

RI-Paths Workshop at CERN



<https://cds.cern.ch/record/2319300>

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RI Impact Pathways. This H2020 INFRASUPP Coordination and Support action has received funding from the European Union's H2020 Framework Programme under Grant Agreement no. 777563

What is CERN?

- International organization established by convention of 1 July 1953, in force in 1954 and revised in 1971
- Full name: European Organization for Nuclear Research; acronym CERN referring to the body in charge of the drafting of the Convention: Conseil européen pour la Recherche nucléaire
- First established in Switzerland (Headquarters Agreement in 1955) and then extended into France (Status Agreement in 1965, revised in 1972)
 - Unique location of the physical assets in two states
 - Develops own rules necessary for proper functioning in agreement with host states (safety, financial, procurement)
 - Has its own social security system (health insurance + pension scheme)

Who is CERN?

- Currently 22 Member States
- Open to non-European states since 2010
 - 4 Associate Member States
(India, Pakistan, Turkey, Ukraine)
 - 3 Associate Member States in pre-stage for full membership
(Cyprus, Serbia, Slovenia)
 - 6 Observers to Council
(Japan, Russia, USA, EU, JINR, UNESCO)

How does it Work?

- CERN represents the co-operation of the member states
- Its assets are owned and administered by the co-operative of the member states
- Host states have a double role
 - They co-own assets and contribute to implement its program
 - CERN and the host states work together to ensure that the member states can achieve the mission within the host-states

Two categories of personnel

Employed personnel
(ca. 2'400,
and 750 fellows)

Staff members

Fellows

Associated personnel (ca. 13'000)

scientists, engineers, project associates linked to a home institution and using CERN infrastructure for their experiments / assisting CERN in the construction of accelerators / detectors and carrying out its projects

International
collaboration
(Users)

Exchange of scientists
(e.g. Scientific
Associates, Guest
Professors)

Training
(Apprentices, Students,
Trainees)

The Governance of CERN



Ursula Bassler
1 year, renewable 2x



Fabbiola Gianotti
5 years,
1.1.2016-31.12.2020

Council

- Supreme decision-making body
- Decides on major aspects of CERN activities
- Composed of Member States' representatives
- Headed by a president

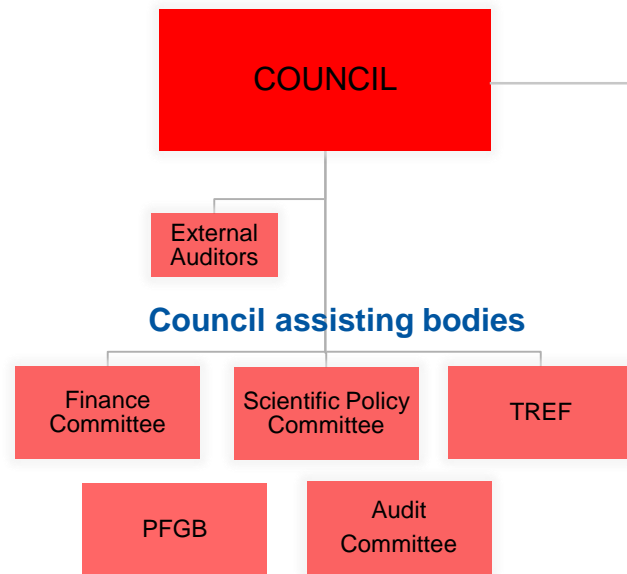


Directorate

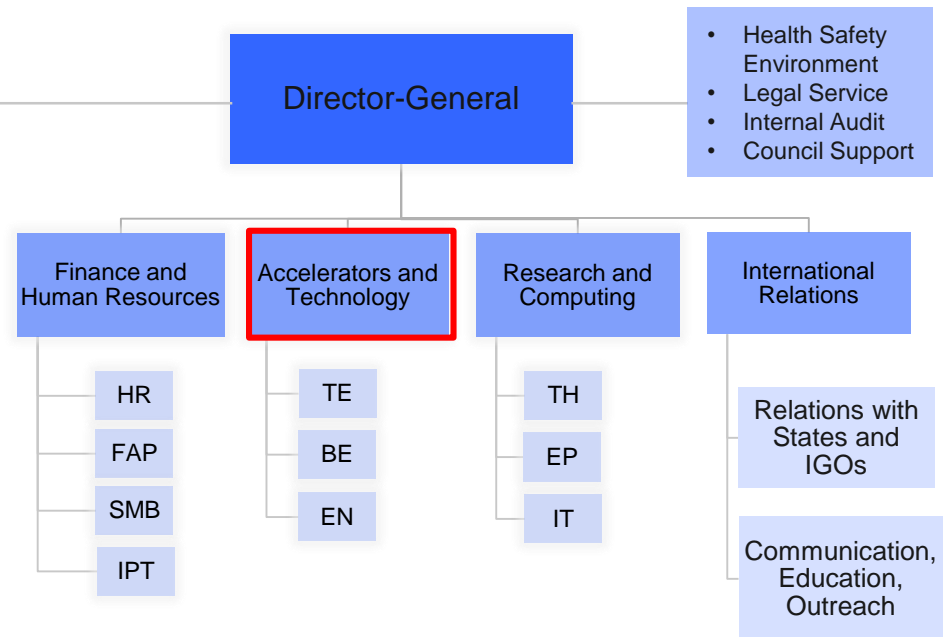
- Director General appointed by the Council
- Acting as a “Chief Executive Officer”
- Mandated to manage CERN under the Council's governance

Organigram

Supreme Decision-Making Authority



Management of the Organisation



What is a Research Infrastructure?

- Definition from *Council Regulation (EC) No 723/2009*
- of 25 June 2009 on the Community legal framework for a *European Research Infrastructure Consortium (ERIC)*
- Facilities, resources and related services that are used by the scientific community to conduct top-level research in their respective fields and covers major scientific equipment or sets of instruments; knowledge-based resources such as collections, archives or structures for scientific information; enabling Information and Communications Technology-based infrastructures such as Grid, computing, software and communication, or any other entity of a unique nature essential to achieve excellence in research. Such infrastructures may be 'single-sited' or 'distributed' (an organised network of resources);
- From the H2020 glossary: An **Installation is a part of a research infrastructure** that could be used independently from the rest. RIs are made up of one or more installations.

Examples for RI Installations

• Programmes (examples)

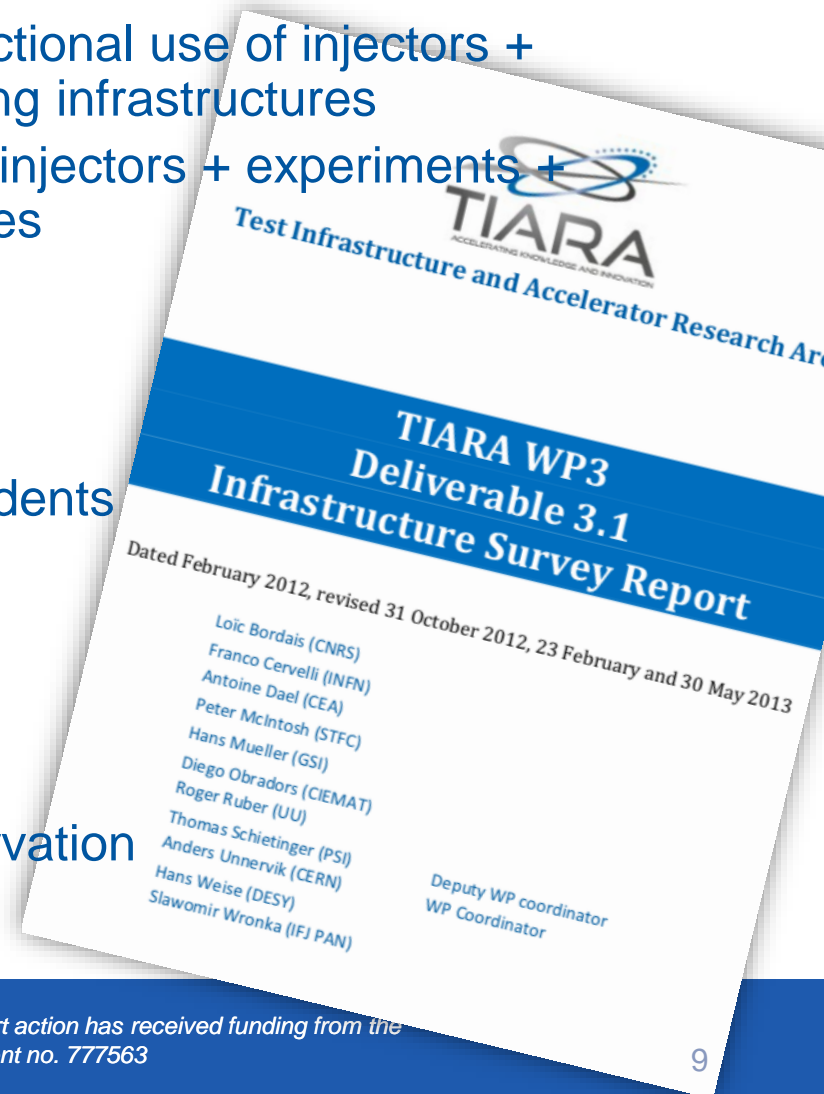
- LHC/HL-LHC consisting of collider + fractional use of injectors + experiments + fractional use of computing infrastructures
- - Antimatter factory + fractional use of injectors + experiments + fractional use of computing infrastructures

• Facilities (examples)

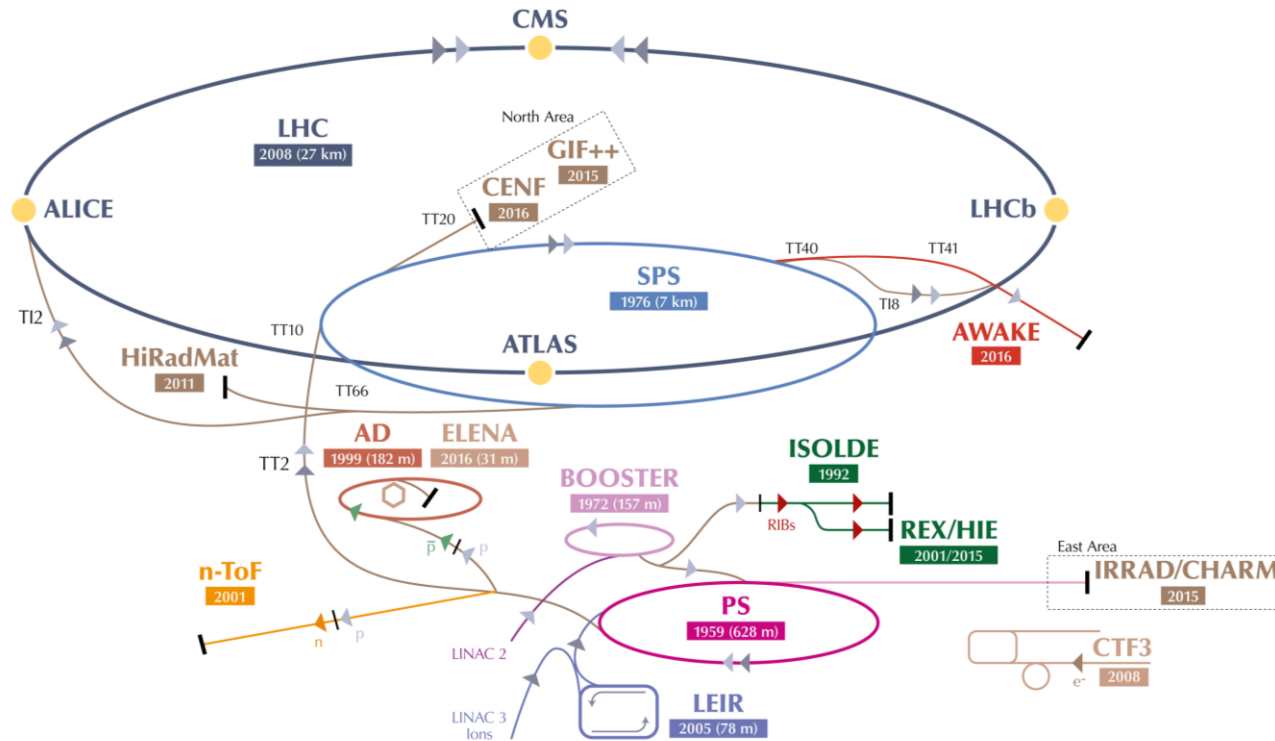
- Magnet testing facility
- Isotope production
- Co-development with NGOs, SMEs, students

• Services (examples)

- World-wide computing grid
- Carrier-neutral Internet Exchange point
- Library services
- Data curation and long-term data preservation



CERN – An “RI” with Many Installations



- Large Hadron **Collider**: Highest energy hadron collider with experiments ATLAS, CMS, LHCb, ALICE, TOTEM, LHCf and MoEDAL
- **Fixed target** experiments at beamlines: SPS, PS
- **Antimatter** factory at AD, ELENA
- Research facilities for **new acceleration technologies**: AWAKE, CLEAR

CERN Irradiation Facilities



The Proton Irradiation Facility (IRRAD) is located on the T8 beam-line in the Meyrin site East Area Proton Synchrotron (PS). For the irradiations, it uses a 24GeV/c proton beam.

[DB ENTRY](#)

[IRRAD WEBSITE](#)



The new Gamma Irradiation Facility (GIF++) is located in the North Area. It combines a ^{137}Cs source with a high-energy particle beam from the SPS H4 beam line.

[DB ENTRY](#)

[GIF++ WEBSITE](#)



The Cern High energy Accelerator Mixed field facility (CHARM), located in the East Area, features a wide spectrum of radiation types and energies.

[DB ENTRY](#)

[CHARM WEBSITE](#)



The High-Radiation to Materials facility (HiRadMat), located in the Meyrin Site on the SPS accelerator is designed to provide High-Power LHC-type pulsed beams.

[DB ENTRY](#)

[HiRadMat WEBSITE](#)



The CERN-EU high-energy Reference Field (CERF) is located in the North Area providing a neutron field for characterization of dosimetry at commercial flight altitudes and in space.

[DB ENTRY](#)

[CERF WEBSITE](#)

CALLAB

This new dedicated state-of-the-art facility replaces the ageing facility in building 172 (~30 years old). It houses several irradiation sources including the ^{60}Co source of CC60

[DB ENTRY](#)

[CALLAB WEBSITE](#)

CC60

The CC60 facility located in the same building as CALLAB



The Very energetic Electron facility for Space Planetary mission missions in harsh Radiative environments, situated 3, is a high energy electron beamline for radiation

X-Ray Facilities

At CERN there are many X-ray irradiation facilities which are included in the database. Please click on the button to view a full list of the X-ray facilities at CERN.


<http://irradiation-facilities.web.cern.ch>

CERN Engineering Facilities

Large magnet and cryostat manufacturing facility
Magnetic measurement facility
Coating facilities
Cryogenic laboratory and tensile facility
Chemistry laboratory
Nano stabilisation and positioning infrastructure
Electrical standards laboratory
High-precision coordinate measuring (metrology)
Horizontal vacuum brazing facility
Large-scale heat reaction and treatment facility
High-voltage dielectric insulation laboratory
Vacuum material characterization laboratory
Laser resonance ionization spectroscopy laboratory
Polymer laboratory
Superconductor and cabling facility
Surface analysis and treatment laboratory
Radioactive waste treatment and management facility



Examples for “special” facilities



The Radioactive Ion Beam facility

ISOLDE

Facility Experiments User info Local group Contacts

Facility History Targets & Separators Projects REX-ISOLDE RILIS Experimental set-ups

The ISOLDE Radioactive Ion Beam facility



CERN Scientific Information Service

Library - Archive - Open Access

Home About us Services Resources Scientific & historical archives Open Access Contact

Welcome to the CERN Scientific Information Service website

SERVICES QUICK LINKS

- Ask a librarian
- Check your loans
- Ask for an article
- Loan from other libraries
- Buy a book or a standard



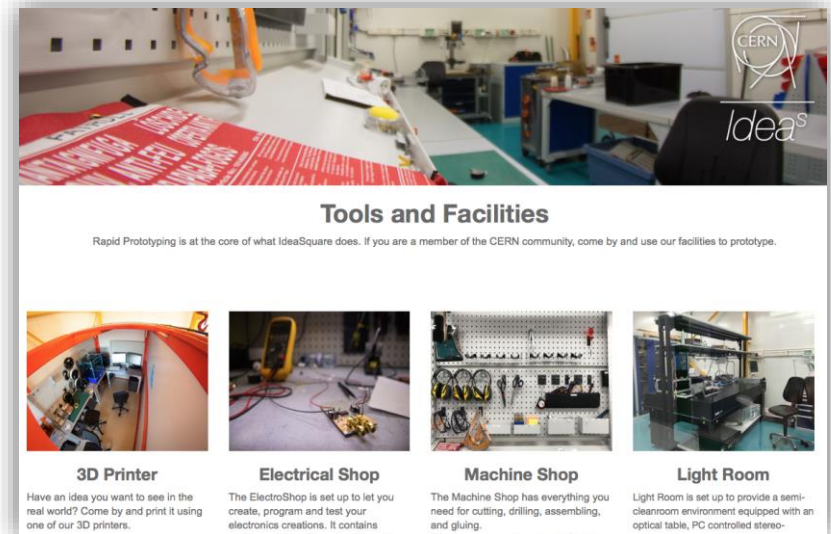
CERN openlab

> Press kit > FAQ > Contact us Search...

SHARING

our knowledge and ICT tools with other research communities

CERN openlab is a unique **public-private partnership**, through which CERN collaborates with **leading ICT companies** and other research organizations. Together we work to accelerate the development of cutting-edge ICT solutions for the **research community**.



Tools and Facilities

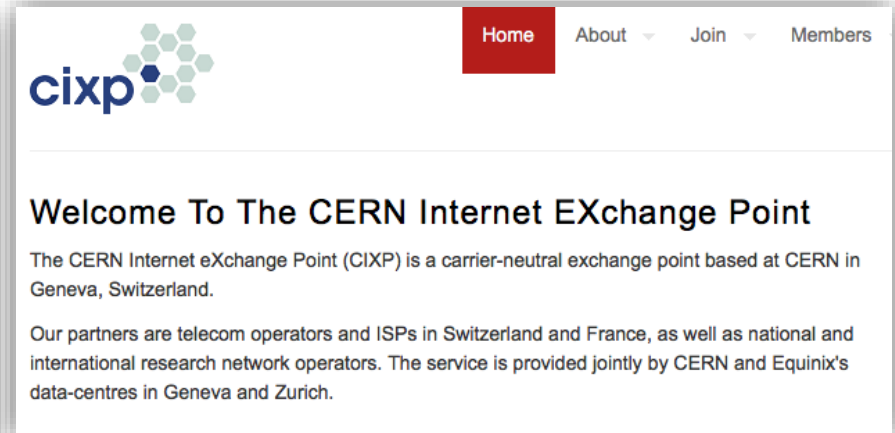
Rapid Prototyping is at the core of what IdeaSquare does. If you are a member of the CERN community, come by and use our facilities to prototype.

- 3D Printer**
Have an idea you want to see in the real world? Come by and print it using one of our 3D printers.
- Electrical Shop**
The ElectroShop is set up to let you create, program and test your electronics creations. It contains
- Machine Shop**
The Machine Shop has everything you need for cutting, drilling, assembling, and gluing.
- Light Room**
Light Room is set up to provide a semi-cleanroom environment equipped with an optical table, PC controlled stereo-

CERN Computing Facilities (Examples)



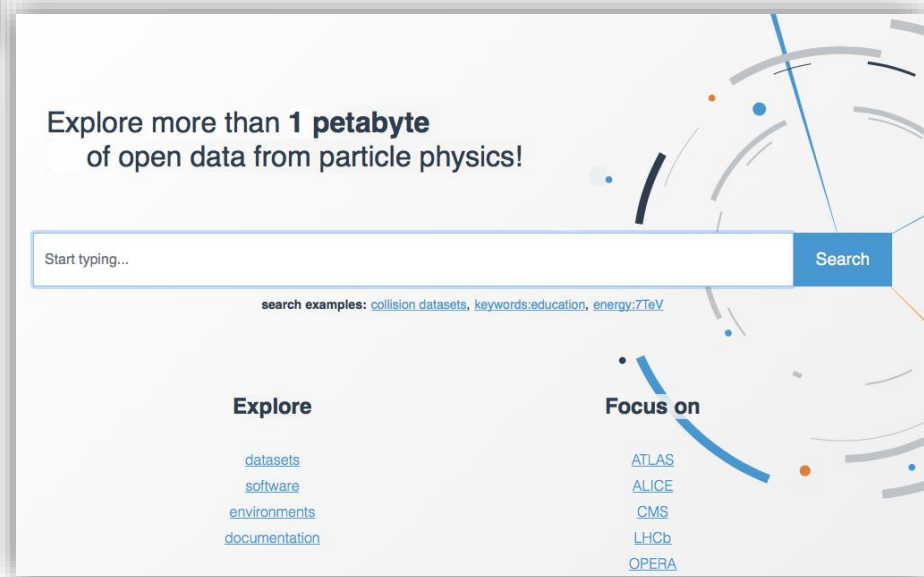
The image shows the header of the WLCG website. On the left is the WLCG logo, a colorful cube. To its right is the text "WLCG Worldwide LHC Computing Grid". Further right is a navigation menu with links: Home, About, Tiers, Structure, Get Involved, Resources, and Collaboration site. Below the header is a world map with numerous yellow circular markers indicating the locations of computing centers across the globe.



The image shows the header and main content of the CIXP website. The header features the CIXP logo (a cluster of green hexagons) and a navigation menu with links: Home, About, Join, and Members. The main content area has a heading "Welcome To The CERN Internet EXchange Point" followed by a paragraph: "The CERN Internet eXchange Point (CIXP) is a carrier-neutral exchange point based at CERN in Geneva, Switzerland." Below this is another paragraph: "Our partners are telecom operators and ISPs in Switzerland and France, as well as national and international research network operators. The service is provided jointly by CERN and Equinix's data-centres in Geneva and Zurich."



The image shows the header and main content of the SCOAP3 website. The header features the SCOAP3 logo (a purple triangle with a green circle) and the text "SCOAP3 – Sponsoring Consortium for Open Access Publishing in Particle Physics". Below the header is a navigation menu with links: Home, What is SCOAP3, SCOAP3 Partners, SCOAP3 Journals, SCOAP3 Repository, FAQs, Resources, Contact, and a search box. The main content area has a large image of a particle detector with a semi-transparent text box that reads: "SCOAP3 is a global partnership of 3,000 libraries, funding agencies and research institutions from 47 countries and Intergovernmental Organizations." At the bottom right of the image is a button that says "Access the Repository".



The image shows the header and search bar of a website. The header has the text "Explore more than 1 petabyte of open data from particle physics!". Below this is a search bar with the placeholder text "Start typing..." and a "Search" button. Below the search bar are search examples: "collision datasets, keywords:education, energy:7TeV". To the right of the search bar is a decorative graphic of a particle detector. Below the search bar are two columns of links. The left column is titled "Explore" and contains links for datasets, software, environments, and documentation. The right column is titled "Focus on" and contains links for ATLAS, ALICE, CMS, LHCb, and OPERA.



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Questions from project



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External Expectations on Impact Assessments

- By whom (today) ?
 - Host states (FR, CH) and some member states (Sweden, Czech republic)
- What are they (today)?
 - No formal requests so far for quantitative impact
 - Mainly statistics that permits member states to quantify the the return of investment
 - Number of students, post-docs, staff from the country per year at CERN
 - Number of visitors including teachers and pupils/students
 - Value of procurement actions with member state
 - Number of patents filed, list of technologies developed
 - Number of publications with authors of host state
- How has it changed in recent years?
 - Tomorrow: See next slide...

For a future infrastructure project...



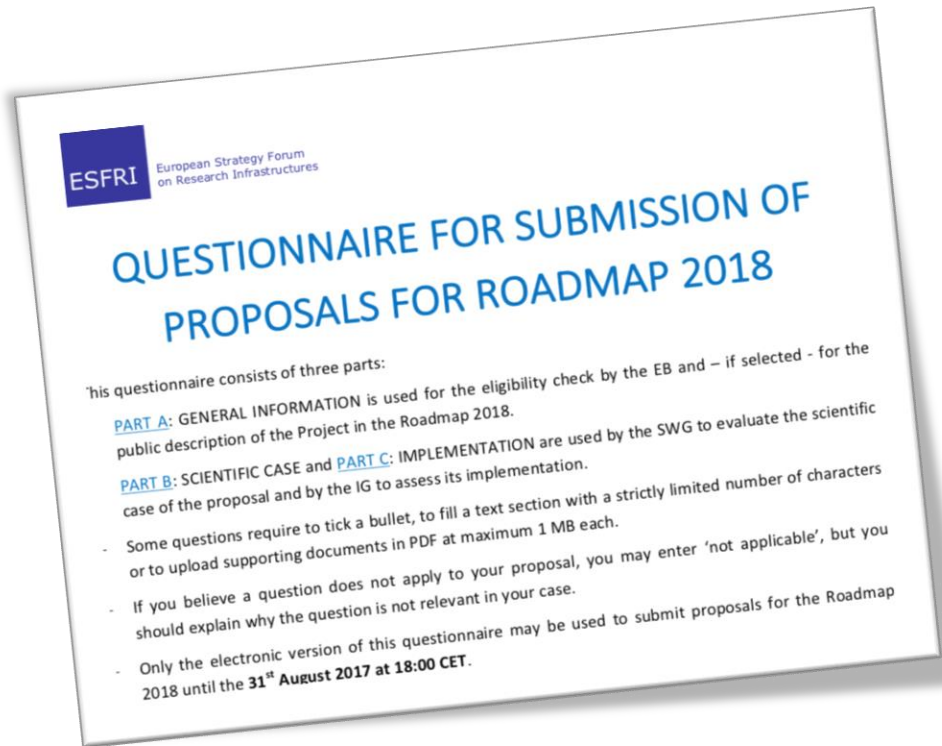
Required by EC for obtaining EU structural, cohesion and ERDF funding



Asked by EIB to obtain loans

«.. The economic decision-criterion is based on the incremental cost benefit/effectiveness of the project [...] as represented by the incremental discounted-cost-per-benefit-point»

Why this Activity now?



Pre-condition to enter the European Strategy for Research Infrastructures (ESFRI) roadmap since 2018

Section 7, paragraph 7.1: «7.6 Elaborate on the business case of your RI effectively linking the described scientific case, funding commitments, user strategy, access policy and Cost-Benefit Analysis (CBA) demonstrating the long term sustainability of the operations of your RI and explain whether and how this business case has already been reviewed».

Why this Activity at CERN now?



Recommended for research Infrastructures who receive co-funding from the EC and which are included in the ESFRI roadmap already.

The report proposes 7 main recommendations covering the key aspects of Long-Term Sustainability of Research Infrastructures. These recommendations are expanded into 35 specific points ranging over securing highly qualified and motivated human resources, realizing a robust transfer of information to society from the Research community-controlled e-Infrastructure, building an infrastructure for RI and innovation activities, understanding the diverse benefits to society, addressing the optimal organizational structure and promoting coordination

Study of the socio-economic impact of CERN HL-LHC and FCC

Contract FCC-GOV-CC-0046 (EDMS 1570377, KE3044/ATS)

<http://cds.cern.ch/record/2319300>

Requested by FR and CH



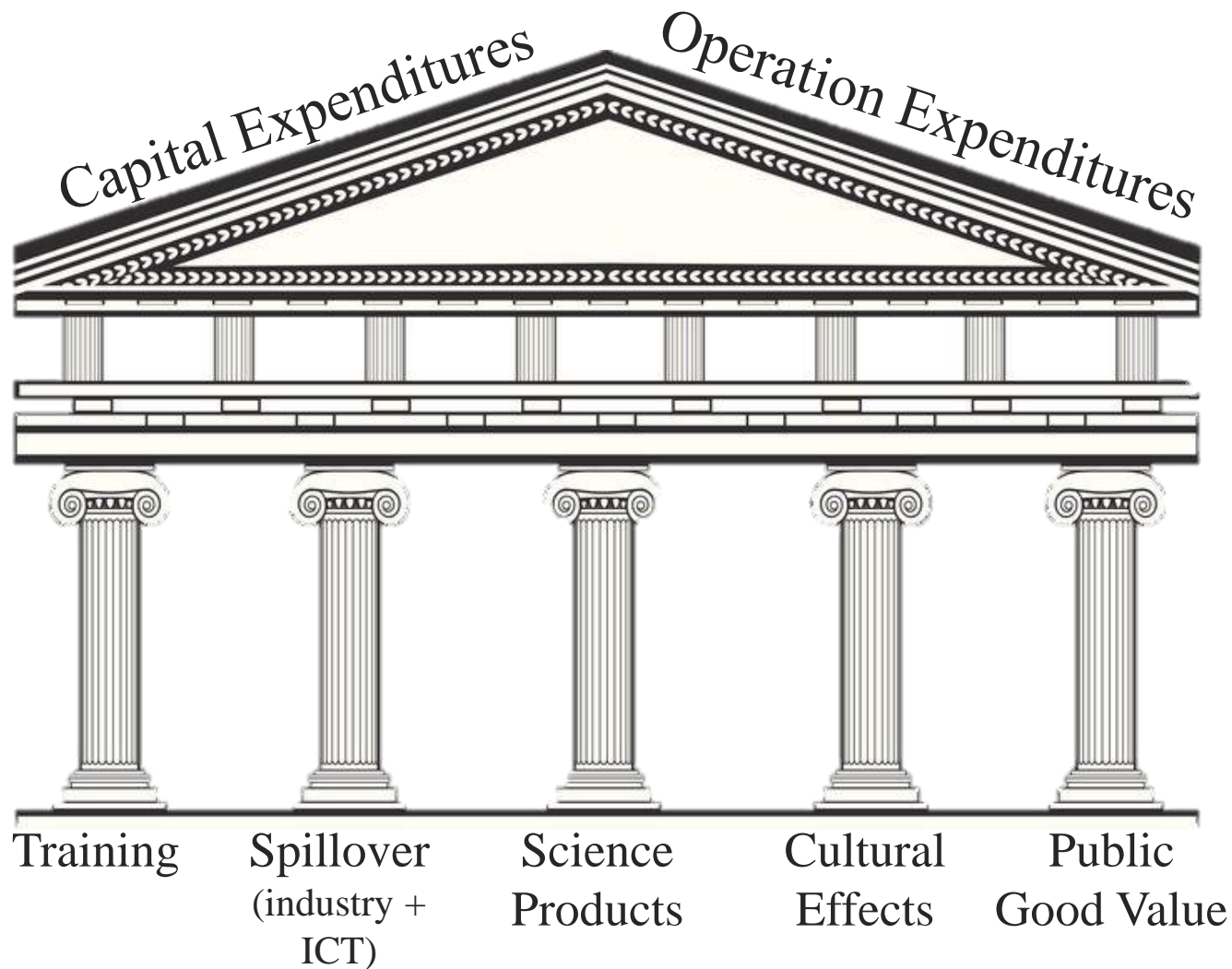
Requested by France and Switzerland as host states for the pre-validation of a scenario for a significant extension of CERN's activities with host-state contributions.

Particularly asked by Switzerland to analyse the evolution of the impact of CERN without a new project after the end of the (HL-)LHC programme.

Rational To Undertake IA Exercises

- Reactive or proactive?
 - Reactive for member state requests
 - Proactive for impact through procurement (see <http://procurement.web.cern.ch>)
 - Proactive for developing an integrated framework for CBA for a future project via the LHC/HL-LHC case as a basis
- In what areas do you seek to trace impact?
 - See model next page
- Do you differentiate between long-term effects of science and immediate ones?
 - Scientific impact not assessed (cannot quantify or predict)
 - Socio-economic impact from "start of project" to "end of operation period" applying social discount rate

Impact Assessment Architecture



Where do we seek to trace?

- **Training**
 - Number and duration of apprentices, MSc./Phd students, post-docs/ESRs
 - Salary and hiring location survey after leave
 - Professional training impact (qualitative)
- **Spillover**
 - Utility/sales ratio (sales utility impact)
 - Industrial sales impact cause-effect network (causality, impact factor in % of contract volume, technology level impact, market expansion factor)
 - Tracking of software tools above a relevant impact threshold
 - Use of software tools in outside CERN including user profile academia, research, industry, private
 - Establishment of a value model for software
- **Scientific products**
 - Tracking of publication baskets and first and second level citations for a project
 - Tracking of accessible data sets and usage count of data sets (difficult for non experiment data such as materials databases)
 - Inclusion of topics in schools (e.g. Geneva International School) and academic curricula
- **Cultural effects**
 - Tracking of visitors at CERN and their spending (TCM), exhibitions, travelling exhibitions, events such as science fairs, TEDs, lectures, workshops engaging the public
 - Tracking of videos, Web sites, social media, books, press cuttings
- **Public good value**
 - Surveys in member states via market-research companies

Challenges

- **Accountability**
 - CERN is a multi installation/facility RI. It is **difficult to account the overall tracked impacts to individual installations**
- **Causality**
 - It is difficult to decide on inclusion/exclusion of impact elements since the **causality between the impact and the specific CERN installation/facility needs to be demonstrated** (e.g. Angels & Daemons book and movie can or cannot be attributed to the LHC cultural goods?)
- **Resources**
 - Comprehensive, regular and credible impact assessment **requires a quality managed process** with an **adequately staffed team** and **committed support from all departments and groups**. Today, only support on a best-effort basis exists and no dedicated CBA team at CERN exists. For an FCC CBA study, a dedicated working group can be created with contracts in place, but only for a limited period of time and for a specific purpose (e.g. study of a future project).
- **Cost**
 - Comprehensive, regular and credible impact assessment requires substantial amounts of **financial engagements**. CBA for benefit if impact assessment?

What Would You Need for the Future?

- **Underexplored areas**

- Value of training

- Long-lasting salary and job profile/hiring surveys are urgently needed, but are difficult to implement in-house due to data protection fears, limited resources and knowledge "how to".

- Value of professional training not explored

- No method known on how to measure the training effect of company employees coming to work at CERN in the frame of projects (see impact via procurement below)

- Measured, but **method not satisfactory**

- Value of software products and services

- Approach to assume the "purchase value of a commercial software" for using an open source tool is not appropriate since a long term (different business models and Web-based services are used today)

- Financial impact of procurement regularly reviewed

- Utility/sales ratio of industrial procurement is only reviewed at rather long time scales. A more regular approach with more rigorous cause/effect matrix would be beneficial also for industry to know how to improve the industrial impacts of large-scale research infrastructure projects. This requires a substantial effort (thousands of companies need to be interviewed an causal networks need to be analysed)

Do Yourself or Outsource?

- **Inhouse**

- Establish data gathering catalogue
 - what, who, how, when
- Instrument tools (e.g. counters on Web sites, cookies, provide organization only tailor questionnaires developed by experienced professionals)
- Develop background materials for surveys
- Work with consultants to develop the process for data gathering commonly to ensure that appropriate data is collected effectively (had good experience already with external partners)
- Instruct departments and groups for
- Analyse and integrate the results to the overall impact report

- **Outsource**

- Contract as much of the data gathering and analysis work to companies, cooperation partners, universities, consultants
- Use outside platforms for surveys as much as possible
 - Compliant with data protection regulations, assure confidentiality and independence as well as compliance with ethics committee guidelines
- Training of in-house personnel about need and value of the activity (usually better perceived if it comes from an independent organization or trainer)