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Feuille de route suisse pour les infrastructures de recherche en vue du message FRI 2025 – 2028 (Feuille de route suisse pour les infrastructures de recherche 2023)

Partie II : Participations suisse à des réseaux internationaux d'infrastructures de recherche



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Département fédéral de l'économie,
de la formation et de la recherche DEFR
**Secrétariat d'Etat à la formation,
à la recherche et à l'innovation SEFRI**

Photo de couverture : Des réseaux internationaux d'infrastructures de recherche ayant la forme juridique ERIC coordonnent des dans leur domaine scientifique des activités de recherche, services et l'échange de connaissances. La Suisse est active active dans plusieurs ERIC et examine régulièrement d'autres participations et affiliations.
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1 Introduction : Rappel du contenu du rapport sur la Feuille de route

Le Secrétariat d'État à la formation, à la recherche et à l'innovation (SEFRI) est responsable de la rédaction de la présente Feuille de route suisse pour les infrastructures de recherche 2023 (« Feuille de route 2023 ») et du processus réalisé avec les partenaires que sont le Conseil des EPF, la Conférence des recteurs des hautes écoles suisses (swissuniversities), le Fonds national suisse (FNS) et l'Académie suisse de sciences naturelles (SCNAT).

La Feuille de route 2023 se base sur un processus établi et se compose de trois parties :

La Partie I (*Feuille de route suisse pour les infrastructures de recherche 2023 : Partie I Infrastructures de recherche nationales*) introduit d'abord les différentes mesures d'encouragement en faveur des infrastructures de recherche au niveau national (chapitre 2). Elle décrit ensuite plus en détails le processus de sélection des projets par les hautes écoles et les établissements de recherche du domaine des EPF ainsi que quelles nouvelles infrastructures

sont planifiées (chapitres 3 à 5). Les annexes de la Partie I contiennent les descriptions scientifiques et les budgets des projets d'infrastructures nationales des Feuilles de route 2015 et 2019 (mises à jour) ainsi que de la Feuille de route 2023 (nouveaux projets à réaliser dès 2025).

La Partie II (*Feuille de route suisse pour les infrastructures de recherche 2023 : Partie II Participations suisse à des réseaux internationaux d'infrastructures de recherche*) rend compte de l'état des participations suisses à des réseaux d'infrastructures européens (chapitre 4), les futures participations à examiner (chapitres 2 et 3) et contient les descriptions scientifiques de ces réseaux (Annexes II.1 et II.2).

La Partie III (*Feuille de route suisse pour les infrastructures de recherche 2023 : Partie III La Suisse dans les organisations internationales de recherche*) décrit les organisations internationales dont la Suisse est membre.

2 Aperçu du paysage des infrastructures européenne de recherche

2.1 Feuille de route ESFRI

ESFRI, le Forum stratégique européen sur les infrastructures de recherche (European Strategy Forum on Research Infrastructures), regroupe les délégués des ministères responsables de la politique de recherche des pays Membres de l'UE et des pays associés aux programmes cadres de l'UE en matière de Recherche et d'Innovation (EU Framework Programme for Research and Innovation). ESFRI a pour mission de soutenir une approche cohérente, coordonnée et stratégique de la politique relative aux infrastructures de recherche à l'échelle européenne, soutenant ainsi l'excellence scientifique dans tous les domaines de la science et de l'innovation.

La feuille de route pour les infrastructures de recherche est un des instruments d'ESFRI dans son effort de coordination des infrastructures de recherche (IR). Depuis la première édition en 2006, ce document a été mis à jour périodiquement¹ et dernièrement en 2021². La feuille de route pour les infrastructures de recherche ESFRI analyse les défis majeurs et stratégiques de la politique relative aux infrastructures de recherche dans les années avenir. Elle présente aussi une cartographie de l'état des infrastructures actuelles et le leur importance dans les grands enjeux scientifiques et sociétaux. Enfin, la feuille de route répertorie toutes les nouvelles infrastructures et les mise-à-jours importantes en passe d'être mise en œuvre dans le cadre d'ESFRI.

Dans le cadre de cette démarche de coordination, ESFRI encourage les pays membres, à se doter d'un instrument de planification des IR à l'échelle nationale, régulièrement mis à jour afin de définir les priorités nationales et de les aligner, si nécessaire, aux besoins des IR pan-européennes. La Suisse s'est dotée d'une feuille de route nationale pour les infrastructures dès 2011, qui a été mis à jour en 2015, 2019 et, par la présente, en 2023. Les infrastructures retenues sur la feuille de route ESFRI sont donc évaluées à

la lumière des intérêts des communautés de recherche suisse et des priorités stratégiques de la Confédération dans le cadre de la feuille de route nationale. Parmi les infrastructures de la feuille de route ESFRI 2021, sept *infrastructures de recherche internationales*³ établies et douze *infrastructures de recherche coordonnées sur le plan international*⁴ bénéficient d'une participation suisse. Il s'agit d'infrastructures de recherche qui se sont établies ces dernières années comme références ou comme infrastructures de recherche importantes pour le développement du domaine de recherche correspondant.

2.2 ERIC comme entité juridique d'infrastructure de recherche

Les infrastructures de recherche pan-européennes disposent d'une personnalité juridique, ERIC (*European Research Infrastructure Consortium*) établie par décision de la Commission européenne depuis 2009⁵ afin de faciliter la création et l'exploitation d'infrastructures de recherche importantes à l'échelle européenne. La personnalité juridique ERIC reconnaît la participation des États membres de l'UE, des pays associés, des pays tiers non-associés ainsi que des organisations intergouvernementales à une infrastructure de recherche. Le règlement ERIC est directement applicable dans les systèmes juridiques nationaux des États membres de l'UE et ne requiert pas de transposition formelle dans le droit national. Cependant, dans le cas de la Suisse, l'adhésion à un ERIC nécessitait jusqu'à peu l'approbation du Parlement. L'adoption en Décembre 2022 du message ERIC (voir 2.3 ci-dessous) délègue maintenant la compétence de décider de l'adhésion à un ERIC au Conseil fédéral.

La personnalité juridique ERIC est particulièrement adaptée à la création et l'exploitation d'infrastructures du type infrastructures « distribuées » ou « coordonnées sur le plan international » et la majorité des ERICs sont de ce type. Ces

1 Jusqu'ici ESFRI a publié les feuilles de route suivantes: 2006, 2008, 2010, 2016, 2018, 2021.

2 <https://roadmap2021.esfri.eu/>

3 Les «installations de recherche internationales» construisent et entretiennent des installations centralisées et accessibles à des utilisateurs externes en vue de la production de résultats de recherche. Elles requièrent de la part de leurs États membres des investissements à long terme et des contributions conséquentes pour l'exploitation et l'entretien (exemples: CERN, ESO).

4 Les «infrastructures de recherche coordonnées sur le plan international» sont constituées en réseaux de «nœuds» nationaux. Ces «nœuds» mettent en commun et coordonnent des infrastructures ou des services.

5 Council Regulation (EC) No 723/2009 of 25 June 2009 on the Community legal framework for a European Research Infrastructure Consortium (ERIC), in: JO L 206 du 8.8.2009.

infrastructures mettent en commun des infrastructures existantes et connectent des groupements de recherche présents dans des universités ou instituts de recherche en les organisant sous forme de nœuds nationaux. L'interconnexion de ces nœuds nationaux et leur coordination centralisée au niveau d'un « hub » représentent la structure élémentaire de nombreux ERICs (Figure 2.1 ci-dessous)⁶. L'opération d'un ERIC est typiquement financée par des contributions financières et en nature des institutions hébergeant les nœuds nationaux⁷. Les statuts des ERICs définissent les modalités de coopération

et permettent dans de nombreux cas d'uniformiser et de standardiser les services et l'accès aux données, rendant les infrastructures plus visibles et compétitives. Les ERICs sont par exemple un moteur important du développement du "FAIR data" qui visent à faciliter l'accès aux données, leur traçabilité et leur réutilisation à d'autres fins. Le développement scientifique et la stabilité financière des ERICs sont fortement dépendants du soutien des États membres des ERICs, qui est lui-même tributaire de la cohésion, de l'organisation et du financement des nœuds nationaux.

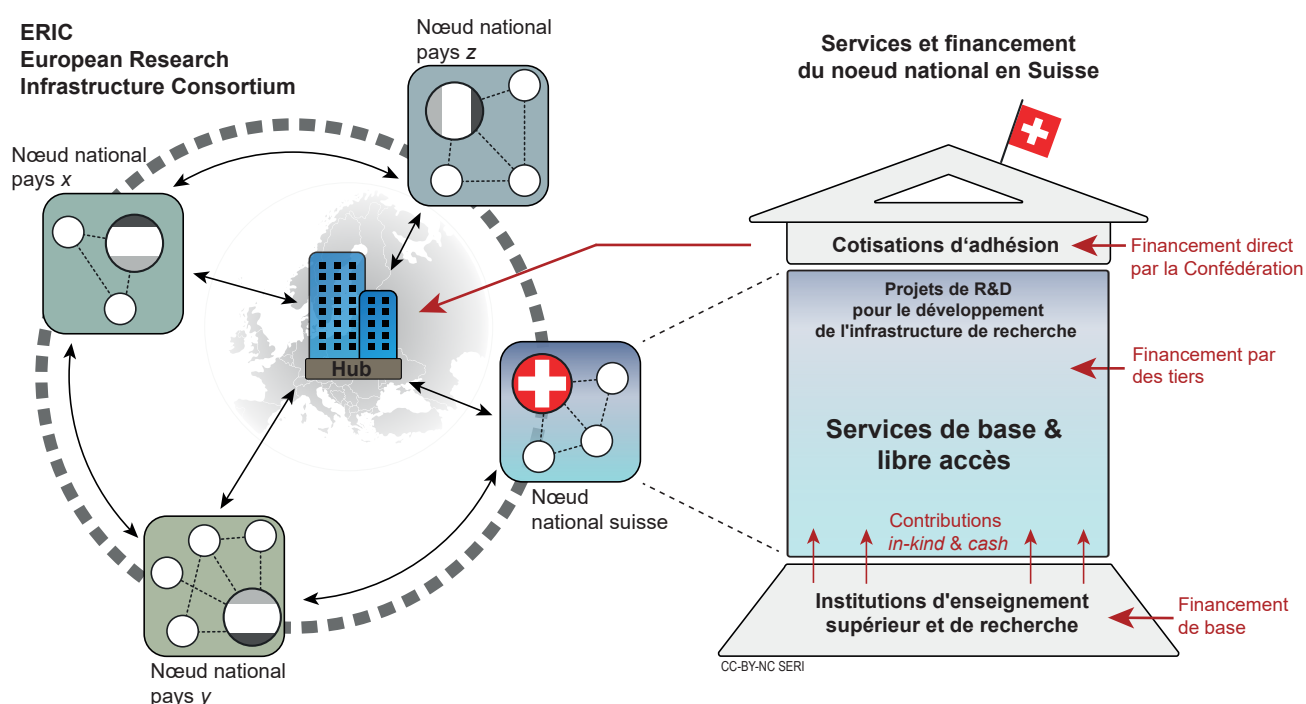


Figure 2.1: Modèle élémentaire de la structure d'un réseau d'infrastructures de recherche de personnalité juridique ERIC et du nœud national suisse y participant.

6 «Nœud national» : Une organisation engagée par chaque État membre/observateur de l'ERIC conformément aux statuts et aux autres accords établissant l'ERIC. Les nœuds nationaux ne sont pas sous le contrôle direct de l'entité juridique de l'ERIC. Les nœuds nationaux sont des entités juridiques qui appliquent leurs propres règles nationales et locales. Un nœud national peut consister en une entité de coordination pour un réseau d'institutions/ installations nationales.

7 Conformément au message ERIC (FF 2022 1137), la Confédération prend en charge les cotisations des membres des ERIC, tandis que l'organisation hôte (établissement d'enseignement supérieur, institution de recherche non commerciale) est responsable du financement des nœuds nationaux.

2.3 Message concernant l'adhésion de la Suisse aux réseaux européens d'infrastructures de recherche.

La mise en réseau au niveau international d'infrastructures de recherche, déjà organisées au niveau national, permet de profiter de synergies et de valoriser les investissements nationaux déjà consentis pour leur mise sur pied et leur exploitation.

Le cadre juridique ERIC a été créé par l'Union européenne dans le but de simplifier l'établissement et l'exploitation d'infrastructures de recherche européennes. La Suisse est déjà membre d'ESS-ERIC établie à Lund en Suède (*European Spallation Source*) depuis 2015⁸, l'un des 24 ERICs existants actuellement (statut au début 2023)⁹.

Le 13 avril 2022, le Conseil fédéral a transmis au Parlement le message concernant l'adhésion de la Suisse à six réseaux internationaux d'infrastructures de recherche ayant adopté la forme juridique ERIC et une modification de la loi fédérale sur l'encouragement de la recherche et

de l'innovation (LERI). Le Parlement a approuvé ce message (Message ERIC)¹⁰ en décembre 2022, ce qui permet au Conseil fédéral de demander l'adhésion à six ERICs existants pour lesquels l'importance d'une participation suisse avait été reconnue dans le processus de la Feuille de route suisse 2019. Il s'agit des infrastructures BBMRI, CESSDA, DARIAH, ECRIN, EPOS et ICOS (voir Tableau 4.1 ci-dessous). Ceci permet aux communautés de recherches concernées de s'investir activement et dans la durée pour ces réseaux d'infrastructures de recherche. De plus, cette adhésion permet à la Suisse (représentée par le SEFRI) de faire valoir ses intérêts avec l'obtention du droit de vote aux assemblées générales de ces ERICs.

Pour cinq infrastructures dont l'importance d'une participation suisse avait également été reconnue dans la Feuille de route 2019 (ACTRIS, eLTER, ECCSEL, SHARE et ESSurvey), il s'agira d'examiner plus en détails une éventuelle adhésion, notamment en fonction du développement de leur statut d'ERIC ou de l'organisation de la communauté scientifique concernée.



Station de mesure du Service sismologique suisse sur la Lauchneralp dans le Lötschental (VS). Les données recueillies par les réseaux sismiques de Suisse et d'Europe sont unifiés et rendus accessibles via EPOS-ERIC. EPOS propose de nombreux autres services et jeux de données dans le domaine des géosciences. Service sismologique suisse à l'EPF de Zurich.

⁸ BBl 2014 6795

⁹ The ERIC landscape - The ERIC landscape is presented by clusters (eric-forum.eu)

¹⁰ BBl 2022 1137

3 Examen des nouvelles participations suisses à des réseaux internationaux d'infrastructures de recherche

Dans le cadre du processus de la Feuille de route 2023, les scientifiques et institutions ont communiqué leur intérêt de participer à des nouveaux réseaux européens d'infrastructures à la fin décembre 2021. Le FNS a ensuite pris position (sur mandat du SEFRI) sur l'importance d'une participation suisse à six¹¹ réseaux d'infrastructures de recherche en juillet 2022. A noter que seules les participations à des infrastructures figurant sur la feuille de route ESFRI pouvaient faire l'objet d'un examen de l'importance pour la Suisse de participer.¹² Dans son analyse, le FNS a examiné, notamment, l'état de l'organisation de la communauté scientifique, l'importance socio-économique de participer ou encore la plus-value scientifique pour la place de recherche suisse. Sur les six propositions de participations, deux (eBRAINS et SoBigData++¹³) ont été jugées d'importance moyenne et quatre d'importance élevée (CLARIN, EMPHASIS, GGP, SLICES, voir Tableau ci-dessous). Etant donnée ces résultats, l'option d'une participation de la Suisse à eBRAINS et SoBigData++ ne sera donc pas approfondie pour l'instant. En ce qui concerne CLARIN, EMPHASIS, GGP et SLICES, le SEFRI va poursuivre les examens en vue d'une éventuelle adhésion de la Suisse à ces réseaux. En plus des six réseaux mentionnés ci-dessus, le FNS a estimé que la participation à CTAO était d'une importance élevée pour la suisse (voir aussi *Feuille de route suisse pour les infrastructures de recherche 2023 : Partie III La Suisse dans les organisations internationales de recherche*).

11 Le FNS a en plus pris position sur l'importance de participer à CTAO (voir Feuille de route suisse pour les infrastructures de recherche 2023 : Partie III La Suisse dans les organisations internationales de recherche).

12 L'intérêt de la communauté scientifique pour l'infrastructure MEDem (Monitoring Electoral Democracy) a été porté à l'intention du SEFRI. Cependant, cette infrastructure n'a pas pu être examinée par le FNS car elle ne figure pas encore sur la feuille de route ESFRI.

13 eBrains: EBRAINS Research Infrastructure. SoBigData++: Integrated Infrastructure for Social Mining and Big Data Analytics

4 Réseaux d'infrastructures avec des participations suisses

En Suisse, les institutions de recherche participent à 17 infrastructures de recherche coordonnées sur le plan européen. Le statut des participations suisses ainsi que le nœud national figurent dans le Tableau 4.1. Le domaine d'activité de ces réseaux d'infrastructures est brièvement décrit ci-dessous. Une description plus détaillée de chaque infrastructure se trouve à l'Annexe II.1 (Description des nouvelles participations examinées au travers de la présente Feuille de route) ainsi qu'à l'Annexe II.2 (Participations examinées au travers des Feuilles de route 2015 et 2019).

ACTRIS : Infrastructure qui coordonne la mesure des constituants de courte durée vie dans l'atmosphère (p.ex. aérosols, gas-trace, polluants).

BBMRI : Plateforme de coordination des banques de données biologiques (biobanques) européennes pour soutenir le développement de nouveaux traitements.

CESSDA : Cette infrastructure fournit des prestations de services intégrées pour les archives de données en sciences sociales.

CLARIN : Infrastructure coordonnant l'accès aux données, outils et services supportant la recherche basée sur les ressources linguistiques.

DARIAH : Réseau européen des infrastructures de recherche numérique en sciences humaines.

ECCSEL : Infrastructure de recherche coordonnant la recherche sur la capture et le stockage de dioxyde de carbone.

ECRIN : Cette infrastructure coordonne et facilite les essais cliniques multinationaux.

ELIXIR : Infrastructure qui coordonne et développe les ressources (données, expertise, bonnes pratiques, etc.) dans le domaine des sciences de la vie. ELIXIR est intégré au cadre EMBL (European Molecular Biology Laboratory).

eILTER : Infrastructure mettant en commun les sites de suivi multidisciplinaire d'écosystèmes.

EMPHASIS : Infrastructure visant à développer et donner accès à des installations et aux services permettant le phénotypage à plusieurs échelles dans différents scénarios agro-climatiques.

EPOS : Cette infrastructure intègre les données provenant de l'étude de la terre solide, particulièrement dans les domaines de la séismologie, des risques naturels et de la geo-énergie.

ESSurvey : Infrastructure d'enquêtes de sciences sociales qui évaluent l'évolution des attitudes, des croyances et des comportements de diverses populations dans plus de trente pays européens.

GGP : Infrastructure en sciences sociales pour la recherche sur la dynamique des populations et des familles.

ICOS : Infrastructure qui coordonne les observations long-termes des teneurs de gaz à effet de serre en vue d'une meilleure compréhension du cycle du carbone.

PRACE : Infrastructure qui permet un accès facilité et coordonné aux infrastructures européennes de calcul numérique.

SHARE : Infrastructure qui coordonne les enquêtes en sciences sociales à long terme sur la santé, la vieillesse et la retraite en Europe.

SLICES : Infrastructure à l'échelle européenne pour soutenir la recherche sur les technologies de l'information et de la communication et la science numérique, y compris l'internet des objets, l'informatique périphérique, les réseaux du futur et de « cloud computing ».

Tableau 4.1: Infrastructures de recherches internationales (noeuds nationaux) et état actuel de la participation de la Suisse dans les ERICs et autres réseaux d'infrastructures (statut début 2023).

CH-Roadmap (Année d'entrée)	ESFRI Roadmap (Année d'entrée)	Acronyme	Forme légale (depuis)	Dénomination et description de l'infrastructure de recherche	Nœud Suisse	Participation Suisse
2015	2006	ELIXIR	Consortium (2013)	European Life Science Infrastructure for Biological Information	Swiss Institute for Bioinformatics (SIB)	Accord de collaboration ELIXIR signé pendant la période FRI 2013–2016
2019	2006	BBMRI	ERIC (2013)	Biobanking and BioMolecular Resources Research Infrastructure	Swiss Biobanking Platform (SBP)	Sur la base des décisions du Parlement en 2022, le Conseil fédéral demandera l'adhésion à ces six ERIC existants en 2023.
	2006	CESSDA	ERIC (2017)	Consortium of European Social Science Data Archives	Centre de Compétences Suisse en Sciences Sociales (FORS)	
	2006	DARIAH	ERIC (2014)	Digital Research Infrastructure for the Arts and Humanities	Data and Service Centre for the Humanities (DaSCH) und DARIAH CH-Consortium	
	2006	ECRIN	ERIC (2013)	European Clinical Research Infrastructure Network	Swiss Clinical Trial Organisation (SCTO)	
	2008	EPOS	ERIC (2018)	European Plate Observing System	ETH Zurich/SED	
	2006	ICOS	ERIC (2015)	Integrated Carbon Observation System	Consortium : ETH Zurich (lead), Empa, WSL, UniBern, UniBasel & Météo Schweiz	
	2016	ACTRIS	ERIC ¹⁴	Aerosol, Clouds and Trace Gases Research Infrastructure	Consortium : PSI (lead), Empa, ETH Zurich, Physical Meteorological Observatory Davos (PMOD), UniBe, MeteoSwiss	
	2006	SHARE	ERIC (2011)	Survey of Health, Ageing and Retirement in Europe	Centre de Compétences Suisse en Sciences Sociales (FORS) et UniL	
	2006	ESSurvey	ERIC (2013)	European Social Survey	Centre de Compétences Suisse en Sciences Sociales (FORS)	
	2008	ECCSEL	ERIC (2017)	European Carbon Dioxide Capture and Storage Laboratory Infrastructure	Pas de nœud Suisse désigné pour le moment	
	2018	eLTER	en attente	Integrated European Long-Term Ecosystem, critical zone and socio-ecological system Research Infrastructure	WSL	Réseaux d'infrastructures de recherche clés qui sont déjà ou deviendront bientôt des ERIC ; participation de la Suisse en cours d'évaluation.
	2006	PRACE	AISBL (2010)	Partnership for Advanced Computing in Europe	ETH Zurich/CSCS	
2023	2006	CLARIN	ERIC (2012)	Common Language Resources and Technology Infrastructure	Linguistic Research Infrastructure (LIRI) situé à l'UZH et CLARIN-CH Consortium	
	2016	EMPHASIS	en cours	European Infrastructure for Plant Phenotyping	ETH Zurich et Agroscope	
	2021	GGP	en cours	The Generations and Gender Programme	Centre de Compétences Suisse en Sciences Sociales (FORS) et UniL	Principales réseaux d'infrastructures de recherche incluses dans la feuille de route ESFRI 2021 et évaluées positivement (note A) par le Fonds national suisse de la recherche scientifique (FNS). Suivant le processus de la feuille de route suisse, le SEFRI examinera la possibilité d'une adhésion suisse à ces réseaux d'infrastructures de recherche dans le cas où elles se verraient accorder la personnalité juridique ERIC.
	2021	SLICES	à déterminer	Scientific Large-scale Infrastructure for Computing/Communication Experimental Studies	IoT Lab et Mandat International	

Domaine scientifique selon la classification ESFRI

Informatique	Environnement	Energie	Santé & alimentation	Innovation sociale et culturelle
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14 ACTRIS devrait devenir un ERIC en 2023.



La Suisse participe à différents réseaux d'infrastructures de recherche coordonnés au niveau international avec la forme juridique ERIC dans le domaine des sciences sociales et humaines. En font partie CESSDA ERIC et DARIAH ERIC ainsi que des études de sciences sociales à long terme comme ESSurvey ERIC et SHARE ERIC. Adobe Stock

Annexe II.1: Description des nouvelles participations examinées au travers de la présente Feuille de route

Remarques importantes :

- 1) Les informations financières ci-dessous représentent des planifications fournies par les hautes écoles / responsables des infrastructures.
- 2) Les chiffres financiers mentionnés dans le présent document pour les périodes FRI 2025–2028 et 2029–2032 sont des données prévisionnelles et sont indiqués uniquement à titre d'estimation grossière des coûts probables à venir et de leur répartition.
- 3) Dernière mise à jour des informations : décembre 2022 à janvier 2023

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Common Language Resources and Technology Infrastructure (CLARIN)

Legal form: ERIC since 2012

Description

CLARIN (<https://www.clarin.eu/>) is a distributed research infrastructure that provides academic and non-academic users with easy and sustainable access to FAIR digital language data and advanced tools to discover, explore, annotate, analyse or combine them. To reach this goal, CLARIN has been building a networked federation of language data repositories, service centres and centres of expertise, with single sign-on access. Tools and data from different centres are interoperable, meaning that data collections can be combined and tools from different sources can be chained to perform complex operations to support research. Currently, CLARIN plays a significant role for the reinforcement of the Social Sciences and Humanities Open Cloud (SSHOC) on the European level, together with DARIAH ERIC and CESSDA ERIC.

National relevance

As a prerequisite for Switzerland's participation in CLARIN, the national consortium CLARIN-CH was founded on 18 December 2020 by the Universities of Bern, Lausanne, Neuchâtel and Zurich, l'Università della Svizzera italiana, the Zurich University of Applied Sciences and the Swiss Academy for the Humanities and Social Sciences. The universities of Basel and Geneva joined the national

consortium in 2022. The CLARIN-CH consortium manages all CLARIN-related activities in Switzerland, develops strategic partnerships with the Linguistic Research Infrastructure (LiRI; hosted by the University of Zurich and acting as Swiss national node for CLARIN ERIC) and the Language Repository of Switzerland (LaRS; hosted by SWISSUbase and responsible of the implementation of national working).

Membership in CLARIN and the development of the Swiss national node offer the following benefits: (i) maximal profitability of existing investments for national research infrastructures, (ii) increased national and international visibility, interoperability and sustainability of Swiss-built resources, (iii) improved access for Swiss researchers to digital language resources available for numerous European languages and families of languages, as well as to advanced tools to explore and exploit such data sets, (iv) increased opportunities for Swiss researchers to participate in European infrastructure programmes and flagship projects, (v) knowledge about how to better serve the scientific community of the SSH field and beyond, as well as the non-scientific community (e.g. libraries, archives, government bodies and industry).

Costs of CLARIN-CH consortium

Funding projection	Total costs of the Swiss node ¹⁵ (CHF m)	Member/Observer fees ¹⁶ (CHF m)
2021–2024	0.57, of which 0.24 for coordination	0.032
2025–2028	0.74, of which 0.30 for coordination	0.38
2029–2032	0.74, of which 0.30 for coordination	0.41

¹⁵ The CLARIN-CH consortium is exclusively funded by its members. The consortium funds the coordination office and all the activities it organises. The costs related to LiRI as CLARIN B-center (i.e. technical support and maintenance, access to services and data) and LaRS as national repository (starting with 2023) remain to be covered.

¹⁶ The observer fees are covered by the CLARIN-CH consortium until 2024. With Switzerland joining the CLARIN ERIC, planned for 2025, member fees will be directly financed by the Confederation.

European Infrastructure for Plant Phenotyping (EMPHASIS)

Legal form: preparatory phase for establishing an ERIC (foreseen for 2023)

Description

Plant phenotyping is a severe bottleneck in plant breeding, variety testing, crop protection, cropping systems and agroecology research. Phenotyping is the precise determination of plant size, architecture and «performance» using optical analyses supported by artificial intelligence.

The mission of EMPHASIS (<https://emphasis.plant-phenotyping.eu/>) is to develop a pan-European, distributed infrastructure providing a growing community of users with access to multi-scale phenotyping platforms, services and resources. This will enable them to analyse genotype performance in diverse environments and quantify the diversity of traits, thus advancing fundamental and applied plant science as a cornerstone for food security in times of changing climate.

Currently, EMPHASIS is in the implementation phase including countries that signed a Letter of Intent and form an Interim General Assembly (IGA) as the main decision-making body to take all high-level strategic decisions on the implementation and operation of EMPHASIS. The IGA was inaugurated in April 2020, including ministry representation from 11 countries. Switzerland is represented in the IGA by the Swiss Federal Office for Agriculture and Agroscope. The ERIC application is expected to be submitted to the European Commission towards the end of 2023, and full operation is planned to start in 2025.

National relevance

ETH Zurich and Agroscope have established and utilised plant phenotyping infrastructure that is highly relevant for EMPHASIS. Recently, ETH Zurich and Agroscope have

been successful as partners in EU funded research infrastructure projects such as AgroServ (2022–2027; implementing and developing services to provide access to phenotyping facilities to address agroecological questions) and PHENET (2023–2027; developing novel methods and technologies across a wide range of plant science communities).

ETH Zurich is focused on establishing technologies such as the field phenotyping platform (FIP) and drone-based high-throughput field phenotyping methods. These technologies are used in teaching and research for crop breeding, variety testing and precision agriculture based on remote sensing. Agroscope has made high-throughput phenotyping methods suitable for official variety testing (wheat, barley, apple, soybean, potato, maize, and other crops), for plant breeding programmes, to assess genetic progress, to integrate agroecology principles into food production, and to improve crop management practices and cropping systems. Such «real-life research» is indispensable for the entire food value chain, from farmers, traders, millers and bakers, through to retailers and the seed industry.

A national research infrastructure was recently granted based on the relevance of this topic and on Swiss achievements: Swiss Biosites for Sustainable Agriculture and Agroecology (SISAL), funded by the ETH Board, will start operation in 2025, providing access to phenotyping facilities, data platforms and other agroecology infrastructure. SISAL will be accessible to all interested partners; ETH Zurich and Agroscope will work together closely to coordinate crop phenotyping activities.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ¹⁷ (CHF m)	Member/Observer fees ¹⁸ (CHF m)
2021–2024	3–5	–
2025–2028	6–10	0.8–1
2029–2032	10–15	0.8–1

¹⁷ Estimates based on funding of phenotyping-related activities (staff and devices) of Agroscope and ETH Zurich, including activities planned in SISAL. Current and future third-party funding will be obtained from the EU, SNSF, FOAG and industry.

¹⁸ The financial contribution for ERIC member and observer countries is under negotiation (range: 0.2–0.25m CHF/year) and depend on the final overall costs. ETH Zurich can host the Swiss node in the context of SISAL; (co-)funding from SERI will be requested.

Generations and Gender Programme (GGP)

Legal form: none (constitution as ERIC is planned)

Description

The GGP (<https://www.ggp-i.org/>) collects, processes and disseminates cross-nationally comparable longitudinal data on young adults, families, generational exchanges, and the life courses of women and men in Europe and beyond. Launched in 2000 by the Population Unit of the United Nations Economic Commission for Europe (UNECE), it has been coordinated by the Netherlands Interdisciplinary Demographic Institute (NIDI) since 2009 and was selected for inclusion and funding in the 2021 ESFRI Roadmap.

The collected data are available free of charge, via a single access point on the GGP's website. Internationally, the number of GGP users (4,000+) is growing constantly and the community meets biannually for a GGP user conference. The scientific outcome of the users is documented in a bibliography that is updated continually. Given the pressing societal topics addressed by the GGP, it can be expected that the user community in Switzerland will grow as well.

National relevance

The Swiss GGP will follow the general GGP set-up encompassing a longitudinal survey with three main waves carried out in three-year intervals over a period of seven years. Between the main waves, shorter country-specific «mini-surveys» are planned which cover topics that are of particular interest to the Swiss community. A dedicated team of researchers from the Institute of Social Sciences (ISS) at the University of Lausanne and the Swiss Centre of Expertise in the Social Sciences (FORS) will coordinate and manage the Swiss survey. While ISS will contribute to the scientific coordination, FORS will be responsible for the data collection and processing in collaboration with the GGP Central Hub.

The GGP represents a project of high strategic and scientific relevance to research, not only in Europe but also in Switzerland. The GGP's unique structure will make it an important complementary resource for Switzerland that goes far beyond existing surveys. It will offer the scientific community and concerned stakeholders the best available data source to analyse demographic trends and changes within Switzerland and beyond.

Costs for the GGP survey in Switzerland

Funding projection	Total costs of the Swiss node ¹⁹ (CHF m)	Member/Observer fees ²⁰ (CHF m)
2021–2024		
2025–2028	3.28	0.06
2029–2032	2.60	0.07

¹⁹ These are estimated total costs (cash and in-kind) that are required to conduct the GGP surveys in Switzerland. They are to be understood as estimates. The national funding model still needs to be defined. One option to be examined in more detail is mixed funding, with contributions from higher education institutions and the Swiss National Science Foundation (via its basic funding for FORS).

²⁰ Estimated membership or observer fees for participation in the future GGP ERIC.

Scientific Large-scale Infrastructure for Computing/Communication Experimental Studies (SLICES)

Legal form: none (constitution as ERIC is planned)

Description

SLICES (<https://slices-sc.eu/>) is working to build a Europe-wide infrastructure to support research on information and communication technologies (ICT) and digital science, including the Internet of Things (IoT), edge computing, future networks and cloud computing. It intends to become the main experimental collaborative instrument for researchers at the European level, enabling researchers and industry to research and develop future technologies and services that explore and expand the possibilities of the future Internet. It will provide advanced computing, storage and network components, interconnected by dedicated high-speed links that will federate and mutualise resources made available by various universities and research centres. SLICES aims to support the transition to a sustainable digital economy, and will allow ICT researchers to address the challenges of digital infrastructures linked to elements such as e-health, transport, energy, smart agriculture and smart cities.

SLICES is a distributed research infrastructure with a central hub in France and 15 national nodes, including one in Switzerland, that are working together to mutualise their investment for ICT research and build the largest ICT research infrastructure in the world. The number of participating countries and institutions has been growing since SLICES was included in the ESFRI Roadmap 2021. SLICES is currently implementing a detailed workplan to foster its user community.

National relevance

The Swiss node is coordinated by IoT Lab and Mandat International and brings together EPFL, ETH Zurich, the University of Geneva, HES-SO and the Bern University of Applied Sciences. The Swiss cluster is leading several

domains, including IoT and digital transformation in verticals, sustainable development and international cooperation, standardisation and interoperability, and data protection.

SLICES will equip researchers and practitioners with a wide range of scientific and experimental resources and tools by deploying and operating a large-scale platform providing access to cutting-edge technologies in wireless networking, IoT, and cloud computing. It will offer a wide variety of advanced computing and networking resources in order to respond to the needs of future dynamic systems, as well as advanced test tools to ensure reproducibility through an automated data repository with an open data approach for these communities. It will support education and capacity-building with new technologies.

SLICES will allow the testing of a wide range of technologies without investing in costly hardware and software platforms. It will significantly reduce development and investment costs for local actors such as SMEs, start-ups, and local public institutions. Through the Swiss cluster it will also contribute to standardisation and international cooperation, including with the UN system and research on innovative technologies in support of the Sustainable Development Goals.

In addition, the Swiss node will facilitate the interconnection, mutualisation and potential integration of existing Swiss testbeds and research infrastructures in SLICES. The ongoing work of the Swiss node lies in developing synergies and formal collaboration with relevant Swiss research infrastructures.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ²¹ (CHF m)	Member/Observer fees (CHF m)
2021–2024	1.5	tbd
2025–2028	10	tbd
2029–2032	3	tbd

²¹ These are estimated total costs (cash and in-kind) that are required to build and/or operate the Swiss national node. The distribution of costs among the institutions involved is not yet defined.

Annexe II.2: Participations examinées au travers des Feuilles de route 2015 & 2019

Remarques importantes :

- 1) Les informations financières ci-dessous représentent des planifications fournies par les hautes écoles / responsables des infrastructures.
- 2) Les chiffres financiers mentionnés dans le présent document pour les périodes FRI 2025–2028 et 2029–2032 sont des données prévisionnelles et sont indiqués uniquement à titre d'estimation grossière des coûts probables à venir et de leur répartition.
- 3) Dernière mise à jour des informations : décembre 2022 à janvier 2023

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European Life Science Infrastructure for Biological Information (ELIXIR)

Legal form: Intergovernmental organisation based on the ELIXIR Consortium Agreement and using the legal personality of EMBL

Description

Research in life sciences increasingly relies on large amounts of complex data, which is challenging to store and analyse – ELIXIR helps to tackle these challenges. ELIXIR (<https://www.elixir-europe.org>) brings together bioinformatics resources – such as databases, software tools, training materials, cloud storage, and supercomputers – into a single yet distributed infrastructure. ELIXIR connects not only services but also the scientific communities in the different member countries. It offers guidance with regard to research data management and thereby contributes to the establishment of best practices across Europe. ELIXIR makes it easier for scientists to find and share data and exchange expertise.

ELIXIR is organised into platforms and communities. The five platforms – Data, Compute, Tools, Interoperability and Training – bring together experts from the 22 ELIXIR members. The Data Platform identifies key data resources and supports the linkages between data and literature. The Tools Platform facilitates access to the best software tools to analyse data. The Compute Platform develops services to store, share and analyse large datasets. The Interoperability Platform develops and encourages the adoption of standards to describe life science data, which allows data to be reused. The Training Platform helps scientists to access the training they need when dealing with large datasets.

The ELIXIR communities are groups of experts from specific life science domains that drive the development of new bioinformatics services to advance their fields.

There are currently 15 communities at different levels of maturity. Some of them were founded more than five years ago and have already implemented specific services (e.g., the Rare Diseases and Plant Sciences Communities). Others are very young and have just identified their needs and set their roadmaps (e.g. the Toxicology and Systems Biology Communities).

Thanks to ELIXIR, smaller bioinformatics resources can grow and join a pan-European infrastructure. This makes new datasets and tools available to researchers across Europe. A substantial part of the ELIXIR budget is used to fund internal projects that contribute to the progress of science while also allowing for the development of a strong bioinformatics community across Europe.

Finally, ELIXIR actively engages with industry, especially with SMEs, in order to understand their needs. This stimulates innovation in the biotechnology, pharmaceutical and agritech industries.

National relevance

ELIXIR provides the national and international life science community with a state-of-the-art bioinformatics infrastructure, including resources, expertise and services. ELIXIR federates world-class researchers and delivers training in bioinformatics.

The Swiss national node of ELIXIR is the Swiss Institute of Bioinformatics (SIB), which plays an important role nationally and internationally.

Funding (CHF m)

2021–2024		2025–2028		2029–2032	
Global*	Swiss*	Global*	Swiss*	Global*	Swiss*
~ EUR 30 m	Swiss Confederation: ~ CHF 1.5	~ EUR 33 m	Swiss Confederation: ~ CHF 1.7	~ EUR 36 m	Swiss Confederation: CHF 1.9

*The ELIXIR budget covers ELIXIR activities (including the hub) but does not cover the costs of the nodes. Figures are estimates.

Biobanking and Biomolecular Resources Research Infrastructure ERIC (BBMRI)

Legal form: ERIC since 2013

Description

BBMRI-ERIC (<https://www.bbmri-eric.eu/>) aims to establish, operate, and develop a pan-European distributed research infrastructure for biobanking and biomolecular resources to facilitate access to resources to support high-quality biomolecular and medical research. With its 23 member states and the International Agency for Research on Cancer (IARC), BBMRI forms one of the largest health-related research infrastructures in Europe. BBMRI has increasingly facilitated sample and data access through its network of national nodes and biobanks. It also offers a growing portfolio of services and trainings on ELSI, quality, IT and education, including the initiation of a BBMRI Academy offering CME courses accredited by ACCME. Addressing current needs and EU Framework Programme calls (e.g. related to the COVID-19 pandemic and the Cancer Mission), BBMRI is effective in all core activities as a united effort by the biobanks, national nodes and headquarters. In parallel, more than 20 key H2020 projects are ongoing and will further contribute towards BBMRI sustainability.

BBMRI will ensure that its core and project activities remain closely aligned in the coming years. BBMRI's value proposition will further apply through intensified community engagement for greater visibility, increased service provision for samples, data and biomolecular resources and novel service value-chains. In Switzerland, BBMRI-ERIC's key partners are: 1) Swiss Biobanking Platform (SBP), as the national node of BBMRI-ERIC and the national reference research infrastructure for biobanking activities; 2) SNSF, indirectly through its support for SBP

services and the strategy of requiring that biobanking standards are integrated into research instruments.

National relevance

In Switzerland, biobanking practices have greatly evolved in recent years, from the individual collection of biological material to professional infrastructures dealing with ELSI, access and sharing, and quality, as well as interoperability issues that have led to increased overall biobanking costs and subsequent issues around sustainability. The SNSF has created SBP to overcome these challenges and respond to the Swiss research community's need for coordinated and harmonised biobanking activities. These needs are in line with the SNSF's long-term efforts to foster excellent research in biology and medicine. SBP provides services in four pillars aligned with the strategy and tools developed by BBMRI-ERIC:

- **Quality:** SBP provides labels (VITA, NORMA and OPTIMA) to evaluate the conformity of Swiss biobanks with the applicable ethical/legal framework and with best practices or professional standards (e.g. ISO 20387).
- **Visibility:** SBP e-catalogue, the NExT, gives access to biobanks and samples at national and European level with a link to the BBMRI Directory.
- **Interoperability:** SBP provides standardised datasets to facilitate data exchange among biobanks.
- **Education:** SBP is developing a CAS course on biobanking to increase the research community's fundamental knowledge in this field.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ²² (CHF m)	Member/Observer fees ²³ (CHF m)
2021–2024	4	0.136 (as observer) / 0.408 (as member)
2025–2028	4	0.408
2029–2032	4	0.408

²² Total estimated budget required to operate the Swiss national node, including observer/membership fees. The costs are currently covered by the SNSF.

²³ Calculation based on current fees and on the assumption of membership from the end of 2023.

Consortium of European Social Science Data Archives ERIC (CESSDA)

Legal form: ERIC since 2017

Description

The provision of social science data and metadata is vital to our understanding of the major challenges facing society today. CESSDA (<https://www.cessda.eu/>) has the mission of building on existing national infrastructure within the member countries and strengthening and expanding the pan-European network of social science data archives. CESSDA members seek to enhance the scientific excellence and efficacy of European research in the social sciences, as well as to facilitate access to data and metadata beyond national borders.

National relevance

The Swiss node of CESSDA at FORS – the FORS Data Service – archives social science data, provides free online access to social science data, and provides support services for data sharing and open science, including data management training. A principal goal of the Swiss national node is to provide full-scale sustainable research infrastructure that enables the Swiss research community to conduct high-quality research, leading to effective solutions to major challenges facing society. The FORS Data Service supports social science research in Switzerland by providing a comprehensive, free and integrated data research infrastructure that facilitates

and supports research, teaching and learning throughout the social sciences and beyond. This is achieved through international standards, protocols and professional best practices pertaining to the preservation and dissemination of data and associated digital objects, and by facilitating researchers' access to relevant resources of the Swiss social science research community and beyond.

SWISSUbase, the technical platform for archiving and accessing the data used by FORS, is now also a jointly operated platform used by other infrastructures and organisations, notably the Swiss CLARIN node (LiRI – Linguistic Research Infrastructure) located at the University of Zurich. SWISSUbase contains more than 800 datasets and more than 3,000 downloads; it had 9,000 registered users at the end of 2022.

The FORS Data Service provides national leadership and expertise in archiving and data management. It openly and constructively engages with its various user communities (researchers as data producers and data users, funding bodies, and other service providers) and works with other stakeholders for their mutual benefit.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ²⁴ (CHF m)	Member/Observer fees ²⁵ (CHF m)
2021–2024	7.90	0.13
2025–2028	8.91	0.31
2029–2032	9.58	0.31

²⁴ The total includes the CESSDA participation fees and is contributed mainly by SNSF (basic funding for FORS).

²⁵ Swiss membership fees will be financed directly by the Confederation as of 2023.

Digital Research Infrastructure for the Arts and Humanities ERIC (DARIAH)

Legal form: ERIC since 2014

Description

DARIAH (<https://www.dariah.eu/>) provides a framework for pan-European cooperation among research infrastructures for scholars in the humanities working with computer-based methods. DARIAH's declared mission is to empower research communities with digital methods to create, connect and share knowledge about culture and society. Its activities draw on four strategic pillars: (i) implementing and managing a discovery portal (SSH Open Marketplace) for reusable tools, services, data and knowledge, (ii) increasing access to education and training resources, (iii) supporting and funding transnational and transdisciplinary working groups to explore innovative ideas, build up skills, and develop and support new tools and services, and (iv) safeguarding the SSH area with respect to research policy and foresight. The Swiss DARIAH node supports DARIAH-EU in achieving these objectives by actively participating in the management of the SSH Open Marketplace and in DARIAH working groups, and by sharing national resources with the European community.

National relevance

The universities of Basel, Bern, Geneva, Lausanne, Neuchâtel and Zurich, Università della Svizzera italiana,

EPFL and the SAHSS founded the current DARIAH-CH consortium on 30 November 2021, in order to facilitate the efficient coordination of DARIAH-related activities in Switzerland. Other academic and research institutions, as well as cultural heritage institutions, may join the national consortium in the coming years. DARIAH's activities in Switzerland are coordinated by the Swiss National Data and Service Center for the Humanities (DaSCH).

Switzerland's participation in DARIAH is essential, especially in the general context of open science. Although researchers' use of digital methods in the humanities has become more skilful in recent years, challenges remain for the Swiss scientific community. Switzerland's participation in DARIAH facilitates collaborative international partnerships with significant benefits for the Swiss humanities research landscape, including: (i) involvement in European research, infrastructure programmes and flagship projects in the digital humanities; (ii) participation in the strategic bodies of DARIAH; (iii) clustering effect for communities by establishing a national coordination office; (iv) exchange of know-how in digital methods and infrastructures for the humanities; and (v) higher visibility across Europe for successful national projects in the digital humanities.

Costs of Swiss national node (without basic funding for DaSCH)

Funding projection	Total costs of the Swiss node ²⁶ (CHF m)	Member/Observer fees ²⁷ (CHF m)
2021–2024	0.32	0.019
2025–2028	0.40	0.2
2029–2032	0.40	0.21

²⁶ For the 2021–2024 period, DaSCH pays all costs of the Swiss node including a 0.5 FTE in accordance with the service level agreement with the SNSF. For the 2025–2028 period, the costs are calculated under the assumption that DaSCH remains the coordinating institution and the position of the National Coordination Officer allocated there. These costs are estimates.

²⁷ As of 2023 Swiss membership fees will be financed directly by the Confederation.

European Clinical Research Infrastructure Network ERIC (ECRIN)

Legal form: ERIC since 2013

Description

ECRIN (<https://www.eclin.org/>) is a non-profit, intergovernmental organisation that supports multinational clinical trials in Europe. ECRIN is a network of networks that connects research facilities at multiple sites in countries across Europe and provides support and services for multinational academic clinical research. The organisational model is based on country memberships and currently has 12 members. Switzerland has participated in ECRIN since its beginnings in 2004.

Each member country hosts a European Correspondent, who is at the heart of the national networks, managing the clinical trial portfolio and coordinating with the national scientific partners (i.e. network of clinical trial units) with the support of the Paris-based core team.

With a focus on investigator-led studies, ECRIN provides consulting, services and tools for clinical trial preparation and management, helping scientists to navigate Europe's fragmented health and legal environment. ECRIN provides freely accessible tools and standards as well as clinical research centre certification (data management) and maintains a Clinical Research Metadata Repository (<https://www.crmr.org/>).

ECRIN aims to expand into two or three new countries and strengthens collaboration of medical research infrastructures (i.e. EU-AMRI, the European Alliance of Medical Research Infrastructures, the collaboration between BBMRI-ERIC, EATRIS-ERIC and ECRIN-ERIC).

National relevance

The Swiss Clinical Trial Organisation (SCTO) is the central cooperation platform for patient-oriented clinical research in Switzerland. The SCTO has been an independent organisation since 2012, an association whose members are the five university hospitals and two cantonal hospitals, the Swiss Academy of Medical Sciences (SAMW) and the Collège des Doyens. The operational partners are the clinical trial units (CTUs) located at the member institutions.

The structure of the SCTO matches the ECRIN criteria for a national node perfectly. With its CTU Network, the SCTO provides an infrastructure that is unique in this field in Switzerland. The Swiss academic research community benefits from increased opportunities for research and trial collaboration as well as greater patient access, which makes Swiss clinical research very attractive in international comparison with respect to innovation and quality.

ECRIN membership provides multiple advantages, including full access to ECRIN management and consultancy services independent of the pathology concerned. Participation in ECRIN also ensures early access to information about regulatory changes for clinical research in Europe and access to the ISO-certified ECRIN Data Centre Certification programme for clinical trials, thus contributing to the harmonisation of European practice in data management.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ²⁸ (CHF m)	Member/Observer fees ²⁹ (CHF m)
2021–2024	0.71	0.31
2025–2028	0.82	0.42
2029–2032	0.82	0.42

²⁸ These are estimated total costs (cash and in-kind, as defined in the ECRIN statutes) covered through SERI contributions.

²⁹ Observer and member fees for participation in ECRIN, covered by SERI.

European Plate Observing System ERIC (EPOS)

Legal form: ERIC since 2018

Description

EPOS (<https://www.epos-eu.org/>) integrates existing geophysical monitoring networks (e.g., seismic and geodetic networks), local observatories (e.g., volcano observatories) and experimental laboratories (e.g., rock physics and tectonic analogue modelling labs) in Europe and adjacent regions into one distributed multidisciplinary research infrastructure for Earth sciences. It provides harmonised and interoperable open access to data, products and services, while also coordinating and supporting transnational access to laboratories and observatories for specific measurements and experiments. Thus, EPOS supports the multidisciplinary study of the structure, composition and dynamics of the Earth, with respect to natural and energy resources as well as natural hazards, and supports the development of a digital twin of the Earth. In addition to Earth scientists, EPOS users include engineers and private practitioners, public offices, the construction industry, critical infrastructures and the insurance sector.

As of early 2023, EPOS consists of 17 member or observer countries; EPOS data and service providers are largely funded nationally. Switzerland participates in EPOS with its national seismic network and seismological data and products of the Swiss Seismological Service (SED) at ETH Zurich (www.seismo.ethz.ch), the Bedretto Underground Laboratory for Geosciences and Geoenergies (ETH Zurich, www.bedrettolab.ethz.ch) and the experimental rock physics laboratories at ETH Zurich, EPFL and the University of Bern. The national geodetic and geological infrastructures are connected to EPOS through the European frameworks EUREF and EuroGeoSurveys.

National relevance

The SED and the Seismology and Geodynamics professorship at ETH Zurich have been key collaborators in EPOS since its inception and constitute the Swiss national node. On top of its national contributions, within the EPOS RI Switzerland coordinates the seismology domain and operates one of the European nodes for access to seismological waveform data as well as the earthquake hazard platform of the European Facilities for Earthquake Hazard and Risk (EFEHR; www.efehr.org). The EPOS framework provides Swiss and European researchers and service agencies with access to data and products from the main Swiss and European research and monitoring infrastructures. These include earthquake data, geodetic and geological mapping, geomagnetic and remote sensing data, near-fault multiparameter data, data collected in laboratories (rock deformation, geochemistry, volcanology) and deep underground laboratories and geoenery testbeds for low carbon energy.

In addition to its academic impact, EPOS thus secures data access at European level to deliver monitoring services that are of national interest and related to federal tasks. EPOS data and activities also provide a key contribution to the development of geothermal technologies and safe underground waste storage, for the implementation of Switzerland's energy, climate and climate change-adaptation strategies.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ³⁰ (CHF m)	Member/Observer fees ³¹ (CHF m)
2021 – 2024	4.65	0.576
2025 – 2028	4.80	0.576
2029 – 2032	5.10	0.605

30 Budget (cash and in-kind) that is required to build and/or operate the Swiss national node. Estimated additional costs for EPOS integration of participating national infrastructures and for the provision of European-level services on top of national services at ETH Zurich, EPFL and other Swiss universities. Does not include installation, operation and maintenance of participating national infrastructures and services. These figures are to be understood as estimates.

31 Swiss membership fee since 2018: EUR 144,000/year, contributed in full since 2019 (2019/2020: ETH, since 2021: SERI). Expected to stay constant until 2028, with a 5% increase anticipated from 2029 (inflation and general increase).

Integrated Carbon Observation System ERIC (ICOS)

Legal form: ERIC since 2015

Description

The ICOS Research Infrastructure (<https://www.icos-cp.eu/>) is crucial for quantifying the greenhouse gas budget of Europe and its neighbouring regions. Integrated, highly harmonised measurements are essential to understanding the present state of greenhouse gas emissions, sinks and sources and designing efficient mitigation and adaptation strategies in response to anthropogenic climate change. ICOS RI currently comprises more than 150 measurement stations across Europe, which provide standardised, high-precision and long-term observations of greenhouse gas concentrations in the atmosphere and their fluxes between atmosphere, ecosystems and oceans. Thus, ICOS RI provides high-quality data and related products for science, and supports policy- and decision-making to combat climate change and its impacts.

The ICOS ERIC currently consists of 16 member countries with their own nationally funded National Networks. ICOS data and related products are fully open access and available at the ICOS Carbon Portal.

ICOS Switzerland (ICOS-CH) operates two ICOS Class 1 Stations: the Atmosphere station Jungfraujoch and the Ecosystem station Davos. Both are unique with their history, location in the central part of the Alps, and integration into national and international research programmes.

National relevance

The ICOS-CH consortium consists of ETH Zurich (National Focal Point), Empa, WSL, the University of Bern, the University of Basel and MeteoSwiss. Measurements at

Jungfraujoch are conducted by Empa, the Universities of Bern and Basel, and MeteoSwiss, and at Davos by ETH Zurich, WSL and Empa. An urban station in Basel (operated by the University of Basel) has one of the longest urban CO₂ flux records worldwide, and is planned to become an ICOS Associated Station.

The scientific excellence of ICOS-CH partners attracts many research collaborations, and facilitates participation in international projects. Swiss researchers and students profit from the intense scientific exchange with the ICOS community, which includes more than 500 scientists from over 80 renowned research institutions. ICOS provides direct access to central services, including calibration facilities, cutting-edge data processing, and dedicated outreach and communication experts. Thus, participation in ICOS RI allows Switzerland to actively shape the future scientific agenda for Earth system research in Europe and beyond. By providing standardised data for an independent verification of Switzerland's Annual Greenhouse Gas Inventory, ICOS-CH supports national policies to meet the targets of the Paris Agreement to mitigate climate change.

ICOS-CH is actively involved in joint outreach activities in many areas, for example examining the effect of the severe drought and heat wave 2018 in Europe or the consequences of the COVID lockdown in 2020. Swiss science has benefited from the high levels of visibility and recognition generated by the ICOScapes photo campaign and the recently published European Greenhouse Gas Bulletin FLUXES.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ³² (CHF m)	Member/Observer fees ³³ (CHF m)
2021–2024	6.75	0.29
2025–2028	8.58	0.30
2029–2032	9.26	0.32

³² Budget (cash and in-kind) that is required to build and/or operate the Swiss national node. The estimated total costs include observer/membership fees. Costs are provided by the SNSF and by all partners (ETH Zurich, Empa, WSL, MeteoSwiss and the Universities of Bern and Basel). These figures are to be understood as estimates.

³³ Fees for 2021–2024 are paid by SERI.

Aerosol, Clouds and Trace Gases (ACTRIS)

Legal form: ERIC (formal establishment scheduled for 2023)

Description

ACTRIS (<https://www.actris.eu/>) coordinates activities for documenting concentrations, understanding processes, and quantifying impacts of short-lived atmospheric constituents on Earth’s climate, air quality, human health and ecosystems at European level. ACTRIS facilitates high-quality Earth system research and provides science-based information necessary to face major societal challenges. It is integrated into the community of environmental research infrastructures (ENVRI) and the European Open Science Cloud (EOSC). Embedding at the global level occurs through the World Meteorological Organization (WMO) and the Aerosol Robotic Network (AERONET).

The core components of the ACTRIS ERIC are central facilities, including head office, data centre and topical centres, which perform operations on European level. National facilities include observational platforms for continuous observations and exploratory platforms for comprehensive process studies. ACTRIS provides effective access for a wide user community to its resources and services, such as national and central facilities or data centres. The EU-funded pilot project Sustainable Access to Atmospheric Research Facilities (ATMO-ACCESS) is currently developing a framework to facilitate novel forms of access and to support users of distributed atmospheric research infrastructures such as ACTRIS.

National relevance

Sustained coordination of environmental observations within Europe is indispensable and requires standardised

approaches to ensure harmonised datasets of high accuracy. Moreover, data provision – through data centres adhering to the FAIR principles and through fully integrated data chains to higher-level services such as those provided by the Copernicus Atmosphere Monitoring Service (CAMS) – plays a key role in maximising scientific and societal benefit.

Switzerland will join the ACTRIS ERIC as an observer. PSI coordinates the Swiss node, which operates facilities located in Switzerland. Two ACTRIS topical centre units, the Centre for Reactive Trace Gases in Situ Measurements (CiGas) and the Centre for Aerosol Remote Sensing (CARS), are operated by Empa and the PMOD/WRC. An atmospheric chemistry simulation chamber exploratory platform is operated by PSI. The Jungfraujoch platform is jointly operated by ETH Zurich, Empa and PSI, and the Swiss midlands platform is operated by MeteoSwiss, the University of Bern, Empa and PSI.

Switzerland is well represented in the European environmental and atmospheric science communities, and the institutions involved in ACTRIS are among the world leaders in observations of and research on aerosols, clouds and trace gases. Swiss activities have established strong links to the European research communities and stakeholders (e.g. EMEP, EUMETNET) and global key players, such as the Global Atmosphere Watch (GAW) Program. Switzerland is active in several of GAW’s scientific advisory groups and participates in Europe-wide pilot projects addressing health impacts of short-lived air pollutants (RIURBANS).

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ³⁴ (CHF m)	Member/Observer fees ³⁵ (CHF m)
2021 – 2024	10.7	–
2025 – 2028	9.8	0.7
2029 – 2032	9.8	0.7

34 Budget (cash and in-kind) covered through institutions, third-party funding and SERI that is required to finalise implementation and to operate the Swiss national node. The national facilities and central facility units constituting the Swiss node of ACTRIS are operated by PSI (coordinating institution), Empa, ETH Zurich, the PMOD/WRC, the University of Bern and MeteoSwiss. These figures are to be understood as estimates.

35 ACTRIS ERIC membership fees are identical for members and observers. These are covered by SERI.

Survey of Health, Ageing and Retirement in Europe (SHARE)

Legal form: ERIC since 2011

Description

SHARE (<https://share-eric.eu/>) is a multidisciplinary and cross-national panel database of microdata on health, socio-economic status and social and family networks. In biennial survey waves, people aged 50 or older from 27 European countries and Israel are interviewed. The first wave of SHARE was conducted in 2004 as a representative survey and has since been repeated every two years with an increasing number of countries participating. Overall, more than 530,000 interviews with more than 140,000 individuals have been conducted in survey waves 1 to 9. The data are available to the entire research community free of charge. Thanks to this synergy between the main European institutions, Switzerland has the opportunity to collect comprehensive national data on ageing at a much lower cost than a stand-alone Swiss-specific ageing survey would entail.

With SHARE, data researchers can provide better understanding of how individuals and families are affected by ageing. SHARE exploits Europe as a «natural laboratory» to investigate the population ageing process and brings together many scientific disciplines, including demography, economics, biology and statistics. This research can be used by scientists and policy-makers to find solutions to the challenges of our social security and healthcare systems. All SHARE data are freely available to researchers.

National relevance

Switzerland has participated in each round of SHARE since its beginnings in 2004 and currently has observer status. The Swiss national node is hosted by FORS in cooperation with the University of Lausanne. Owing to their high quality, Switzerland's data are included in a very large proportion of publications using SHARE data. The Swiss data are used by both Swiss researchers and researchers working abroad. Indeed, a large majority of the publications involve comparative analyses and include Swiss data as well. The Swiss SHARE data are also a reference for international comparisons, for example, by the OECD or WHO, which helps to raise Switzerland's international profile.

In Switzerland, the SHARE data are also a reference for institutions such as the Swiss Health Observatory (Obsan), the Federal Office of Public Health and the statistical offices that support the Confederation, cantons and other institutions. Participating in SHARE also allows for much more cost-effective production of ageing data for Switzerland than trying to collect comparable data independently without the support of the international SHARE infrastructure.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ³⁶ (CHF m)	Member/Observer fees ³⁷ (CHF m)
2021–2024	4.6	0.1
2025–2028	4.7	0.1
2029–2032	4.8	0.1

³⁶ These are estimated total costs (cash and in-kind) that are required to build and/or operate the Swiss national node. They are to be understood as estimates. On the one hand the costs for the implementation of the survey are covered by SNSF project funding for the University of Lausanne (cf. SNSF project database). On the other hand, FORS is co-responsible for the implementation of the survey in accordance with the performance agreement with the SNSF.

³⁷ These are estimated observer fees for (future) participation in the RI. The fee is covered through the budget of the hosting institution. The observer fees for SHARE are covered by SNSF basic funding for FORS.

European Social Survey ERIC (ESS)

Legal form: ERIC since 2013

Description

ESS ERIC (<https://www.europeansocialsurvey.org/>) is a pan-European research infrastructure providing freely accessible data for academics, policymakers, civil society and the wider public. This academically driven cross-national survey has been conducted across Europe since its establishment in 2001. The ESS received ERIC status in 2013, and in 2016 it was recognised as an ESFRI Landmark. As of the end of 2022, the ESS ERIC comprises 27 member countries and 1 observer country (Switzerland).

The ESS ERIC has become the gold standard for comparative surveys in the social sciences, known for its high standards of methodological quality, and is very widely used. Every two years, face-to-face interviews are conducted with newly selected, cross-sectional samples. The survey measures the attitudes, beliefs and behaviour patterns of diverse populations in more than 30 nations. The ESS data is available free of charge for non-commercial purposes. ESS ERIC has over 200,000 registered users, and over 5,900 identified publications. The ESS ERIC Headquarters are currently hosted by City University, London (UK). The Core Scientific Team (CST) comprises eight institutions in Germany, Belgium, Norway, Netherlands, Spain, Slovenia and UK. All participating countries are required to contribute to the central coordination costs of the ESS ERIC.

National relevance

Thanks to continual funding from the Swiss National Science Foundation, Switzerland has participated in every

round of the European Social Survey, which was launched in 2002. FORS has been conducting the survey since it was founded in 2008, and therefore hosts the Swiss national node of ESS ERIC.

Because of the uninterrupted, high-quality and timely Swiss datasets, Switzerland's data are included in a very large proportion of publications using ESS data. ESS data are a reference for international contextualisation and very often used in publications for this purpose, like OECD statistics on other topics, helping to raise Switzerland's profile on the international scene. Switzerland's ESS team and other Swiss researchers are very present in the international community related to this survey, and the country contributes to major methodological and substantial discussions in the social sciences. Over 5,700 out of 200,000 registered users are from Switzerland, and 10,000 ESS datasets have been distributed so far to Swiss users (ESS user statistics from May 2022).

FORS must continue to produce high-quality data with comprehensive documentation and deliver the data in time for inclusion in the first international release, in order to maintain and expand the impact of ESS data from and in Switzerland. Furthermore, the Swiss ESS team contribute to the impact of this outstanding survey both at home and abroad, through their work with ESS data, their presentations of the survey in academic and public arenas as well as the expertise they contribute to the central ESS.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ³⁸ (CHF m)	Member/Observer fees ³⁹ (CHF m)
2021–2024	2.90	0.43
2025–2028	3.53	0.48
2029–2032	3.65	0.48

³⁸ These are estimated total costs (cash and in-kind) that are required to build and/or operate the Swiss national node. They are to be understood as estimates. The costs for conducting the ESS in Switzerland are included in the basic funding the SNSF provides to FORS.

³⁹ These are estimated observer fees for the future participation in the RI. The observer fees for ESS are covered by the basic funding of FORS by SNSF.

European Carbon Dioxide Capture and Storage Laboratory Infrastructure ERIC (ECCSEL)

Legal form: ERIC since 2017

Description

ECCSEL (<https://www.eccsel.org/>) is the European Research Infrastructure for CO₂ Capture, Utilisation, Transport and Storage (CCUS), which encompasses interlinked transnational scientific facilities and national nodes. Their vision is to enable low to zero CO₂ emissions from industry and power generation to combat climate change, and their aim is to enhance European science, technology development, innovation, and education in the field of CCUS. ECCSEL currently has five member countries and offers worldwide open access to over 90 world-class European CCUS research facilities, ranging from lab-scale testing units and large-scale pilot and demonstration plants to full-scale test sites.

Research facilities across the CCUS value chain are covered through ECCSEL, which coordinates European development of facilities and their services to meet identified needs. ECCSEL also reaches out to relevant industry and research communities to determine their research infrastructure needs and thereby enable full-scale deployment of CCUS in Europe.

National relevance

All scenarios developed by international bodies, including the Swiss government, indicate the key role that CCUS (carbon capture, utilisation and storage) systems will have in the coming decades, not only to mitigate carbon dioxide emissions but also to allow the active removal of carbon dioxide from the atmosphere. Such strategic direction is now supported by targeted policies by the Federal Office for the Environment and the Swiss Federal Office of Energy (FOEN and SFOE).

Swiss researchers and Swiss industry have been playing an important role in advancing the science and engineering of CCUS systems. Swiss research institutions can contribute unique experimental facilities to ECCSEL, such as geomechanical characterisation infrastructure, set-ups for the study of CO₂ capture processes, and underground laboratories to conduct CO₂ injection/storage field tests (the three underground laboratories at the Grimsel Test Site, Mont Terri rock laboratory and BedrettoLab). Swiss start-ups, such as Climeworks, neustark and Synhelion, are at the international forefront of innovation in the CCUS space. This makes Swiss participation in the ECCSEL-ERIC both extremely effective and useful.

Belonging to the ECCSEL consortium and community enables Swiss researchers to be key contributors to the international efforts in developing and demonstrating CCS technologies. This in turn helps the Swiss community to have an even greater impact on international projects, initiatives and negotiations. At the national level, it attracts interest as well as additional research funds from the public and private sectors. As ECCSEL develops and gains new partners, new experimental facilities and scientific and political weight, participation will clearly be crucial – not only from a scientific point of view, but also from the practical perspective of finding feasible solutions to cope with Swiss greenhouse gas emissions and to enable the deployment of negative emissions solutions.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ⁴⁰ (CHF m)	Member/Observer fees ⁴¹ (CHF m)
2021–2024	4.5	0.32
2025–2028	4.5	0.32
2029–2032	4.5	0.32

⁴⁰ Budget (cash and in-kind) required to build and/or operate the Swiss national node. The main contributing institution(s), which form the national node, should be: ETH Zurich, EPFL, PSI, Empa, the University of Geneva and the University of Bern. These figures are to be understood as estimates.

⁴¹ The indicated cost is the fee calculated assuming that the number of members remains the same. The cost will decrease as more members join.

Integrated European Long-Term Ecosystem, critical zone and socio-ecological system Research infrastructure (eLTER)

Legal form: Preparatory phase for establishing an ERIC; eLTER is a pan-European network, based on bylaws accepted by national networks, of LTER international (ILTER) which is based on an international convention

Description

The overall purpose of the eLTER (<https://elter-ri.eu/>) is to provide a pan-European integrated research infrastructure (RI) of long-term research sites for multiple and cross-disciplinary use in the fields of ecosystem, critical zone and socio-ecological research. The eLTER RI features a unique «whole system approach» from plot to landscape scale, integrated in a nested design and allowing for interdisciplinary natural science research and investigating human–environment systems.

The aim is to secure scientific excellence with increased research quality through scientific cross-disciplinary synthesis and quantity in terms of the number of appropriately equipped research sites. The eLTER RI will provide indispensable datasets for system model development and validation, hence supporting system understanding, predictions and decision-making.

Pan-European RI components will seamlessly link the network of up to 25 national RIs, comprising approximately 200 sites and multiple user communities of eLTER RI services. The design secures full complementarity with related environmental in-situ RIs such as ICOS, DANUBIUS and AnaEE. Generic services from e-infrastructures (e.g. LifeWatch, EUDAT) will be complemented by cost-efficient elements such as DEIMS (<https://deims.org/>).

National relevance

With the anticipated consideration for the ESFRI roadmap 2023, LTER Switzerland, comprising 20 long-term forest monitoring sites as part of the Swiss Long-term Forest Ecosystem Research (LWF), TreeNet, UNECE/ICP Forests and ICOS, will be an attractive partner in the European research landscape, and the Swiss research system will greatly benefit from the eLTER–ESFRI network in terms of the following main aspects: (1) Facilitated transnational access for ETH Zurich, EPFL and Swiss universities to audited categories of approximately 200 in-situ facilities and to harmonised data from long-term observations (incl. remote sensing data) of key ecological and socio-economic parameters. (2) The eLTER network offers great potential for standardisation, common protocols, established standards, and basic interfaces to related infrastructures and data at the local, national and European levels. (3) Facilitated access to future ESFRI related calls, applying «ecosystem» or «whole-systems» approaches. (4) Participation in eLTER will enable the Swiss research system to apply a comprehensive and integrated view of interactions in natural and human-influenced systems. (5) LTER Switzerland’s participation in eLTER will further increase the visibility of the Swiss research system, fostering national collaboration with ETH Zurich, EPFL and Swiss universities, international networking and globally competitive research frameworks for cutting-edge research. It will also expand opportunities to promote Switzerland’s excellent forest and ecosystem research expertise and unrivaled research facilities to stakeholders in public administration and industry.

Costs of Swiss national node

Funding projection	Total costs of the Swiss node ⁴² (CHF m)	Member/Observer fees ⁴³ (CHF m)
2021–2024	7.5	0.05
2025–2028	7.5	0.05
2029–2032	6.6	0.05

42 Budget (cash and in-kind) that is required to build and/or operate the Swiss national node. The costs are expected to be covered by the Federal Office for the Environment (FOEN), the Swiss National Science Foundation (SNSF) and the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL). These figures are to be understood as estimates.

43 Membership or observer fees for the participation in the RI.

Partnership for Advanced Computing in Europe (PRACE)

Legal form: AISBL since 2010

Description

The mission of PRACE (<https://prace-ri.eu/>) is to facilitate access to a research infrastructure that enables high-impact scientific discovery and engineering research and development across all disciplines, in order to enhance European competitiveness for the benefit of society. PRACE seeks to fulfil this mission by offering world-class computing and data management resources and services through a peer review process. It also seeks to strengthen European users of high-performance computing (HPC) in industry through various initiatives. PRACE has a strong interest in improving the energy efficiency of computing systems and reducing their environmental impact.

The PRACE AISBL was established in 2010. The PRACE AISBL enables the provision of world-class computing services to the key scientific and industrial communities in Europe, and the PRACE Council places the utmost importance on the successful continuation of the PRACE AISBL. It has 25 member countries whose representative organisations create a pan-European supercomputing infrastructure, providing access to computing and data management resources and services for large-scale scientific and engineering applications at the highest performance level.

The computer systems and their operations accessible through PRACE are currently provided by five PRACE members (BSC representing Spain, CINECA representing Italy, ETH Zurich/CSGS representing Switzerland, GCS representing Germany and GENCI representing France). As PRACE prepares for its next phase, it is evaluating which

direction the organisation should take in order to best serve its users in light of the evolving HPC landscape.

The PRACE project partners have received or are receiving European Commission (EC) funding under the PRACE Preparatory and Implementation Phase Projects (PRACE-1IP, 2010–2012, RI-261557 | PRACE-2IP, 2011–2013, RI-283493 | PRACE-3IP, 2012–2017, RI-312763 | PRACE-4IP, 2015–2017, 653838 | PRACE-5IP, 2017–2019, 730913 | PRACE-6IP, 2019–2021, 823767). The total funding of the PRACE projects amounts to EUR 132 million over nine years (2010–2019), of which EUR 125 million is provided by the EC.

National relevance

Being part of the PRACE RI has a number of advantages for Switzerland:

- Swiss scientists receive access to extreme-scale computing resources of different architectures.
- Being part of a wider frame will enhance the visibility and quality of the Swiss Tier-0 programme (formerly called CHRONOS).
- The support structure (level 2 and 3) for the Tier-0 allocations is funded by the general partners and will be considered a consolidated contribution to the User Lab.
- The level 3 support for projects that are Tier-0 candidates will help scientists in Switzerland and elsewhere in Europe to attain more ambitious goals at scale.

Costs for providing services to other PRACE members

Funding projection	Total costs of the Swiss node ⁴⁴ (CHF m)	Member/Observer fees ⁴⁵ (CHF m)
2021–2024	2.62	0.28
2025–2028	0	0.28
2029–2032	0	0.28

⁴⁴ These are estimated total costs (cash and in-kind) that are required for the Swiss National Supercomputing Centre to provide HPC services to the other PRACE members.

⁴⁵ PRACE AISBL membership fees paid by the Swiss National Supercomputing Centre/ETH Zurich.

