization of Big Science (Eisenhower 1961, Weinberg 1961)
- New focus on civilian Big Science (Kennedy 1962)
- Driving role of a Big Science in scientific and industrial **collaboration** (de Solla 1963)

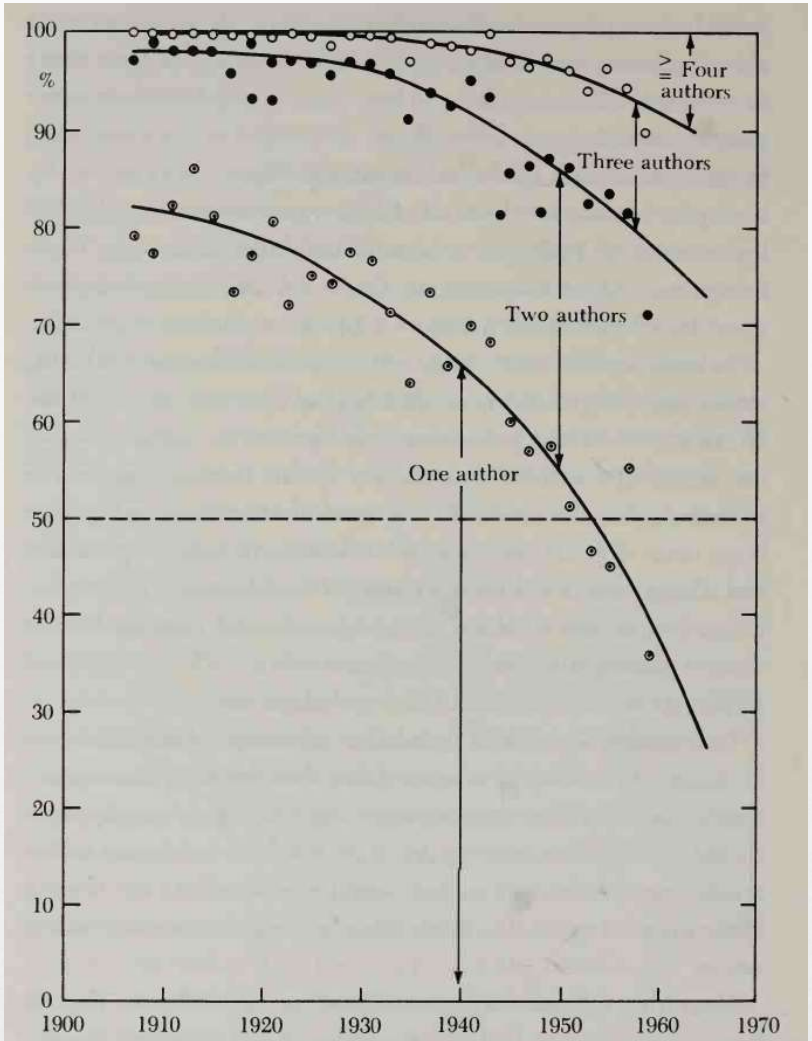
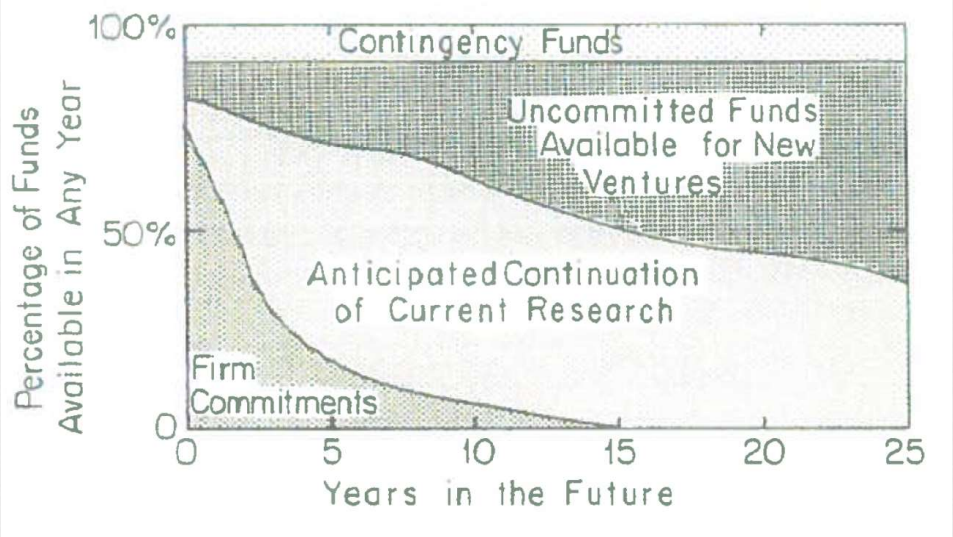


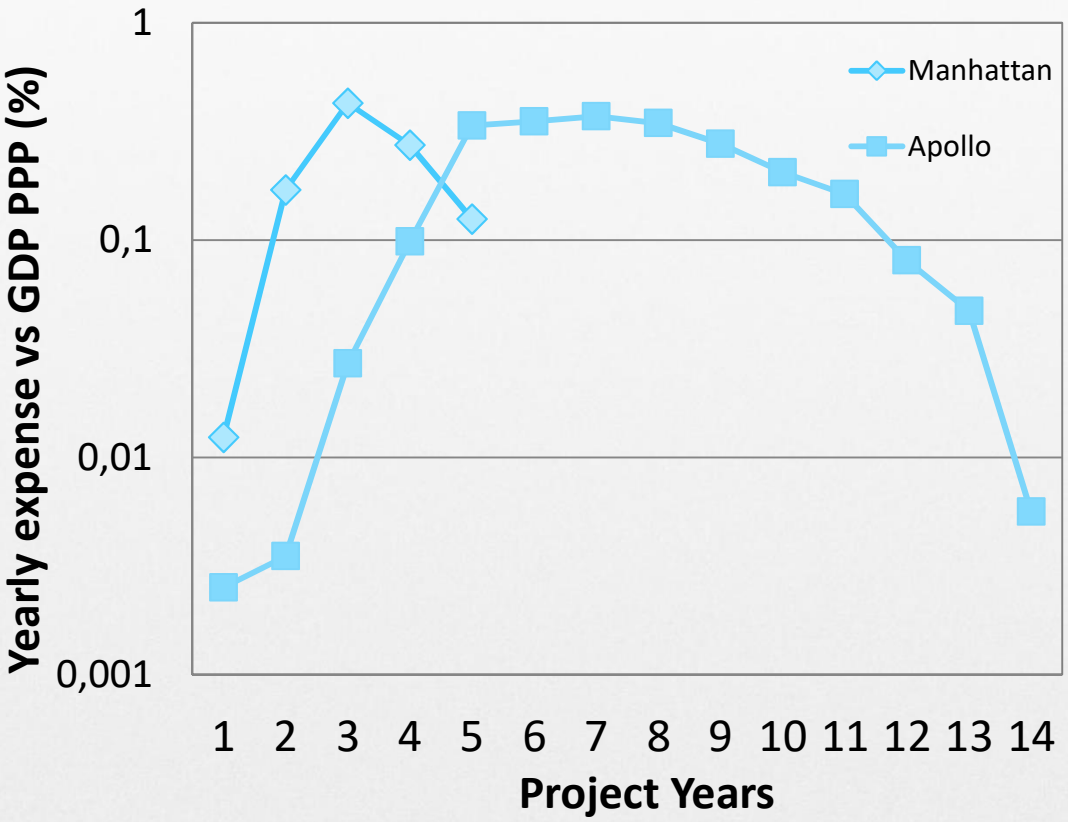
Figure 3.3. Incidence of Multiple Authorship as a Function of Date

20th century Big Science

- Further debate during following 40 years, not changing context
- Big Science as strategic cultural, economic and foreign policy tool
- **Large, concentrated** public investment cornerstone of science, innovation, competitiveness and industrial development

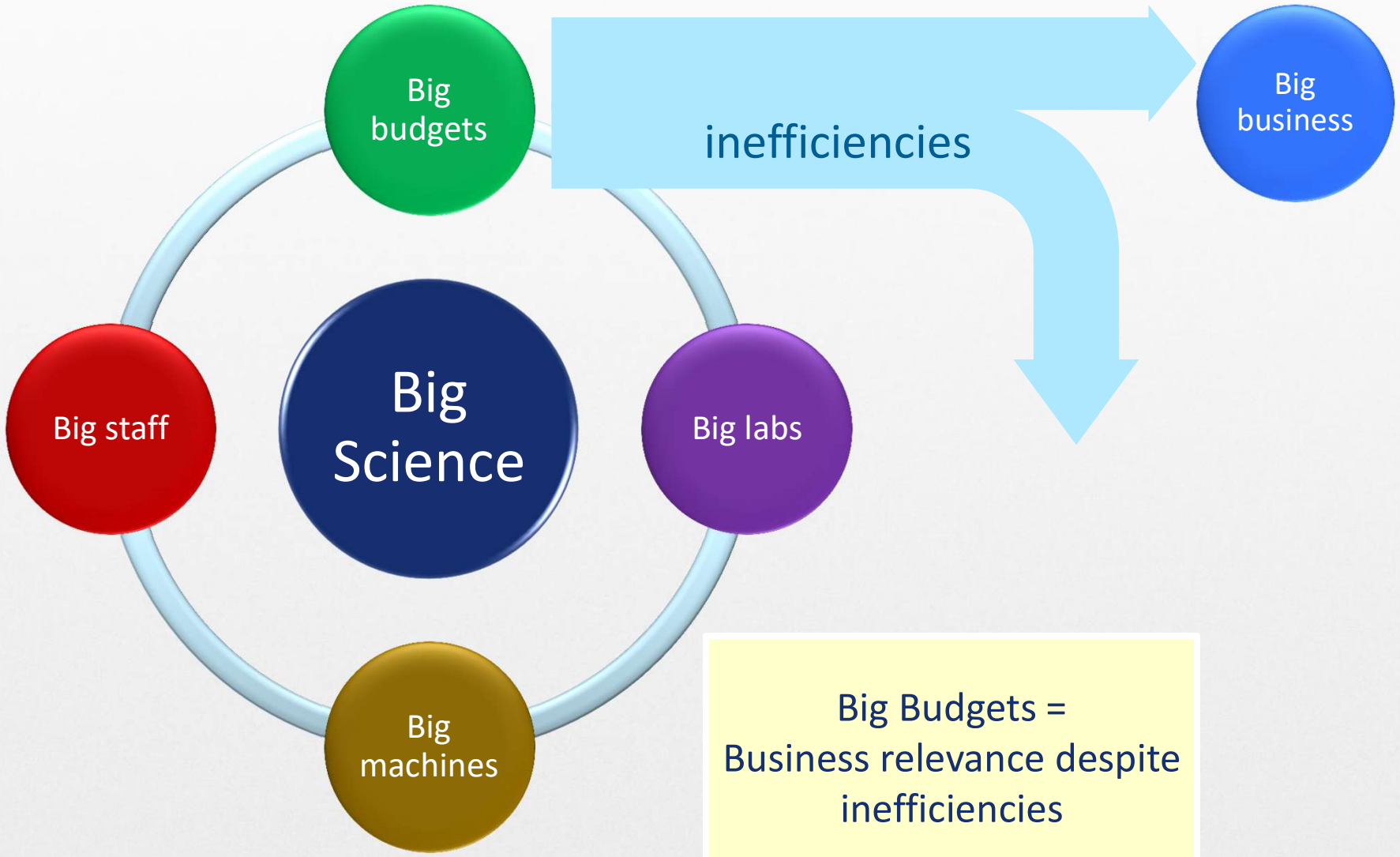


20th century Big Science



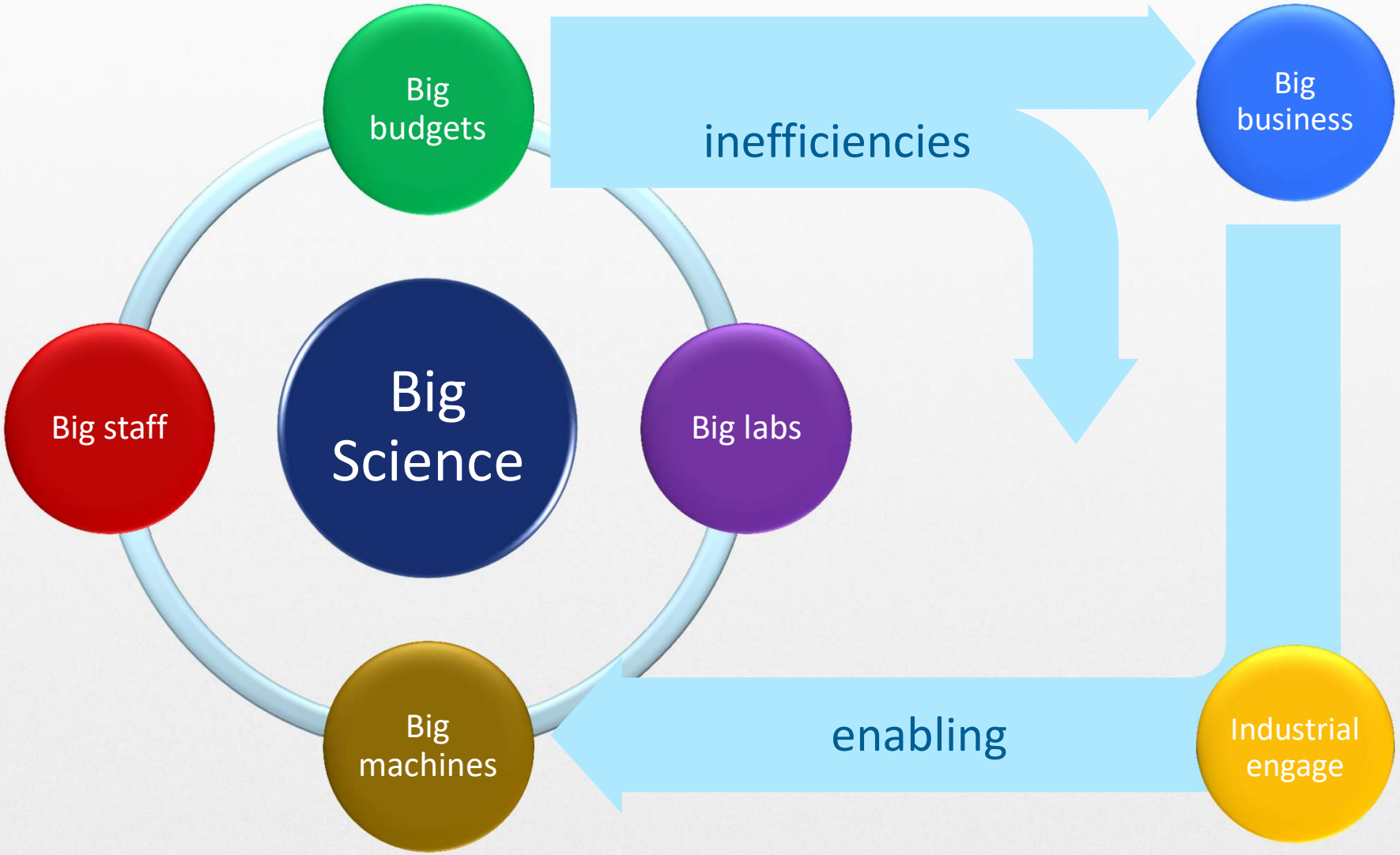
- Total R&D expenditure around 2-3% of GDP …
- … 1% of GDP in large science and technology projects
- Essential opportunity for technology-engaged industry

20th century Big Science



Big Budgets =
Business relevance despite inefficiencies

20th century Big Science



Outline

1. Big Science of yesteryears
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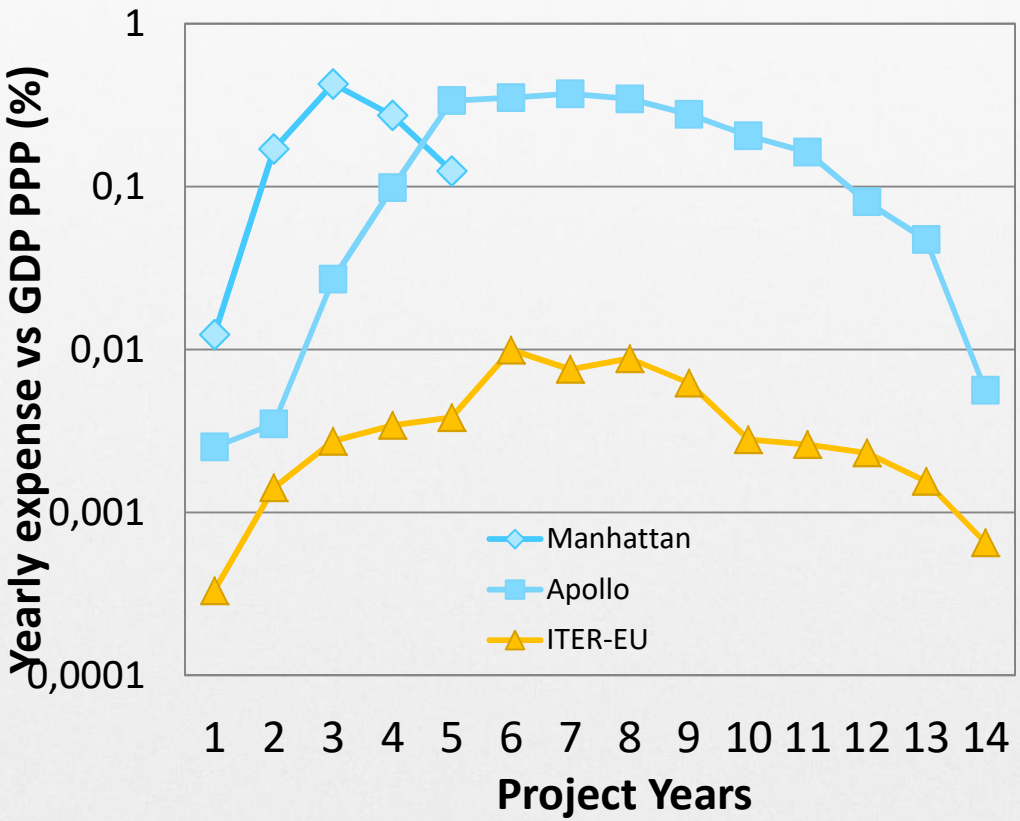
21st century Big Science

- Higher fragmentation in R&D funding
- Decreasing infrastructure spending, less than 0.1% of GDP
- Larger fraction of non-public R&D
- Big Science less relevant to industry



Decreasing infrastructure spending

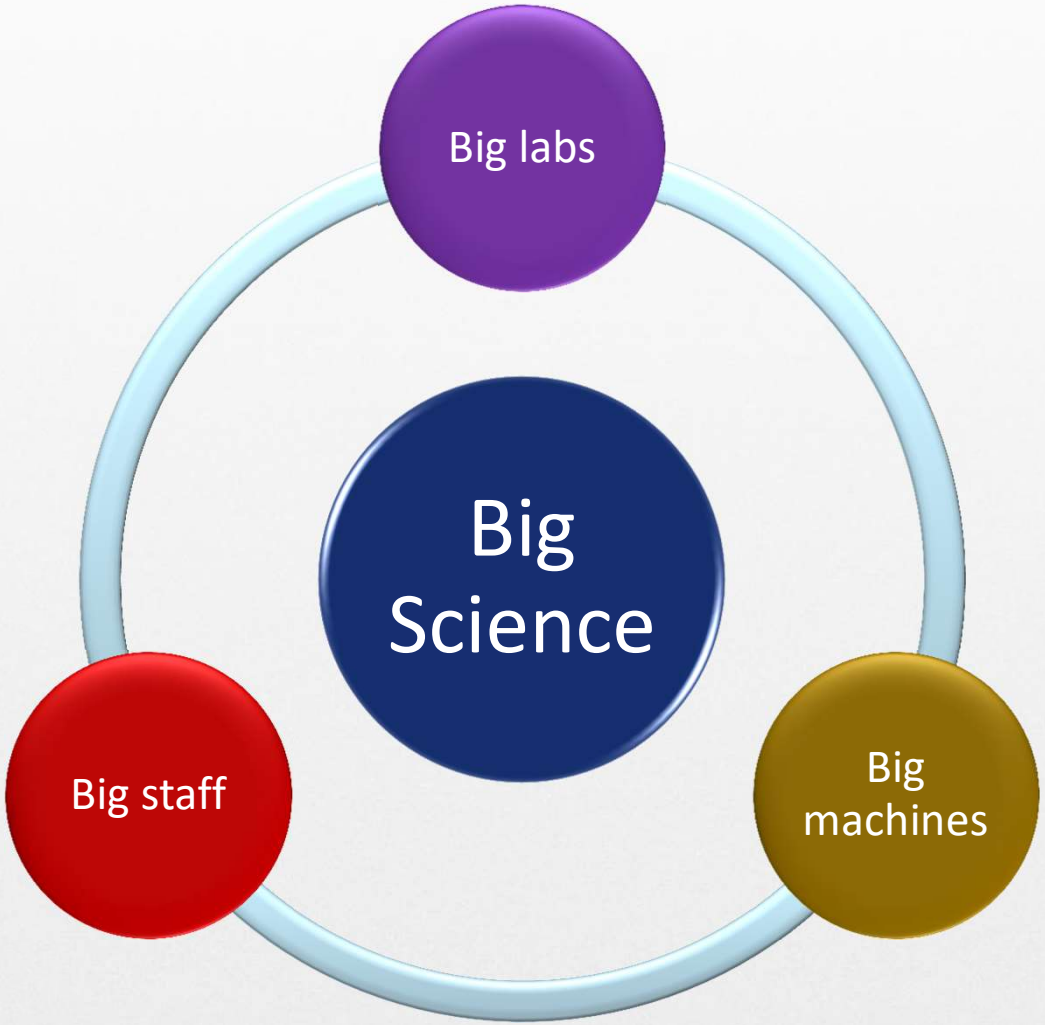
	Total research investment, 2014 (billion €)	Estimate for infrastructure, 2014 (billion €)
European Union	191	8
United States	298	12
Rest of the Word	423	16
Total	*912*	*36*

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

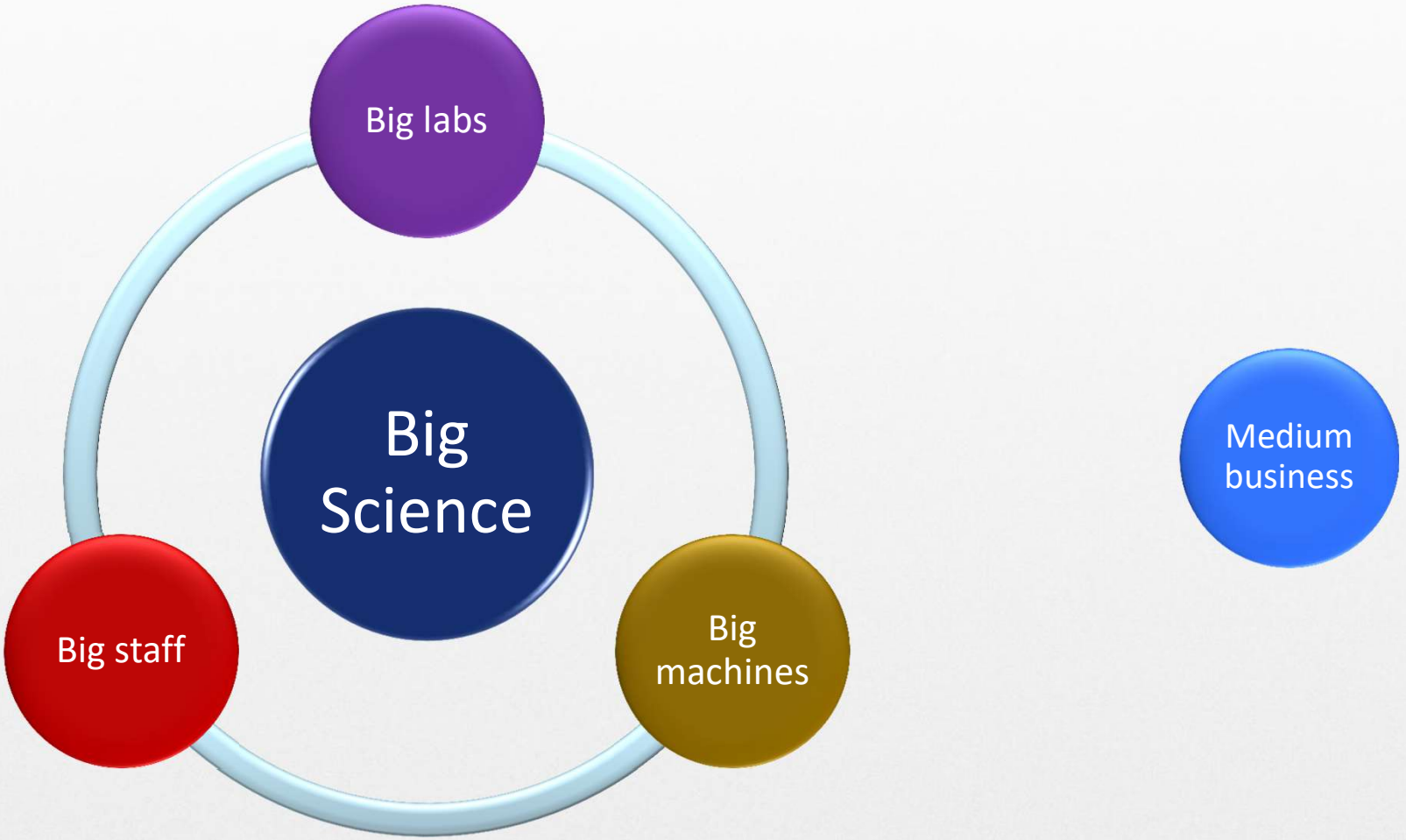
Decreasing impact on economy

Compared to present economy (company profits)

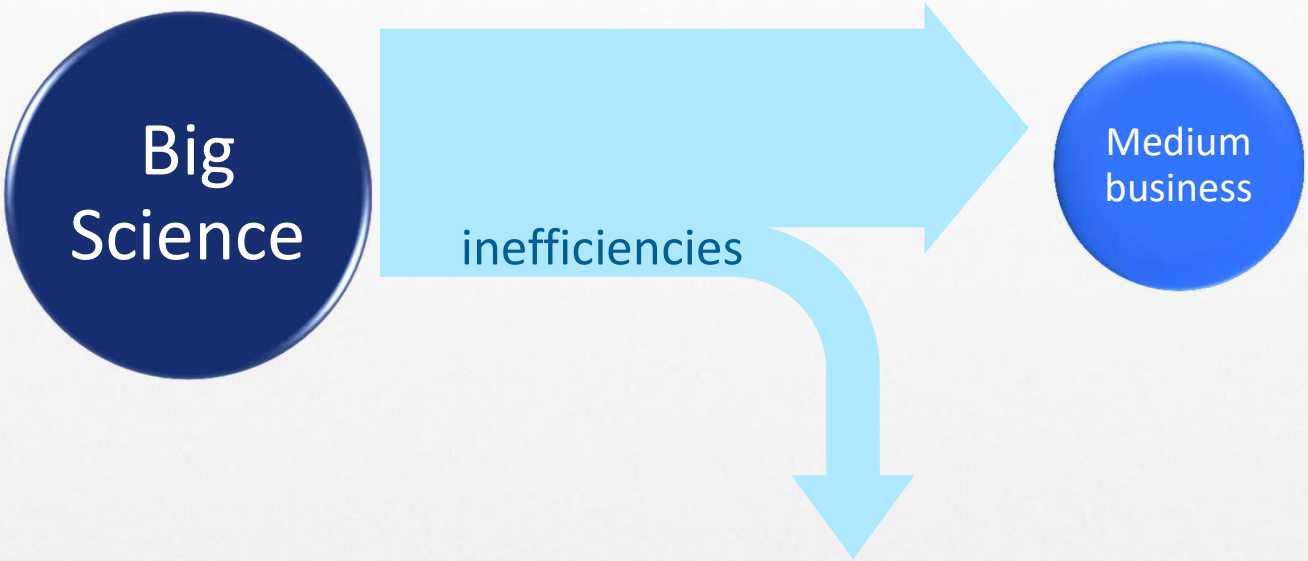
21st century Big Science



21st century Big Science



21st century Big Science



Need to reduce inefficiencies to ensure needed industrial engagement

Outline

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Inefficiencies in supply chain

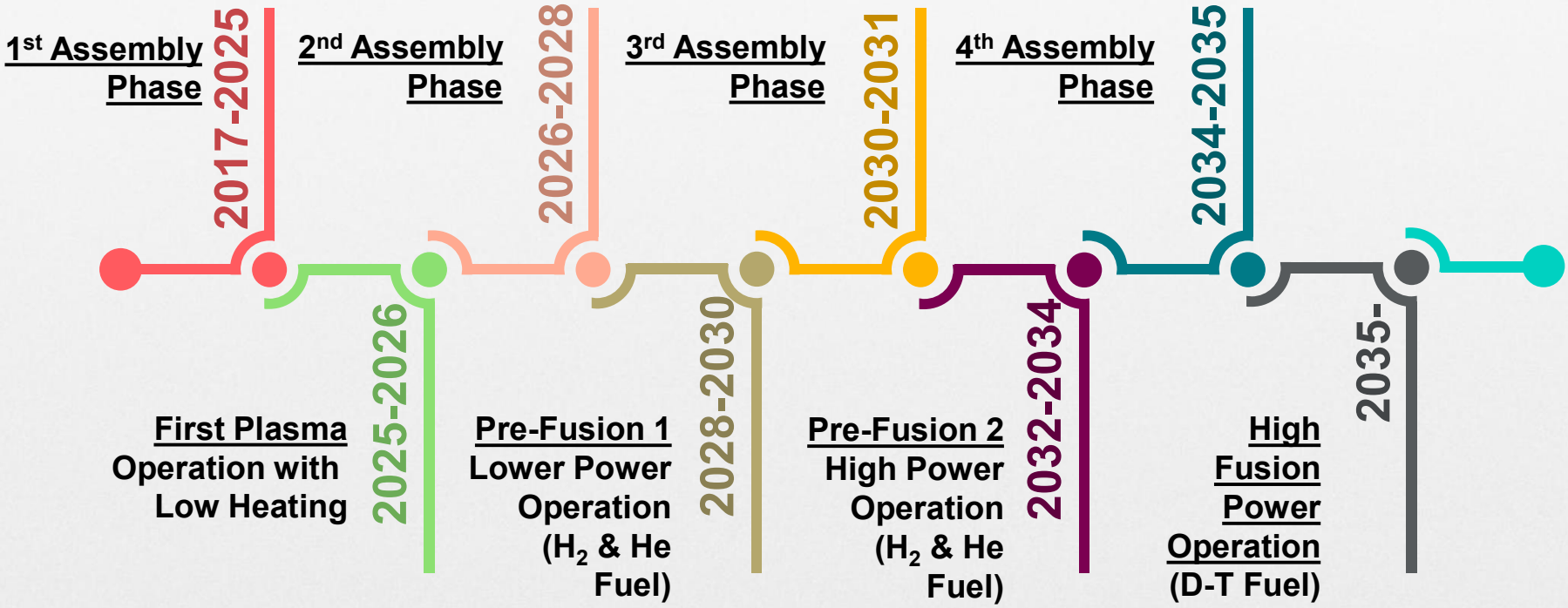
- Time variability in projects procurement volume and technology needs

- Gap between companies' interest in projects and skills/resources to perform

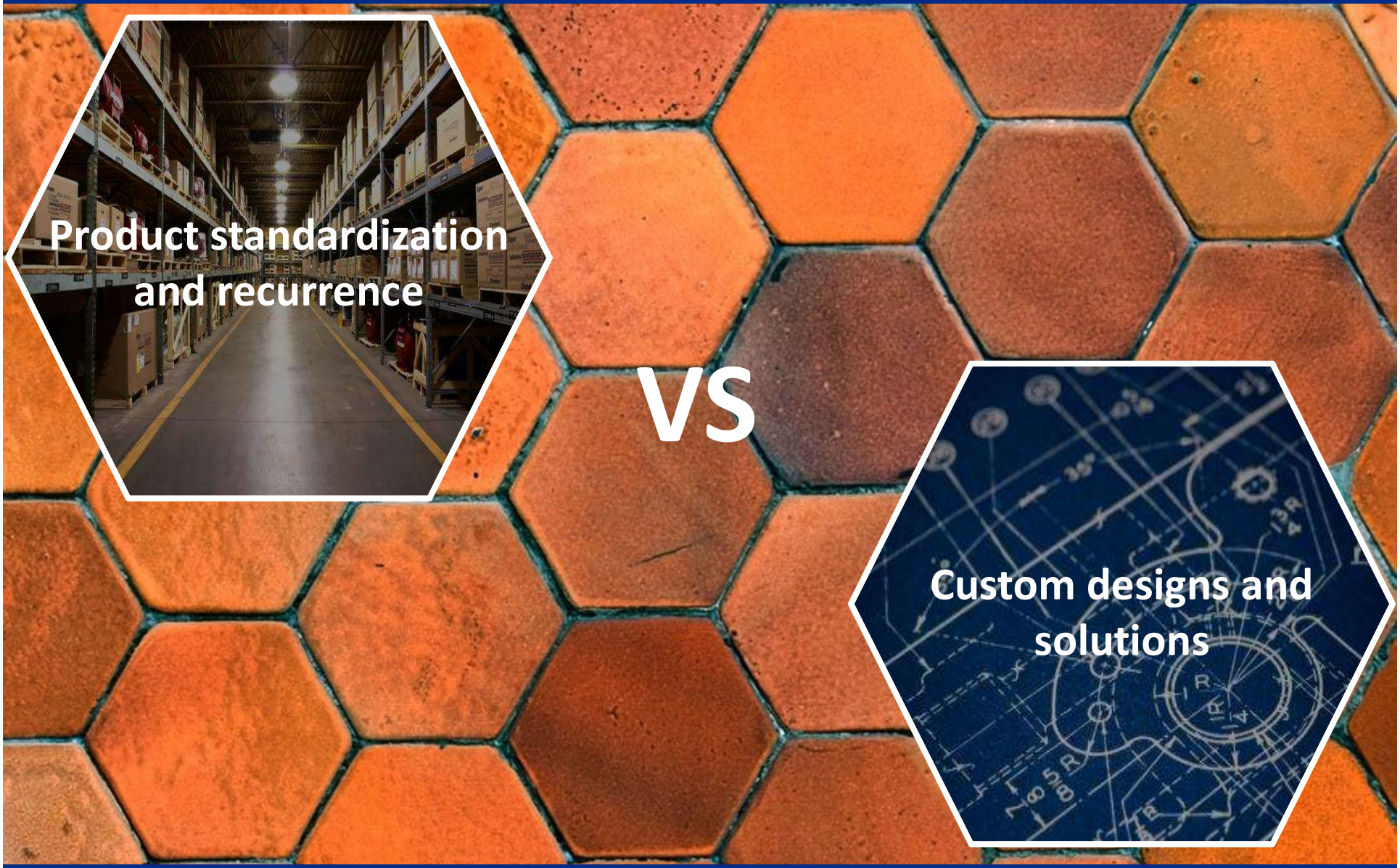
- Competition among S&T projects for production capacity and human resources

Long term plans: ITER experience

- Long term engagement needed
- Decade-long product development lifecycles



Need and business model not aligned



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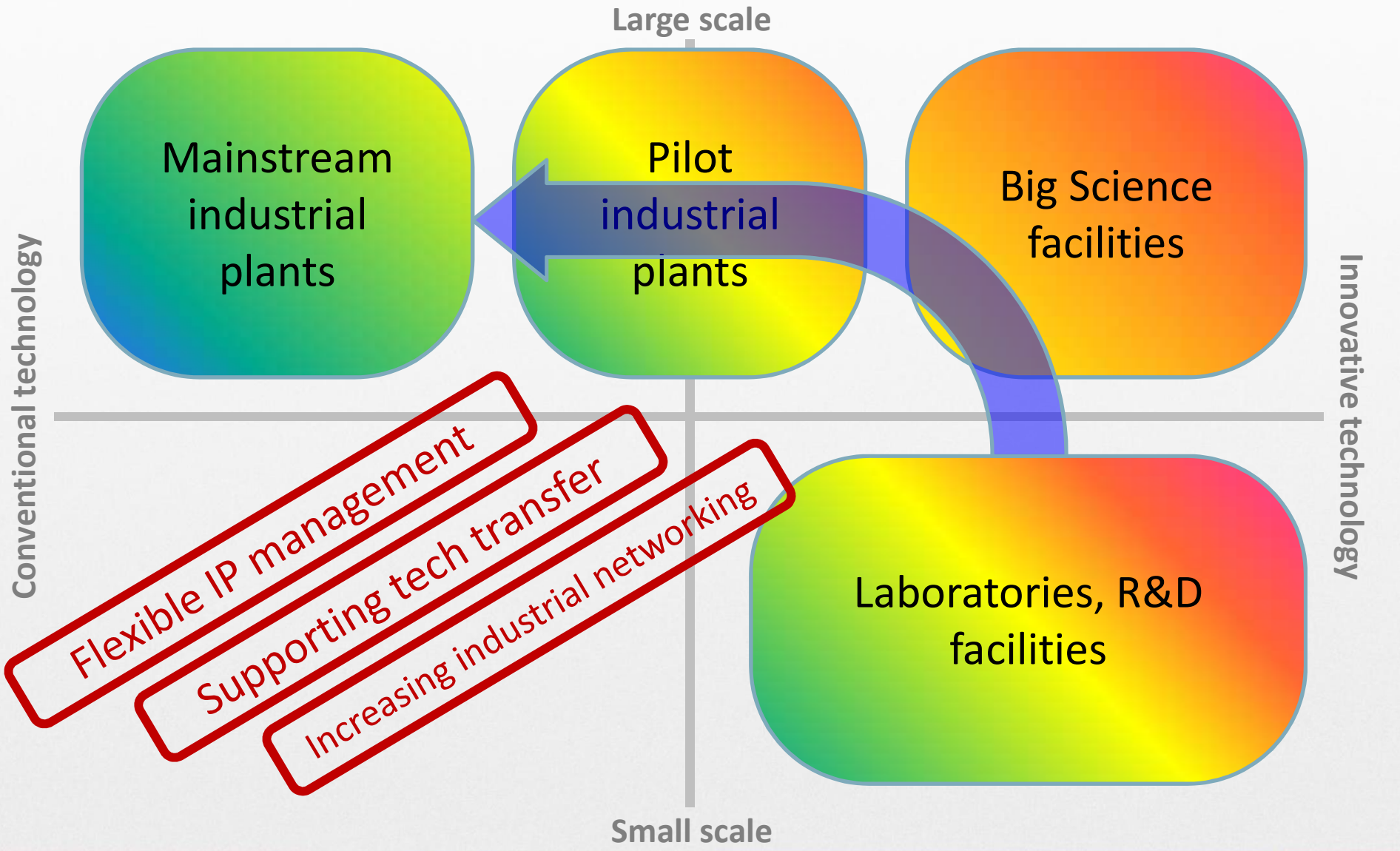
4. **Achieving buy-in**

Improving the appeal for industry

Improving the appeal for industry

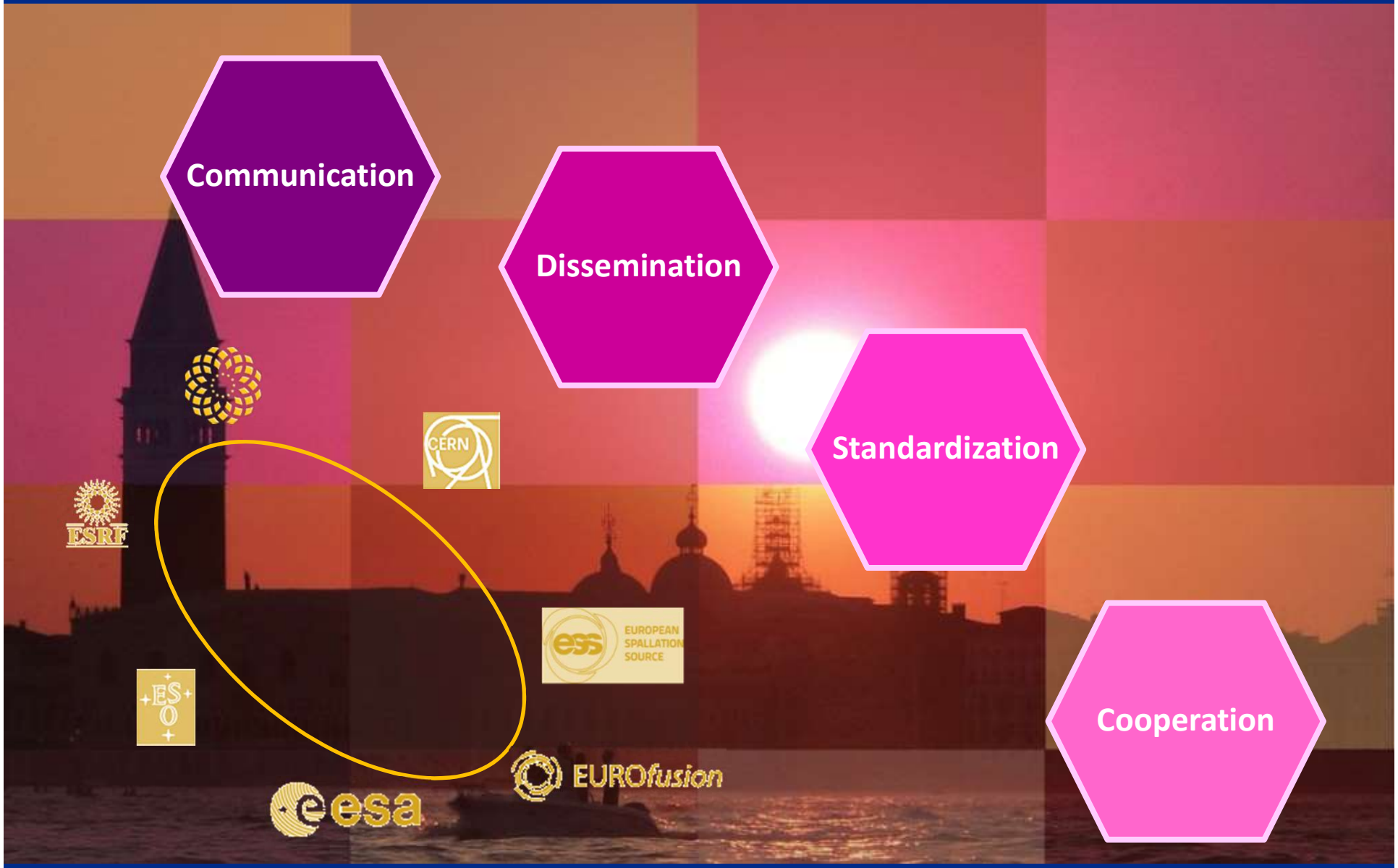
Big Science as industrial pathfinder



Promoting effective business models

Coordinating with other S&T projects

Coordinating with other S&T projects



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