Introduction

WHAT IS BIG SCIENCE ?

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ITALIAN NATIONAL AGENCY FOR TECHNOLOGIES, ENERGY AND SUSTAINABLE ECONOMIC DEVELOPMENT

What is Big Science ?

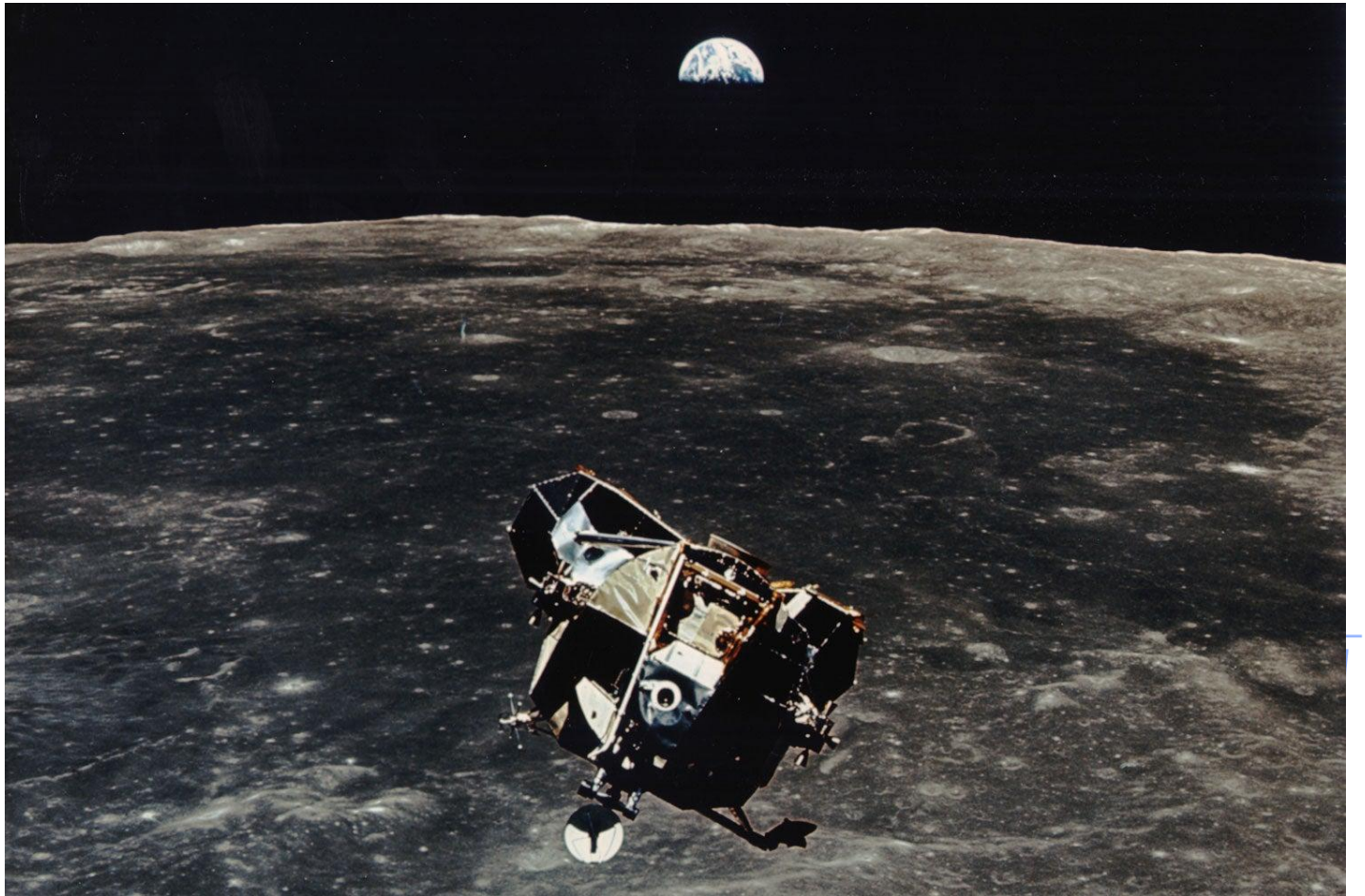
“Research project requiring substantial funding spread over long time spans, large and coordinated groups of scientists/technicians, large laboratories/infrastructures equipped with equipment often purpose-built for the Project in order to achieve a technological feat for the benefit of a broad human community in a given historical era.”

Tentative definition

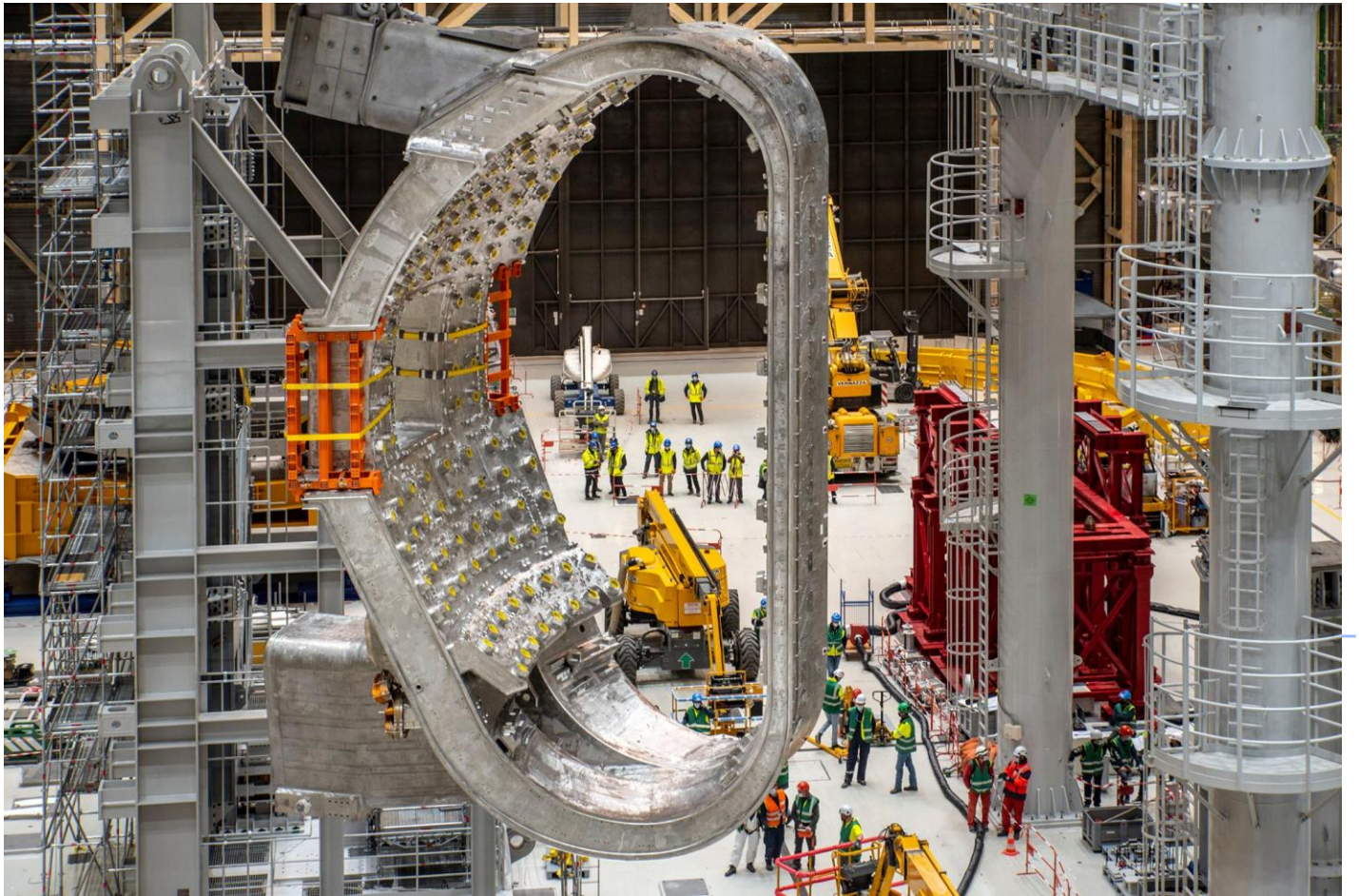
Big Science circa 3000 BC

Big Science in the 15th century

Big Science and economy - late 20th century



Big Science and economy – Early 21st century



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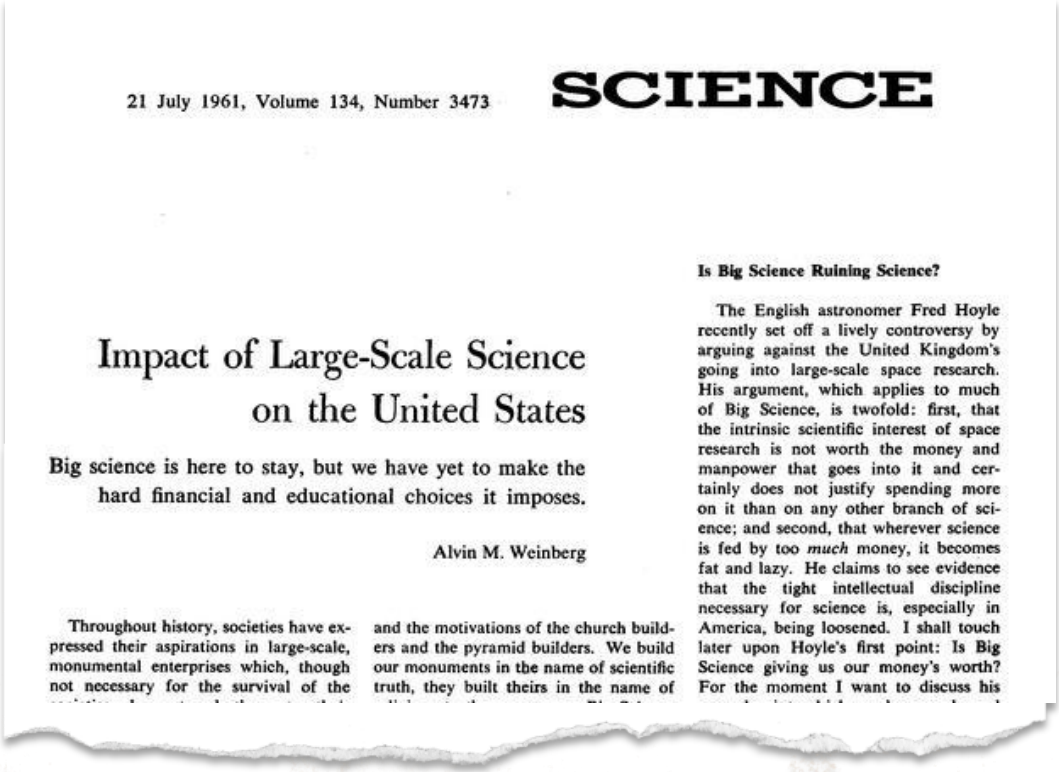

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SCIENCE

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

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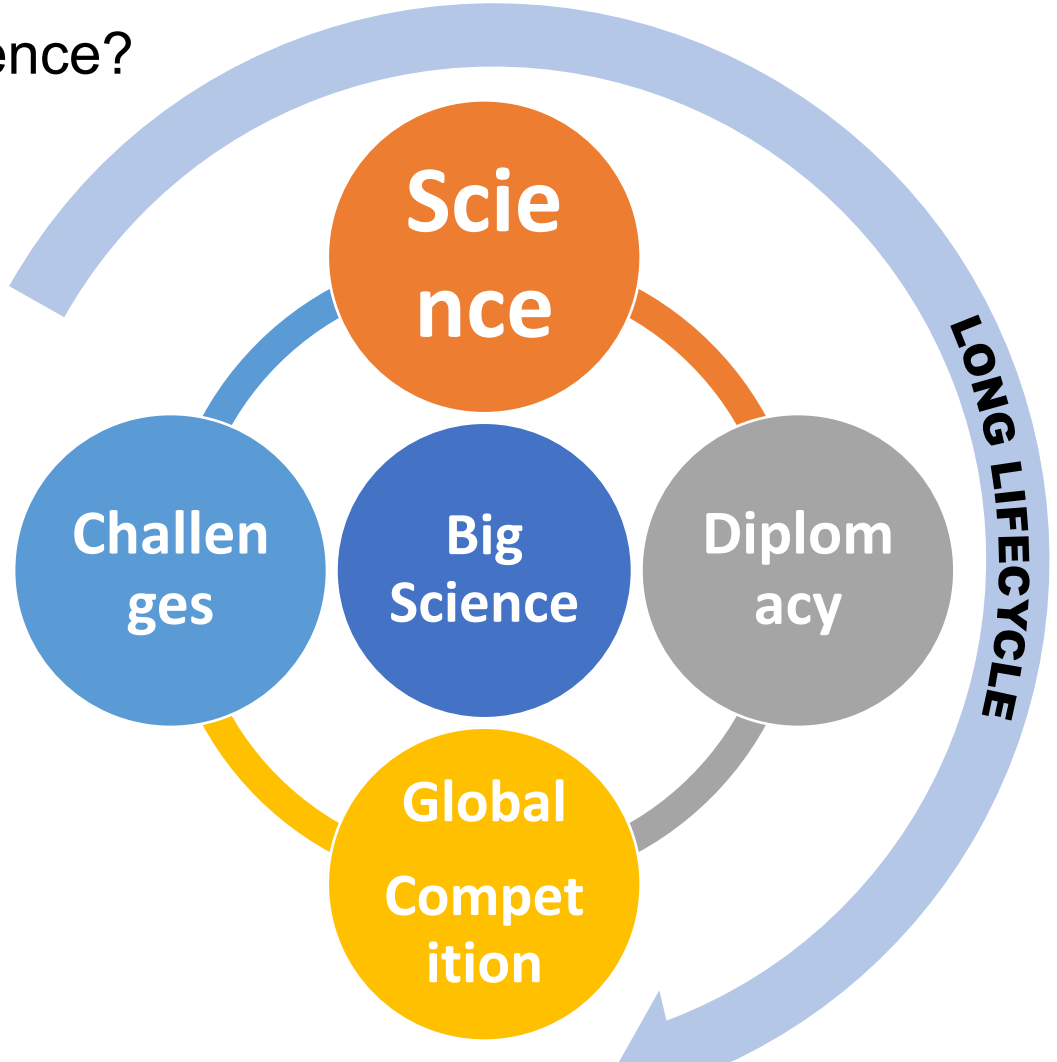
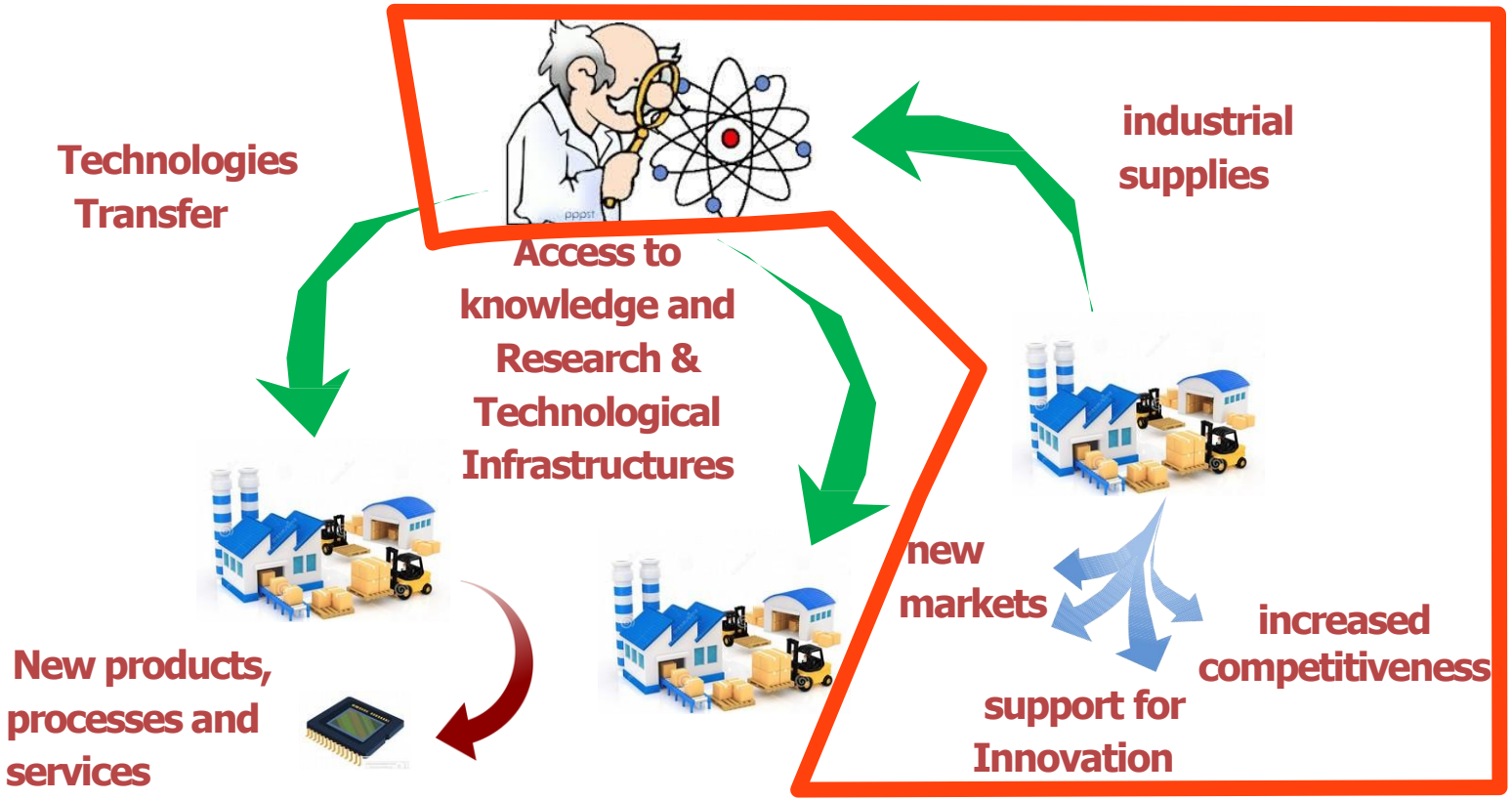


Connections among Big Science Organizations and companies



Procurement Handbook 2024 – Represented Research Orgs.

- The BSBF 2024 Procurement Handbook contains information about the following 19 research organizations:10 Partner BSOs + 9 ABSOs https://www.bsbf2024.org/procurement-handbook/

Key aspects of the main Big Science Organizations (BSOs) in Europe

Name of the BSOs and year of foundation	Legal nature of its institutional basis	Locations and number of member countries	Annual budget for tenders open to businesses
CERN ***Conseil Européen pour la Recherche Nucléaire*** 1954	Intergovernmental Organization	Geneva (Switzerland and France), 23 countries	€ 500 Million
EMBL *European Molecular Biology Laboratory* 1974	Intergovernmental Organization	Heidelberg (Germany, UK, France, Italy and Spain), 27 countries	€ 60 Million
ESA ***European Space Agency*** 1980	Intergovernmental Organization and EU Agency	Paris (France, Germany, UK, Netherlands and Italy) 22 Space Agencies	€ 6.000 Million
ESO *European Southern Observatory* 1962	Intergovernmental Organization	Garching (Germany, Switzerland and Chile) 17 countries	€ 130 Million

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ESRF *European Synchrotron Radiation Facility* 1988	Intergovernmental Organization	Grenoble (France) 13 countries	€ 20 Million
ESS ***European Spallation Source*** 2014	International Consortium	Lund (Sweden and Denmark) 17 countries	€ 150 Million
F4E ***Fusion for Energy*** 2007	EU Joint Undertaking (ITER Domestic Agency), EU Executive Agency	Barcelona (Spain, France, Germany and Japan) 27 EU member countries	€ 550 Million
ITER Organization ***International Thermonuclear Experimental Reactor*** 2007	Worldwide Intergovernmental Organization	Cadarache (France) 7 Domestic Agencies (Cina, India, Japan, USA, South Korea, Russia and EU)	€ 800 milioni

Towards a common Governance of Big Science

- Analyze differences among BSOs, their management, internal decision-making procedures, external relationships with each other and with other institutions;
- Understand that the Big Science domain is fragmented, cause various modes of operation due to the different legal basis of BSOs in Europe;
- Defining common strategies for global governance;
- Independent and spontaneous coordinating bodies among BSOs are already active in Europe;
- Request to facilitate access of business worldwide system to a Big Science global market, simplifying international bidding requirements;
- Ideal field of study for developing research on (Big) Science Diplomacy.

Coordinating experiences in governance of Big Science in Europe

Organization and year of foundation	Institutional legal framework and purpose	Members and headquarters	Coordination methods and governance
ESFRI *European Strategy Forum on Research Infrastructure* 2002	EU institutional coordination to promote scientific integration through common strategies for sharing and accessing high-quality research infrastructure networks and their development in the international context.	27 EU member states, and other associated. Headquartes in Brussels	Assembly composed of two national delegates at ministerial level who elect an Executive Board, composed of national representatives chosen by consensus and the European Commission. A Chair is appointed within the Assembly for a two-year term. The European Commission's DG RTD provides secretarial services. It acts through working groups on the basis of a multi-year roadmap.
EIROforum *European Intergovernmental Research Organization Forum* 2002	Indipendent coordination among large intergovernmental scientific organizations to develop interactions among them, joint activities and high-level international representation.	8 BSOs: CERN, EMBL, ESA, ESO, ESRF, EUROfusion, European XFEL and ILL. Rotating headquarters, currently in Heidelberg	The Council, chaired on a rotating basis for two years, is composed of the DGs of the eight partner BSOs, which appoint a Coordination Group for day-to-day administration. It acts through the work of thematic working groups.

Coordinating experiences in governance of Big Science in Europe

Organization and year of foundation	Institutional legal framework and purpose	Members and headquarters	Coordination methods and governance
BSBF *Big Science Business Forum* 2018	Independent coordination among BSOs in Europe to facilitate their relations with industry, procurement strategy, technological and economic development and competitiveness of European companies in global markets.	10 BSOs promoters: CERN, ESA, ESO, ESRF, ESS, European XFEL, FAIR, F4E, ILL, SKAO, and more ABSOs. Rotating headquarters, currently in Maastrict	*International Organizing Committee* composed of representatives from the 10 BSOs, PERIIA, national ILOs and structure that hosts the biennial edition of the Forum on a rotating basis. *IOC* guarantees its ordinary activities and presides over it. BSBF acts through the promotion of events, meetings, and joint activities to implement a BS Common Market.
PERIIA *Pan European Research Infrastructure ILO Association* 2018	Spontaneous coordination of national ILOs – *Industrial Liaison Officers* who work with BSOs to promote industrial participation in the world of Big Science.	A hundred national ILOs from thirty different countries working with a dozen BSOs in Europe. Rotating headquarters, currently in Copenhagen	Assembly of all ILOs that appoints a PERIIA Executive Board and its Chair for two years to ensure the promotion and management of all activities. It acts through the work of thematic working groups, the promotion of joint events and initiatives also in collaboration with BSOs.

The action context of Big Science Diplomacy

Analyse possible forms of international relations among Big Science stakeholder

A multifaceted panorama for BSOs in Europe:

- Some completely follow EU regulations, others only partially or not at all;
- Some include EU member countries alongside non-member or extra-European countries;
- Many autonomous forms of coordination among BSOs (EIROforum, PERIIA, BSBF);
- Some are scientific or business Consortia with national bodies participation;
- Some operate primarily at the global level (ITER, ESA, ESO, CERN, SKAO).

The last word. What is Big Science?

- Big Science = Answers to **major global challenges**
- Big Science = Sign of **eras, societies** and **geopolitical balances**
- Big Science = Joint effort of **science, policy** and **industry**
- Big Science = Source of **innovation, training** and **competitiveness**
- Big Science = Ideal place for **international relations among supranational organizations**

This is

Big Science Diplomacy

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