

SSIC Report 5/2015

# Evaluating the Swiss National Science Foundation with Respect to the Strategic Funding of Research Infrastructures and Disciplinary Areas

Final Report



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Schweizerischer Wissenschafts- und Innovationsrat  
Conseil suisse de la science et de l'innovation  
Consiglio svizzero della scienza e dell'innovazione  
Swiss Science and Innovation Council

## The Swiss Science and Innovation Council

The Swiss Science and Innovation Council SSIC is the advisory body to the Federal Council for issues related to science, higher education, research and innovation policy. The goal of the SSIC, in line with its role as an independent consultative body, is to promote a framework for the successful long term development of Swiss higher education, research and innovation policy.

## Der Schweizerische Wissenschafts- und Innovationsrat

Der Schweizerische Wissenschafts- und Innovationsrat SWIR berät den Bund in allen Fragen der Wissenschafts-, Hochschul-, Forschungs- und Innovationspolitik. Ziel seiner Arbeit ist die kontinuierliche Optimierung der Rahmenbedingungen für die gedeihliche Entwicklung der Schweizer Bildungs-, Forschungs- und Innovationslandschaft. Als unabhängiges Beratungsorgan des Bundesrates nimmt der SWIR eine Langzeitperspektive auf das gesamte BFI-System ein.

## Le Conseil suisse de la science et de l'innovation

Le Conseil suisse de la science et de l'innovation CSSI est l'organe consultatif du Conseil fédéral pour les questions relevant de la politique de la science, des hautes écoles, de la recherche et de l'innovation. Le but de son travail est l'amélioration constante des conditions-cadre de l'espace suisse de la formation, de la recherche et de l'innovation en vue de son développement optimal. En tant qu'organe consultatif indépendant, le CSSI prend position dans une perspective à long terme sur le système suisse de formation, de recherche et d'innovation.

## Il Consiglio svizzero della scienza e dell'innovazione

Il Consiglio svizzero della scienza e dell'innovazione CSSI è l'organo consultivo del Consiglio federale per le questioni riguardanti la politica in materia di scienza, scuole universitarie, ricerca e innovazione. L'obiettivo del suo lavoro è migliorare le condizioni quadro per lo spazio svizzero della formazione, della ricerca e dell'innovazione affinché possa svilupparsi in modo armonioso. In qualità di organo consultivo indipendente del Consiglio federale il CSSI guarda al sistema svizzero della formazione, della ricerca e dell'innovazione in una prospettiva globale e a lungo termine.

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Adopted by the Council on the 16<sup>th</sup> of September 2014

## Acknowledgements

The Swiss Science and Innovation Council (SSIC) would like to thank the institutions of the higher education, research and innovation (HERI) sector for their openness and constructive cooperation. Specific thanks are due to the Swiss National Science Foundation (SNSF) and the State Secretariat for Education, Research and Innovation (SERI), as well as to those who generously agreed to be interviewed as part of the present evaluation mandate.

The SSIC would like to particularly acknowledge the team of international experts for making themselves available for this task and for the valuable contributions their expertise provided.

## Danksagung

Der Schweizerische Wissenschafts- und Innovationsrat SWIR dankt den Institutionen des BFI-Bereichs für die Gesprächsbereitschaft und die gute Zusammenarbeit. Der Dank gilt namentlich dem Schweizerischen Nationalfonds SNF und dem Staatssekretariat für Bildung, Forschung und Innovation SBFI wie auch den Interviewpartnern, mit denen sich der Rat im Rahmen des vorliegenden Evaluationsmandats ausgetauscht hat.

Zu besonderem Dank verpflichtet ist der SWIR den internationalen Experten und Expertinnen für ihre Disponibilität und für das Einbringen ihrer wertvollen Kompetenzen.

## Remerciements

Le Conseil suisse de la science et de l'innovation (CSSI) remercie les institutions du domaine formation, recherche et innovation (FRI) de leur disposition au dialogue et de leur esprit de coopération. Sa reconnaissance va notamment au Fonds national suisse et au Secrétariat d'Etat à la formation, à la recherche et à l'innovation (SEFRI), ainsi qu'aux interlocuteurs avec lesquels il s'est entretenu pour cette évaluation.

Le CSSI remercie tout particulièrement les experts internationaux de leur disponibilité et des précieuses compétences qu'ils lui ont apportées.

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# Summary

## Zusammenfassung

## Résumé

**E** On behalf of the State Secretariat for Education, Research and Innovation (SERI), the Swiss Science and Innovation Council (SSIC) evaluated the Swiss National Science Foundation for Promoting Scientific Research (SNSF) from two perspectives: the strategic funding of research infrastructures (RIs) and the funding of disciplinary areas.

A self-evaluation by the SNSF and the experience of Council members formed the basis for this final report. The SSIC also drew on the results of conversations and interviews with Swiss HERI actors, as well as on a report provided by an international panel of experts.

A system-based perspective was used for analysing the SNSF's research infrastructure and disciplinary area funding. The report begins with a general appraisal of the SNSF and its significance in and for the Swiss HERI sector.

The SSIC finds that the responsibilities, structures, and processes in the Swiss way research infrastructures are funded is not coherently organised. In light of international developments, one can identify a number of challenges for future research funding policy in Switzerland. The SSIC recommends a comprehensive solution which would give the national government a key coordinating and strategy-formulating role, together with a separate budget. The SNSF, in its

functioning and structure, should focus on the academic and scientific evaluation of research infrastructure proposals. To this end, an expanded Section IV or a new, independent, Section V for research infrastructure could be created. Its expertise would lie in evaluating the potential utilization, technical feasibility, and ability to fund large research infrastructures.

In the section on the funding of disciplinary areas, the Council weighs the chances and risks of pursuing a proactive as opposed to a reactive funding policy. It begins with a number of tenets. In the Council's view, the internationally acknowledged success of Swiss research is no reason for the SNSF to change its current policy. The funding of research projects, following the "responsive mode", ensures ideal conditions for researchers in Switzerland. The academic or scientific evaluation of proposals provides the best means to take new ideas and research developments into account. But foresight activities of the kind proposed by the SNSF are not suited to objectively recognize emerging research trends. To counter the known mainstreaming effects of peer review processes, the SSIC suggests considering creating a new process for supporting riskier research projects.

The Council adopted the report on the 16<sup>th</sup> of September 2014. It is here published in its original version.

**D** Im Auftrag des Staatssekretariats für Bildung, Forschung und Innovation (SBFI) hat der Schweizerische Wissenschafts- und Innovationsrat (SWIR) den Schweizerischen Nationalfonds zur Förderung der wissenschaftlichen Forschung (SNF) unter zwei Gesichtspunkten evaluiert: strategische Förderung von Forschungsinfrastrukturen und Fachgebieten.

Grundlage dieses Berichts bilden in erster Linie der Selbstevaluationsbericht des SNF und die Erfahrung der Ratsmitglieder. Der SWIR stützt sich ausserdem auf die Ergebnisse von Gesprächen mit Schweizer BFI-Akteuren und den Bericht eines internationalen Expertenpanels.

Die Analyse der beiden Fragenkomplexe erfolgt aus einer systembetrachtenden Perspektive. Sie wird eingeleitet durch eine allgemeine Würdigung des SNF und seiner Bedeutung für das Schweizer BFI-System.

In Bezug auf die Förderung von Forschungsinfrastrukturen wird die Rolle des SNF im erweiterten Kon-

text des Schweizer Fördersystems erörtert. Der SWIR stellt fest, dass die Verantwortlichkeiten, Strukturen und Prozesse im Forschungsinfrastruktur-Bereich nicht hinreichend kohärent ausgestaltet sind. Im Lichte der internationalen Entwicklungen lassen sich eine Reihe von Herausforderungen benennen, denen sich die künftige Förderpolitik der Schweiz stellen muss. Der SWIR empfiehlt eine Gesamtlösung, die dem Bund für Strategie, Koordination und Finanzierung (gesondertes Budget) eine primäre Rolle zuweist. Funktion und Struktur des SNF sollen sich auf die wissenschaftliche Evaluation von Forschungsinfrastruktur-Vorhaben beziehen. Zu diesem Zweck könnte eine erweiterte Abteilung IV oder eine neue eigenständige Abteilung V für Forschungsinfrastrukturen eingerichtet werden, die ihre Expertise in Richtung Nutzung, technische Machbarkeit und Finanzierbarkeit von grossen Forschungsinfrastrukturen ausbaut.

Im Kapitel über die Förderung von Fachgebieten nimmt der Rat eine Abwägung der Chancen und Risiken einer «proaktiven» und «reaktiven» Förderpolitik vor. Er geht dabei von einer Reihe von Grundsätzen aus. Nach Auffassung des Rates gibt der international anerkannte Erfolg des Schweizer Forschungssystems keinen Anlass, die bisherige Förderpolitik des SNF umzusteuern. Die Förderung von Forschungsprojekten nach dem *responsive mode* gewährleistet den Forschenden in der Schweiz ideale Rahmenbedingungen und bietet über die wissenschaftliche Begutachtung der Gesuche die besten Chancen, neue

Ideen und Entwicklungen in der Forschung zu berücksichtigen. *Foresight*-Aktivitäten, wie sie der SNF vorsieht, sind dagegen nicht geeignet, emergente Forschungstrends objektiv zu erkennen. Um den bekannten *Mainstream*-Effekten des *Peer Review*-Verfahrens entgegenzuwirken, regt der SWIR an, die Schaffung eines neuen Förderarrangements für risikoreichere Forschungsprojekte zu prüfen.

Der Rat hat den vorliegenden Bericht am 16. September 2014 verabschiedet. Er publiziert diesen hier in der Originalversion.

**F** Le Conseil suisse de la science et de la technologie (CSSI) a évalué, à la demande du Secrétariat d'Etat à la formation, la recherche et l'innovation (SEFRI), deux volets du travail du Fonds national suisse de la recherche scientifique (FNS): l'encouragement stratégique des infrastructures de recherche et celui des disciplines scientifiques.

Le présent rapport se fonde principalement sur le rapport d'autoévaluation du FNS et l'expérience des membres du Conseil. En complément, le CSSI a mené des entretiens avec des acteurs du domaine FRI suisse et s'est appuyé sur le rapport d'un groupe d'experts internationaux.

L'analyse adopte une perspective systémique sur chacun des deux volets de l'évaluation. Elle est précédée d'une appréciation générale du FNS et de son rôle dans le système formation, recherche et innovation (FRI) suisse.

En ce qui concerne l'encouragement des infrastructures de recherche, l'évaluation envisage le rôle du FNS dans le contexte élargi du système suisse d'encouragement. Le CSSI constate que la définition des responsabilités, des structures et des processus n'est pas suffisamment cohérente dans ce domaine. L'actualité internationale permet de discerner un certain nombre de défis que devra relever la future politique d'encouragement de la Suisse. Le CSSI recommande d'y apporter une réponse globale, donnant un rôle de premier plan à la Confédération en ce qui concerne la stratégie, la coordination et le financement (notamment au moyen d'un budget distinct). Le fonctionne-

ment et la structuration du FNS doivent être adaptés à l'évaluation scientifique des projets d'infrastructures de recherche; il serait possible, à cette fin, d'étoffer la division IV ou de créer une division V indépendante pour les infrastructures de recherche, dotée des compétences nécessaires en matière d'utilisation et de faisabilité technique et financière des grandes infrastructures de recherche.

Dans la section consacrée à l'encouragement des disciplines scientifiques, le Conseil procède à une pesée comparative des apports et des risques d'une politique d'encouragement proactive ou réactive. Il part pour cela d'un certain nombre de principes, qu'il commence par exposer. Il observe que le succès internationalement reconnu de la recherche suisse n'invite pas à un recentrage de la politique d'encouragement actuelle du FNS. L'encouragement réactif des projets garantit aux chercheurs des conditions générales de travail idéales en Suisse, et l'évaluation scientifique des demandes offre les meilleures chances de détection des idées et pistes nouvelles. Les activités prospectives qu'envisage le FNS ne se prêtent pas, en revanche, à la reconnaissance objective des tendances émergentes de la recherche. Le CSSI propose, pour contrecarrer l'effet de nivellement que produit l'examen par les pairs, d'étudier la possibilité de créer un nouveau dispositif d'encouragement des projets de recherche à risque.

Le Conseil a entériné le présent rapport le 16 septembre 2014. Il le publie ici sans y apporter de modifications.







# Introduction

## 1 The Point of Departure

The SSIC conducted an external evaluation of the SNSF on behalf of SERI.<sup>1</sup> In doing so, it fulfilled its legal function, and supported the Federal Department for Economic Affairs, Education and Research in its periodic review of Swiss research and innovation policy.<sup>2</sup> The SSIC last conducted a comprehensive institutional evaluation of the SNSF in 2001.

## 2 Goal and Subject of the Mandate

The goal of this review is a comprehensive examination and assessment of the SNSF's self-evaluation of the strategic funding of (A) research infrastructures and (B) disciplinary areas.<sup>3</sup> Following the SERI draft paper, the key questions of this mandate are:

### A Strategic funding of research infrastructures

#### A.1 Existing SNSF funding efforts

- Have SNSF activities to fund research infrastructures proven their worth?
- Where, and in which form, have “typical” or “near-systematic” problems emerged?

#### A.2 Perspectives

- What are the key middle and longer-term challenges for a coherent funding practice?
- What links have emerged from this with respect to the development of disciplinary areas in Switzerland, that lie in the remit of the SNSF?

#### A.3 Future SNSF funding efforts

- Do existing funding practices call for special adjustments, and if so, which?
- What consequences are there for other actors (national government, cantons, universities) with respect to the financing of research infrastructures?

1 WBF/SBFI (2013), *Mandat des Eidgenössischen Departements für Wirtschaft, Bildung und Forschung (WBF) vertreten durch das Staatssekretariat für Bildung, Forschung und Innovation (SBFI) an den Schweizerischen Wissenschafts- und Technologierat (SWTR), Evaluation des Schweizerischen Nationalfonds (SNF) unter den Gesichtspunkten “Förderung von Forschungsinfrastrukturen” und “Entwicklung und Förderung von Fachbereichen”*, 27 March 2013, Bern. Details of this mandate may be found in WBF/SBFI (2013), *Evaluation des Schweizerischen Nationalfonds (SNF) unter den Gesichtspunkten “Förderung von Forschungsinfrastrukturen” und “Entwicklung/Förderung von Fachbereichen”*, draft paper, 20 March 2013, Bern.

2 Research and Innovation Promotion Act (FIFG); SR 420.1, Art. 54, letter c.

3 The self-evaluation report was provided to the SSIC on 16 Dec. 2013. SNSF (2013), *Evaluation of the Swiss National Science Foundation: Funding of infrastructure and development of research fields. Self-evaluation report of the SNSF*, Bern.

## **B Strategic funding of disciplinary areas**

### **B.1 Reactive funding efforts**

- The funding policy of the SNSF has thus far been reactive. Under which aspects (e.g., increased quantity; how costs develop; funding efficiency; critical mass or concentration) and challenges (e.g., the coordination of national and international “funding vessels”) will the existing policy reach its limits?
- Are there specific challenges (e.g., in conjunction with the question of developing or strengthening new disciplinary areas in Switzerland, or questions raised by international cooperation and networking) that call for a more active steering (or setting foci) of funding policy by the SNSF’s Research Council?

### **B.2 Proactive funding efforts**

- Which specific form would such a proactive funding policy take?
- With which instruments and based on what evidence could this policy be developed further in the Research Council?
- With which (established or new) instruments, and in which scope, could or would this then have to be implemented by the SNSF itself?
- What are the consequences for other actors (in the research community, universities, funders, national government)?
- What risks does this pose for the future development of national funding for research and innovation?

The SSIC understands the mandate it has been given as helping to provide strategy advice from a systems perspective. It examines the future research policy options the SNSF faces with respect to both A and B, and formulates recommendations, differentiated by actor group, for national research funding policy.

## **3 Approach Used and Organisation of the Report**

The SSIC’s considerations are based primarily on the analysis of the SNSF’s self-evaluation, as the mandate calls for, and the experience of members of its Council. In addition, the SSIC carried out a number of interviews with Swiss HERI actors (see Appendix B). The SSIC also convened a panel of international experts, conducting discussions with these panellists about the advantages and disadvantages of various research policy options (see Appendix C), also as called for by the SERI mandate. The contributions made by the external reviewers served as food for thought, from an international perspective, and the experts’ report was evaluated in the relevant and respective sections of this report. Where relevant, specialist literature was also utilized.

To analyse the documentation provided by the SNSF, the SSIC created a working group with four of its Council members. Queries were also directed at the SNSF about particular aspects of the self-evaluation report, and the answers received were integrated into the evaluation.

As part of a wider survey of stakeholders, the SSIC asked for comments from the representatives of CRUS, KFH, CTI, the Swiss academies (SAMS, SATW, SAHS, SCNAT) and the EDK about the aspects of SNSF funding policy addressed here. The results of these conversations with stakeholders are an integral part of the SSIC’s analysis.

In accordance with the timetable laid out in the mandate, the SSIC presented SERI with an interim report at the end of June. It contained the main thrust of the recommendations, more fully formulated in the third part of the present report, to which the SNSF responded with a brief statement. At its plenary meeting in mid-September 2014, the SSIC acknowledged this SNSF position, discussed it, and took it into account in the final report.

The present document is structured as follows: In Part A, the Council lays out the point of departure in the mandate it has been given, along with how it understands the aims (in terms of knowledge) and goals of the evaluation. After describing the methodological approach employed, the questions raised by SERI are

situated in their science policy context. In a section at the end of Part A, and as transition to the main Part B, the significance of the SNSF and its role in Swiss research funding is briefly discussed.

Analysis and results follow the structure of the mandate. Chapter 1 addresses the funding of research infrastructures, while Chapter 2 addresses the strategic funding of disciplinary areas. Based on the results of these two analyses, Part C presents the conclusions and recommendations of the Council with respect to the two questions raised.

## **4 The Context of the Questions Raised**

The questions raised in the SERI mandate focus on a basic issue of research policy that has been extensively discussed both in Switzerland and in other countries. In the Council's view, what is at stake is the future of the system of publicly-funded research, one part of the overall funding of R&D in the country.<sup>4</sup> The key issue is how the framework conditions and the actor constellations, and most particularly the role of the SNSF, need to be configured to maintain Switzerland's leading international rank in education, research and innovation.

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4 The lion's share of the 18.5 billion Francs spent on R&D in Switzerland comes from private industry. National government and cantons together provide about one-quarter of the funding. In international comparison, one of the striking characteristics of the Swiss research and innovation sector is the extraordinarily high degree of private sector research activity. BFS (2014), *F&E-Finanzierung*, <http://www.bfs.admin.ch/bfs/portal/de/index/themen/15/09/key/ind2.indicator.20203.202.html?open=202#202> (consulted on 19 June 2014). As the context of this report is publicly-funded research, however, this aspect is not pursued here.

## 5 The SNSF's Significance in the Swiss HERI Sector

Since its founding in 1952, the SNSF has been the central agency which, for all research disciplines, funds self-selected or bottom-up basic research. On behalf of the national government, the SNSF allocates public funds by competitively selecting project proposals in a manner following international standards. As the “nation’s research conscience”, as the SNSF is sometimes called, it thereby fulfils the function of a superordinate assessor or referee who ensures research excellence.<sup>5</sup> The prerequisite is a high degree of autonomy, which it has as it is legally a foundation under private law. In selecting and funding excellent research projects, the SNSF makes a significant, internationally recognized, contribution to Switzerland’s top position in the HERI sector.<sup>6</sup> A well-functioning national science foundation strengthens the attractiveness of the country to top researchers from around the world. Through the SNSF, the national government supports about one-quarter of all R&D funding in Switzerland.<sup>7</sup> Research funding provided by the SNSF supplements the basic public financing provided to institutions and augments competitively-awarded funding for research in Swiss universities and research institutions.<sup>8</sup> The SNSF thus has a monopoly position, which also gives it a special responsibility to provide funding in support of research that is externally funded. The

national government has placed increasing emphasis on competitively-awarded research funding, with the result that the SNSF’s role has been substantially increased in the last few years.<sup>9</sup> It has been given a system-shaping function in Swiss research, particularly in defining suitable funding instruments.

For recipients, the financial resources the SNSF makes available have symbolic meaning in addition to their purely material value. Competitively-awarded external funds create research reputations and increase career opportunities, raising the internal competition among researchers. Basic institutional financing mechanisms linked to performance augment the incentive effects of SNSF funding, which further increases the demand for SNSF monies. The introduction of funding for overhead costs have driven these dynamics even higher, such that a growing proportion of non-commercial research activities, along with the support provided to mostly younger research personnel, is by now mostly coming from short-term, project-linked SNSF funds.<sup>10</sup> The SNSF, through its various funding activities, the funding it provides for self-selected research projects, for career advancement, programmes, and in support of cooperative efforts, means it has wide-ranging structural effects on the entire higher education landscape.

Additionally, the SNSF plays an important integrative role in the federally-organised system of research in Switzerland, as it speaks to all branches engaged in basic research. Researchers from different disciplines

5 Speech by Federal Councilor Johann N. Schneider-Ammann on the occasion of awarding the 29<sup>th</sup> national Latsis Prize 2012 on 10 Jan. 2013, [https://www.wbf.admin.ch/de/aktuell/reden/reden-2013/?tx\\_rsspicker\\_pi\\_list%5Boid%5D=47420&tx\\_rsspicker\\_pi\\_list%5Bview%5D=single](https://www.wbf.admin.ch/de/aktuell/reden/reden-2013/?tx_rsspicker_pi_list%5Boid%5D=47420&tx_rsspicker_pi_list%5Bview%5D=single) (consulted on 4 June 2014).

6 A much cited indicator of the Swiss research system’s competitiveness is the high success rate of researchers in Switzerland in obtaining ERC project funding. The average success rate in obtaining ERC research grants (2007–2013) was 23%, which meant Switzerland ranked first; England, France and Israel had a success rate of 16%.

7 In 2012, the Swiss national government provided about 3.6 billion CHF in R&D funding. About 40% of this was indirect funding for universities. Overall, Switzerland invests about 3.1% of its GDP in R&D, putting it sixth behind South Korea, Israel, Finland, Sweden and Japan. For more on this, see SNF (2014), *Forschungsplatz Schweiz*. [http://www.snf.ch/SiteCollectionDocuments/por\\_fac\\_sta\\_fopl\\_ch\\_jb12\\_d.pdf](http://www.snf.ch/SiteCollectionDocuments/por_fac_sta_fopl_ch_jb12_d.pdf) (consulted on 26 Aug. 2014).

8 According to SNSF calculations, it provides about 15% of the research funding at Swiss universities. See SNSF (2013), *Evaluation of the Swiss National Science Foundation*, p. 15. A Federal Statistical Office publication (BFS [2010], *Finanzen der universitären Hochschulen 2009*) calculated that SNSF funding provided to cantonal universities accounted for 5–10% of their total budgets. On this, see SUK (2012), *Schlussévaluation der mit projektgebundenen Beiträgen nach FG geförderten Projekte 2008–2011. Schlussbericht*, authored by Dora Fitzli et al., Bern, p. 3.

9 EVD; BBT (2012), *Beiträge des Bundes und der Kantone an den Bereich “Bildung, Forschung und Innovation” 2004–2016*, Neuchâtel, pp. 10–12 and BFS (2012), *Öffentliche Finanzierung der Forschung in der Schweiz 2000–2010*, Bern, pp. 22–23. In the funding period from 2008–2011, the SNSF had 2.8 billion CHF available, about 1.1 billion more than in 2004–2007. At an average yearly growth rate of 7.5%, the means available for competitively-awarded research funding have seen a substantial increase.

10 According to the SNSF, in 2011 about 30% of the researchers at Swiss universities submitted a proposal to the SNSF or were being funded by the SNSF as part of ongoing research projects. SNF (2013), *Evaluation of the Swiss National Science Foundation*, pp. 2, 15. The funding awarded went to a total of about 8,450 individuals, 4,900 of whom were funded in the context of projects, 850 as part of career advancement efforts, and 2,700 through programmes. See SNF (2012), *Jahresbericht 2011*, Bern, p. 28.

can communicate across the boundaries of their disciplines in the SNSF's Research Council. The breadth of the support the SNSF provides means it makes a significant contribution to holding the research community in the country together.

The last comprehensive evaluation of the SNSF was conducted in 2001. Since then the SNSF has implemented its "SNF Futuro" reforms and undertaken adjustments in key areas, including project proposal administration and its evaluation process.<sup>11</sup> The goal has been to harmonize how proposals were being handled between Sections and specialist committees, to optimize communication with those submitting proposals, and make the cooperation between Research Council and administrative offices more efficient. The ability of the SNSF to reflect on its practices was further improved by a comprehensive external evaluation of its selection processes and a survey of researchers conducted in 2013.<sup>12</sup>

From the outset, the SNSF has functioned as an intermediary, a funding organisation at the intersection between research and policy. It both serves as a funder responding to research proposals and as an implementer – and at times as a strategic organ – of national government policy.<sup>13</sup> The diverging expectations of the research community, society, and political authorities, however, may pose serious challenges to the SNSF over the longer term. There is a risk that the standards of research quality, and the funding decisions derived from them, may come in conflict with

politically and strategically motivated mandates from the national government.

In the Swiss research and innovation realm, the SNSF fulfils tasks of central importance. The evaluation of project proposals for their excellence, as well as the funding provided to self-selected basic research (in the "responsive mode"), form the core of the SNSF's mission. All the SSIC's interlocutors attested to the SNSF's very good performance, and it also receives very high marks in international comparison. These HERI actors uniformly agree that the SNSF should remain a reliable partner for researchers in the future.

The SSIC is convinced that the relationship of trust that has been built over the decades with the Swiss research community can only be maintained if the SNSF successfully upholds its high demands for research quality in the projects it funds. The SNSF's Research Council should therefore, on principle, be called upon where its core competence in competitively-awarded research funding can be employed most sensibly. Given the relevance of the SNSF to the Swiss HERI sector, the SSIC generally recommends careful development of SNSF's funding activities and funding modalities.

11 On the "SNF Futuro" reform programme and the individual measures taken, see the SNSF notification at <http://nfp.snf.ch/D/Aktuell/Dossiers/Seiten/SNF-futuro.aspx> with the link to the SNSF's 2007 final report about the reforms.

12 Coryn, Chris et al. (2012), *An Evaluation of the Transparency and Overall Quality of Evaluation at the Swiss National Science Foundation: Final Report*. Kalamazoo. The results of the survey were made available in May 2014. See also Langfeldt, Liv; Ramberg, Inge; Gunnes, Hebe (2014), *Swiss Research Funding – Researcher Survey for the Swiss National Science Foundation (Report 5/2014)*, Oslo.

13 "Par le biais de ses organes (en particulier par son Conseil de fondation), le FNS est le point de contact le plus important entre le monde scientifique et la sphère politique". Leresche, Jean-Philippe (2014), *Politique de la recherche et de la technologie*, in: Knoepfel, Peter et al. (Ed.), *Handbuch der Schweizer Politik*, 5<sup>th</sup>, completely revised and expanded edition, Zurich, pp. 779–803, here p. 792. Also, Benninghoff, Martin; Braun, Dietmar (2010), *Research Funding, Authority Relations, and Scientific Production in Switzerland*, in: Whitley, Richard; Engwall, Lars; Gläser, Jochen (Eds.), *Reconfiguring Knowledge Production: Changing authority relationships in the sciences and their consequences for intellectual innovation*, Oxford, pp. 81–109.



# Analysis and Results



# 1 Funding Research Infrastructures

## 1.1 Preamble

The tendency to use increasingly complex and expensive instruments for conducting research, most evident in technical disciplines and the natural sciences, is a driving force in modern science and research. The increasing digitalization of academic life has led to a new dynamic that affects not just those natural science disciplines that are regarded as particularly intensive infrastructure users, but increasingly prevails in the humanities and social sciences. These developments pose considerable challenges to existing systems that were created to fund research infrastructures.<sup>14</sup>

The creation of large-scale research organisations such as *European Organization for Nuclear Research CERN* (1954), *European Southern Observatory ESO* (1962), *European Space Research Organisation ESRO* (1964), and later, *European Molecular Biology Laboratory EMBL* (1973), means issues surrounding RI funding have long been on the science policy agenda.<sup>15</sup> The foundations for a multilateral funding policy in Europe were thus long laid; in 2002, they were given form and an institutional home in ESFRI, the European Strategy Forum on Research Infrastructures.<sup>16</sup>

The international discussion about funding RIs has become considerably more significant in the last decade, and today is based on a relatively homogeneous, broad understanding of research infrastructure.

The term “research infrastructure” has become more differentiated, loosening itself from its older connotation, one strongly influenced by the natural sciences, of large-scale research facilities. By now, it encompasses a broad spectrum of the research means used by differing disciplines, including large-scale equipment, devices, platforms and laboratories, but also databanks, survey panels, collections, editorial projects and e-infrastructures.<sup>17</sup> Conventional infrastructures like buildings, libraries and archives are not systematically subsumed under this definition, though they too increasingly function as consortia.<sup>18</sup>

In Switzerland, the RI discussion is also based on a broad conception of research infrastructure. In its self-evaluation, the SNSF explicitly begins with the definition of RIs used in the MERIL project,<sup>19</sup> and further differentiates between RIs with a direct research purpose, and RIs that serve to coordinate research areas.<sup>20</sup> The operative definition of RI used in the Swiss roadmap follows the general view of RI at the European level, though it explicitly excludes editorial projects in the humanities.<sup>21</sup>

There is a consensus that RIs have strategic importance for the future development of national and international research. Infrastructures push a broad spectrum of research activities forward, both basic and applied, and make it possible to address a variety of complex and interdisciplinary questions, at least in part. This makes it possible to establish connections to international cutting-edge research.

The role the SNSF plays in funding cannot be regarded in isolation, particularly in light of the continued Europeanization and internationalization of research

14 In this context, one should note the developments in “digital humanities”. See Immenhauser, Beat (2013), *Digital Humanities: Neue Herausforderungen für den Forschungsplatz Schweiz*, in: *SAGW Bulletin* 3 (2014), p. 31 as well as the dossier on the topic on pp. 32–59.

15 Jacob, Merle; Hallonsten, Olof (2012). The persistence of big science and megascience in research and innovation policy, in: *Science and Public Policy*, 39/4, pp. 411–415.

16 ESFRI’s task is to define a European strategy for developing research infrastructures, identify new research infrastructures that are of European interest, and to push for their implementation through transnational projects. [http://ec.europa.eu/research/infrastructures/index\\_en.cfm?pg=esfri](http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=esfri).

17 Wissenschaftsrat (2013), *Bericht zur wissenschaftsgeleiteten Bewertung umfangreicher Forschungsinfrastrukturvorhaben für die Nationale Roadmap (Pilotphase)*, Paper 2841–13, Cologne, p. 11.

18 Exceptions to this rule can be found in reports about RIs in the humanities, for example in BMBF (2013), *Forschungsinfrastrukturen für die Geistes- und Sozialwissenschaften*, Bonn.

19 MERIL stands for Mapping of the European Research Infrastructure Landscape. Since Sept. 2013, it has made an online databank of publicly accessible RIs in Europe available. See <http://portal.meril.eu/converis-esf/static/about>.

20 SNSF (2013), *Evaluation of the Swiss National Science Foundation*, pp. 57–58. Along these lines, the SNSF intends to restructure its portfolio and delegate those RIs that coordinate research areas to the academies. See *Botschaft vom 22. Februar 2012 über die Förderung von Bildung, Forschung und Innovation in den Jahren 2013–2016*, BBl 2012, 3099f., particularly p. 3204.

21 SBFI (2011), *Schweizer Roadmap für Forschungsinfrastrukturen. Schlussbericht* (as at 30 March 2011), Bern, p. 7. [http://www.epos-eu.org/assets/documents/Roadmap/SWITZERLAND%20Roadmap%20\(original\)%202011.pdf](http://www.epos-eu.org/assets/documents/Roadmap/SWITZERLAND%20Roadmap%20(original)%202011.pdf). The Oct. 2013 call for RI applications uses this same operative definition. SERI and SNSF (2013), *Call for Applications for New Research Infrastructures of National Relevance* (consulted 23 Oct. 2013), Bern, p. 8. The call may be found at: [http://www.sbf.admin.ch/themen/01367/02040/index.html?lang=de&download=NHZLpZeg7t,Inp61ONTU042I2Z6ln1acy4Zn4Z2qZpnO2Yuq2Z6gpJCdX94fmym162epYbg2c\\_JjKbNoKSn6A--](http://www.sbf.admin.ch/themen/01367/02040/index.html?lang=de&download=NHZLpZeg7t,Inp61ONTU042I2Z6ln1acy4Zn4Z2qZpnO2Yuq2Z6gpJCdX94fmym162epYbg2c_JjKbNoKSn6A--). On the SNSF’s RI concept, see SNSF (2013), *Evaluation of the Swiss National Science Foundation*, 8: “For practical reasons, the SNSF has explicitly excluded long-term publishing projects in the humanities and social sciences from the definition of infrastructure, even though most international infrastructure definitions include publishing projects.”

infrastructures. Two contexts are relevant to appropriately judge the relevance of SNSF funding policies: the legal framework it functions within nationally, and the challenges Switzerland faces internationally. Hence, the following analysis first examines the domestic regulatory framework for RI funding, providing an overview of the actors involved and their roles, with special attention devoted to the national government (Sect. 1.2). In a second step, and against this background, the SNSF's funding activities in the RI realm are reviewed, as laid out in the SNSF's own self-evaluation (Sect. 1.3). Section 1.4 describes the current characteristics of Swiss RI funding, while section 1.5 discusses the challenges facing Swiss RI funding policies in light of international developments. Finally, section 1.6 sketches out the contours of a future Swiss RI funding policy, with special attention devoted to the SNSF's mandate.

## 1.2 Funding RIs: The Regulatory Framework and Actors

In Switzerland, the funding for RIs takes place within a regulatory framework which assigns the individual HERI actors – including the SNSF – specific roles and tasks. The constellation of actors which has developed in the RI realm is embedded in a more comprehensive system of research funding, one which has been a national government competency since the 1970s.<sup>22</sup> RI funding, however, plays a negligible role in the national government's funding of innovation.<sup>23</sup>

The relevant material at the national level is primarily regulated by the Research and Innovation Promotion Act (RIPA) and its accompanying regulations.<sup>24</sup> As for the intersection between RI funding and “cost-intensive areas”, some relevant articles can be found in the current law governing financial support provided to Swiss universities (UFG), and in the Higher Education Act (HEdA).<sup>25</sup> In particular areas, such as the research on energy, and in the context of research conducted to fulfil federal administrative mandates, special laws exist that can make provision for the national funding of infrastructures.<sup>26</sup> The relevant higher education laws, in cantons which have universities, regulate the frameworks and conditions for RI funding in those universities.

22 See the Swiss national constitution of 29 May 1874 (version of 20 April 1999), p.14, <http://www.admin.ch/opc/de/classified-compilation/18740006/199902070000/101.pdf>. In the current constitution, HERI funding responsibilities of the national government are laid out in Arts. 63a and 64.

23 The CTI does not fund any larger research infrastructures that are either part of the basic financing of the universities or that are supported by other regular university funding sources. The share of support for RI in national subsidies provided to innovative projects lay considerably under 1% in 2012 and 2013. In CTI projects, most infrastructure funding comes from the implementing partners. See the answer from Mr A. Berwert (KTI) to a corresponding information request from the SSIC, 6 June 2014 (available from the SSIC on request).

24 See the Research and Innovation Promotion Act (RIPA = FIFG; SR 420.1) and the accompanying regulation (V-FIFG; SR 420.11) of 29 November 2013 (as at 1 January 2014).

25 As of this writing, the Higher Education Funding and Coordination Law (HEdA = HFKG; SR 414.20) is scheduled to go into force on 1 January 2015. See <http://www.admin.ch/opc/de/federal-gazette/2011/7455.pdf>.

26 As of this writing, the SSIC does not have a comprehensive overview available of the special laws and regulations governing research infrastructure funding. The Energy Law of 26 June 1998 (SR 730.0) is one example of such regulation, see <http://www.admin.ch/opc/de/classified-compilation/19983485/index.html>. In this context, the national government supports pilot or demonstration facilities, and for particular experiments, these may serve as infrastructure. See <http://www.bfe.admin.ch/geoinformation/05061/05397/05398/index.html?lang=de>.

In addition to the national government and the research organs it supports (see Art. 4, RIPA), other major actors in RI funding include the universities themselves and, indirectly, the cantons, as they are the legal bodies which maintain them. According to BFS figures, the cantonal universities expended about 950 million CHF on infrastructure in 2012, and the universities of applied sciences and teacher training universities together spent about 357 million CHF.<sup>27</sup> The share of infrastructure costs, as a proportion of the overall costs of the universities (excluding the ETHs), lies at about 12–13%.

### 1.2.1 The role of the Swiss national government in RIs

The national government has two primary tasks in the RI realm: coordination and funding. The EAER is the Cabinet department with overall responsibility for this area. More specifically in EAER, SERI is in charge of research funding and university policy planning and coordination processes. It also is the public authority which prepares decisions and implements them, oversees and funds the ETH domain, supports the institutions engaged in university-level research, and oversees the national research infrastructures (following Art. 15, RIPA) as well as the SNSF, the Swiss academies, and the SUC. It is thus also involved in funding research infrastructures.

#### a. Coordination

With respect to cost-intensive RIs, Art. 41, Par. 4, of RIPA imposes a specific coordination obligation on the national government for all projects which, given their profile and high costs, potentially affect the entire Swiss university sector and which therefore need a broad basis of support. With respect to particularly cost-intensive areas, SERI is responsible for coordinating the international funding policies of the national

government, plans for ETH development, and university policy planning. Art. 36, Par. 1, of HEdA also specifies that national coordination and the division of labour in particularly cost-intensive endeavours should be carried out in conjunction with the cantons.

In the area of large-scale RIs, a Swiss roadmap is the core coordination and planning instrument for clarifying and assessing which national needs exist.<sup>28</sup> It is also SERI's task, following Art. 55 of the RIPA regulations, to periodically report on the current state of nationally significant RIs, giving special emphasis to large-scale, international research structures and to internationally-coordinated RIs in which Switzerland participates. In doing so, the Swiss roadmap takes into account ESFRI plans to establish European RIs with independent legal identity in a European Research Infrastructure Consortium and to ensure their longer-term existence with the help of "national hubs" and financial support from members.

Organisationally, the responsibility for the national roadmap process falls to the "national research and innovation" division in SERI. The "international research and innovation cooperation" unit is responsible for questions of international RI funding policy, in particular for the coordination with ESFRI and the administration of Swiss participation in large-scale international infrastructures.

In October 2013, to update the first Swiss RI roadmap (from 2011), the SNSF and SERI for the first time launched a common call for new RIs of national significance.<sup>29</sup> As in the first version, the new roadmap does not contain funding decisions but instead serves as a basis for such decisions within the framework of the ERI Dispatch (for 2017 to 2020). It provides an inventory and review, generated in a bottom-up fashion, of existing RIs, and suggests which RIs might be of significance in the future. Following HEdA, new revisions of the roadmap are to take RIs in cost-intensive areas into account.<sup>30</sup>

27 See BFS (2014), *Finanzen der universitären Hochschulen, der Fachhochschulen und pädagogischen Hochschulen*, Basisdaten 2012, <http://www.bfs.admin.ch/bfs/portal/de/index/themen/15/06/data/blank/04.html#Finanzen>. University calculations distinguish between three types of costs: personnel, materials, and infrastructures. The infrastructure costs listed in this document cannot be broken down to identify infrastructures specific to research, so these figures are only gross estimates of university investment in RIs.

28 SBF (2011), *Schweizer Roadmap für Forschungsinfrastrukturen*, [http://www.epos-eu.org/assets/documents/Roadmap/SWITZERLAND%20Roadmap%20\(original\)%202011.pdf](http://www.epos-eu.org/assets/documents/Roadmap/SWITZERLAND%20Roadmap%20(original)%202011.pdf).

29 SERI and SNSF (2013), *Call for Applications for New Research Infrastructures of National Relevance*, 23 October 2013, [http://www.sbf.admin.ch/themen/01367/02040/index.html?lang=de&download=NHZlpZeg-7t,lnp6I0NTU042I2Z6lnIacy4Zn4Z2qZpnO2Yuq2Z6gpJCedX94fmym162epYbg2c\\_JjKbNoKSn6A--](http://www.sbf.admin.ch/themen/01367/02040/index.html?lang=de&download=NHZlpZeg-7t,lnp6I0NTU042I2Z6lnIacy4Zn4Z2qZpnO2Yuq2Z6gpJCedX94fmym162epYbg2c_JjKbNoKSn6A--). The deadline for submission of RI proposals was 23 Jan. 2014. To bring these RI lists regularly up to date, calls for applications are to be held every four years.

30 According to the notification in the ERI Dispatch for 2013–2016, p. 3277.

The precondition for being included in the roadmap is the national importance of the RIs, its broad use by the research community, its accessibility, and a central governance structure. For an application to be considered, it also requires a written letter of commitment from the university administrations involved. No minimum financial amount is defined for RIs.

The following criteria are relevant in selecting the proposals:<sup>31</sup>

- a) Relevance of the new RI for national and international research, either from a specialized or interdisciplinary point of view
- b) Potential for the development of national and international collaboration
- c) Overall feasibility and state-of-the-art
- d) Integration of the new RI in the Swiss research landscape

The roadmap overseen by SERI is a five-step process, according to the call for applications. In the first, existing and already funded RIs are inventoried, and the need for new RIs of national importance to Swiss research ascertained. Once established, researchers from Swiss higher education and research institutions, in a second step, can submit the corresponding proposal to the SERI. The SNSF then evaluates and classifies the proposals submitted for new RIs. In a third step, the SNSF prioritizes the proposals based on so-called “foresight” activities. The roadmap process calls for the SNSF’s recommendations to flow into consultations with the most important stakeholders, a process SERI initiates. This phase is meant as a way to assign individual RI funding to institutions likely to support and fund it. Based on the multi-year planning of the respective institutions, the EAER makes the funding decisions in the context of the next ERI Dispatch, and presents this to parliament for discussion and approval.

31 Two additional quality criteria are noted in the appendix to the SERI and SNSF call for applications: utilization and accessibility, and financial support and institutional embedding. See SERI and SNSF (2013), *Call for Applications for New Research Infrastructures of National Relevance*, p. 13.

## b. Funding

Where individual higher education institutions have insufficient funding possibilities, and where a national interest exists, the national government can support larger infrastructure projects, either under direct jurisdiction or indirectly. These national government funds for RI are tied to fulfilling the conditions laid out in the Law on Subsidies.<sup>32</sup>

Art. 15, as part of the national funding for research, and Arts. 28 and 29 (all in RIPA), which govern the funding of international research, is an avenue by which the national government can make direct funding decisions using its own decision-making competence.

Federal monies flow into infrastructure projects indirectly through the national funding of the ETHs (Art. 7), the SNSF (Art. 10), and the various Swiss scientific academies (Art. 11, all RIPA). In the context of the UFG and HEdA, the national government supports common RIs of universities through investment contributions, as long as the cost of the individual project does not exceed 300,000 CHF and at least half the operating costs are covered.<sup>33</sup> SUC project-linked funds are another means for the national government to fund RI projects.<sup>34</sup> The following Table 1 illustrates the various funding lines that make it possible for the national government to provide subsidies to RI under the current system.<sup>35</sup>

32 See, specifically, Art. 6 of the Federal Law of 5 October 1990 (as at 1 January 2008) on grants and compensation (Subventionsgesetz [Law on Subsidies], SuG; SR 616.1), <http://www.admin.ch/opc/de/classified-compilation/19900241/index.html>.

33 See the Federal Law of 8 October 1999 (as at 1 January 2013) on the financing of universities and cooperation in the higher education sector (Universitätsförderungsgesetz [Law on Financial Support to Universities], UFG; SR 414.20), Art. 18, Par. 2, letter b, and Art. 13, Par. 2; see also HFKG (Art. 47, Par. 3).

34 The legal basis for this is provided by UFG (Art. 13, Par. 1, letter c, and Art. 20) as well as HFKG (Art. 47, Par. 1, letter c).

35 The detailed description of the individual funding lines of the national government in the RI realm can be found in the Appendix under letter A.

Funding line or organ	Legal basis	Funding recipients	Payment framework	Evaluating institution	RIs examples
ETH domain	Art. 7, RIPA	Researchers and institutions in the ETH domain, international organisations	ERI Dispatch, special dispatches	ETH domain	CSCS, ICOS, SLS, SwissFEL
SNSF	Art. 10, RIPA	Swiss research universities, international organisations	ERI Dispatch	SNSF	BUB, GMBA, IHES, SHARE, SHP, SCTO/ ECRIN
Swiss Academies	Art. 11, RIPA	Researchers in Switzerland	ERI Dispatch	Academies	National dictionaries, DDS, HLS
Research facilities of national significance	Art. 15, RIPA	Researchers in non-university research institutions in Switzerland	ERI Dispatch	SSIC	FORS, IRSOL, SIB, SSA
International cooperation in the area of research and innovation	Art. 28, RIPA and international agreements	International organisations	ERI Dispatch, special dispatches	International organisations	CERN, EMBL, ESA, European X-FEL
Investment contributions to cantonal universities	Art. 18, UFG	Cantonal universities	ERI Dispatch	Cantonal universities	n.a.
Project-specific contributions	Art. 20, UFG	Universities	ERI Dispatch	SUC	PASC, SEON, SwissTransmed

Table 1 **National Subsidization of Research Infrastructures**

## 1.3 Funding RIs: The SNSF's Role

Among other things, the SNSF (following Art. 10 of RIPA), focuses on funding “research infrastructures which serve the development of fields of expertise in Switzerland and which are not under the remit of higher education institutions which conduct research, or of the national government.”<sup>36</sup> The law assigns the SNSF a subsidiary role in funding RI, under the notion it should provide start-up, follow-up, and co-financing for RIs which have limited financial needs, and where the length of funding needed is limited.

Under the overall rubric “research infrastructures”, the SNSF spent about 225 million CHF between 2008 and 2012 for various research support facilities.<sup>37</sup> If one ignores what is at times strong yearly variation in outlays, and takes 2012 as the reference year, then the SNSF spent about 63 million CHF (8.3% of its annual budget) on assembly, utilization, coordination, maintenance, and operation of national and international RIs (e.g., laboratory facilities, monitoring instruments, survey panels, research administration offices, publication projects, cohort studies; see Table 2).<sup>38</sup> The SNSF now financially supports research infrastructures whose numbers have increased sharply since 2000,<sup>39</sup> and whose type, need for resources, genesis, and history differ considerably. Correspondingly, the amount the SNSF contributes ranges enormously, from a low of around 10,000 to a maximum of 3.7 million CHF (for RIs in medical studies). The variation in the SNSF's RI portfolio is also reflected in the modalities used: there are two funding instruments (R'Equip<sup>40</sup> and FORCE/FINES/FLARE<sup>41</sup>) and four different budget lines (a SERI mandate with a separate

budget; the internal SNSF budget for research infrastructures; project funding; and programme funding).<sup>42</sup>

In practice, two modes can be distinguished. In the first, the SNSF primarily provides start-up, follow-up, and co-funding for RIs that directly serve to carry out research projects. The name of the funding instrument R'Equip reflects this, as it funds the acquisition, modernization, and development of larger research apparatuses whose costs exceed the normal basic financing of an institute or a laboratory. The SNSF contributes a maximum of one million CHF, and as a rule provides a maximum of half the acquisition costs if they exceed 100,000 CHF. Characteristic of this type of RI funding is a limited need for resources, a limited time the funding is needed, and a maximum of a one-half funding share. The funding decisions are made on the basis of a competitive selection process and are the responsibility of the SNSF's Research Council.

In the second mode, the SNSF participates at the behest of the national government in funding existing or new RIs over a longer time period, at times with considerable subsidies. The SNSF's share in the funding of these research infrastructures can lie anywhere between 10% and 100%. As a rule, this funding is for international, long-term RIs carried out in the context of ESFRI or the Swiss roadmap (as examples: European Social Survey ESS, ICOS, ECRIN). However, they also include national RIs in biomedical research, including longitudinal studies or CTU, whose construction and maintenance requires funding with a lengthy time horizon. In this category, one also finds the funding of instruments for large, international research experiments in the area of particle physics, astrophysics, and astroparticle physics (FLARE); this is carried out

36 See RIPA (Art. 10, Par. 3, letter c).

37 SNSF (2013), *Evaluation of the Swiss National Science Foundation*, p. 35. The share of infrastructure funding in the overall budget of the SNSF for 2008–2012 was about 6%.

38 Ibid., pp. 23, 24, 35. The present calculation also takes long-term “research infrastructure” projects in the humanities and natural sciences into account. The SNSF's budget in 2012 was 755.2 million CHF. See SNSF (2013), *2012 – Forschungsförderung in Zahlen*, Bern, [http://www.snf.ch/SiteCollectionDocuments/por\\_fac\\_sta\\_kurz\\_jb12\\_d.pdf](http://www.snf.ch/SiteCollectionDocuments/por_fac_sta_kurz_jb12_d.pdf).

39 See esp. diagram 12 in SNSF (2013), *Evaluation of the Swiss National Science Foundation*, p. 37. The number of RIs in which the SNSF participates financially is given as 35, but more than 65 RI projects are listed in the appendix to the report. FLARE and R'Equip proposals are not included among them.

40 See also SNSF (2011), *Reglement über die Gewährung von Beiträgen an Forschungsapparaturen (R'Equip-Reglement)*, Version of 14 Dec. 2011, [http://www.snf.ch/SiteCollectionDocuments/ll\\_requip\\_reglement\\_d.pdf](http://www.snf.ch/SiteCollectionDocuments/ll_requip_reglement_d.pdf).

41 In the new ERI period, FORCE/FINES has been replaced by FLARE (*Funding Large international REsearch projects*). See the details on the SNSF website at <http://www.snf.ch/de/foerderung/infrastrukturen/flare/Seiten/default.aspx>.

42 In its plan for 2012–2016, the SNSF also funds RIs through the NCCR programme. See SNSF (2010), *Mehrijahresprogramm 2012–2016. Planungseingabe zuhanden der Bundesbehörden*, Bern, p. 5: “The growing need of researchers for research infrastructures should be taken into account with an amount of 241 million CHF.”

under a separate budget line through SERI. Characteristic of this funding mode is that the strategic decisions on the direction to be taken are primarily made by SERI, which mandates the SNSF to carry out the respective funding activities.

The demands made of RI project proposers here are vastly greater than for normal project funding. In a FLARE proposal, for example, both a research plan and a technical explication statement are required, as is a detailed budget and a detailed business plan which “contains not only a financial overview but also the expected results, along with the financial contributions of Swiss participation in the course of the experiment.”<sup>43</sup>

In addition to its role as funder, the SNSF also fulfils a function in providing expertise. The SNSF sets out four evaluation criteria for its review of RI proposals: need and research or scientific urgency; scientific quality and relevance of the RI; the envisioned research and the researchers as well as the assurance of longer-term funding through the participation of third parties; and the utilization and accessibility of the RI. In doing so, the SNSF relies “on the expertise of its Research Council and its knowledge of the Swiss research scene”.<sup>44</sup> In practice, RI proposals are evaluated in the specialist Section of the SNSF's Research Council responsible for the subject, or by an experts' panel.

In the implementing regulation, projects funded by the SNSF run a maximum of three years.<sup>45</sup> The evaluation of RI proposals correspondingly has a three-year project cycle. The logic of this project funding means that even for longer-term research infrastructures, and regardless of which channel funds them, all RIs are evaluated every three years, and if approved, receive a new budget for the next period.

Funding instrument/ Project or funding type	Budget line	Funding amount (in million CHF)
Research infrastructures	Research infrastructures	13.4
R'Equip	Research infrastructures	13.6
FORCE/FINES/FLARE	SERI mandate with a separate budget	5.4
Longitudinal studies in biology and medicine / CTU	Programme	10.4
Long-term projects in the humanities	Project funding, Sect. 1	5.8
Long-term projects in the natural sciences	Project funding, Sect. 2	14.3
<b>TOTAL</b>		<b>62.9</b>

Table 2 **SNSF Research Infrastructure Funding (2012)**

<sup>43</sup> SNF (2014), *FLARE*, <http://nfp.snf.ch/D/foerderung/Infrastrukturen/flare/Seiten/default.aspx>. The FLARE programme ensures Swiss participation in international large-scale projects in the named fields.

<sup>44</sup> SNF (2010), *Mehrjahresprogramm 2012–2016*, p. 40. In the context of the Swiss roadmap for research infrastructures, the SNSF assesses and prioritizes the projects from the perspective of the development of disciplinary areas in Switzerland, taking the context of European and international trends into account. See SBF; SNF (2012), *Leistungsvereinbarung 2013–2016 zwischen der Schweizerischen Eidgenossenschaft und dem Schweizerischen Nationalfonds zur Förderung der wissenschaftlichen Forschung* (as at 12 December 2012), Bern, p. 8.

<sup>45</sup> See SNF (2007), *Beitragsreglement des Schweizerischen Nationalfonds über die Gewährung von Beiträgen vom 14. Dezember 2007* (as at 1 July 2012), Bern, Art. 3, p. 3.



## 1.4 Funding RIs: Characteristics of the Swiss System

Switzerland provides an attractive environment for conducting research, and it has excellent research facilities and equipment.<sup>46</sup> The access of researchers in Switzerland to large-scale research infrastructures abroad is guaranteed, thanks to the national government's participation in major international research organisations. The research funding policy pursued by the national government and the cantons has until now included relatively generous basic financing for institutions, and the SNSF's funding as well as SERI's coordination efforts have also contributed to this positive situation for researchers in Switzerland.

While Swiss HERI actors assess the portfolio of existing research infrastructures positively, there is a degree of scepticism if not dissatisfaction with the current regulations and current process for establishing and funding new RIs.

Based on the preceding analysis as well as responses from HERI institutions the SSIC consulted, one can characterize the RI funding system and arrive at the following conclusions:

### **The current regulation of competencies with respect to RIs is inconsistent and patchy.**

In Switzerland, RI funding is part of the public funding of basic research. The country's constitution states that this lies in the area of competency of the national government. However, the regulations governing evaluations, decision-making, and funding of RIs are distributed across two different laws – RIPA and HEdA – and decision fields. They are partly under-determined with respect to the jurisdictions or responsibilities of the actors.<sup>47</sup> It is also insufficiently clear which instruments are best suited for funding which research infrastructures. The SNSF is given a mandate from SERI to undertake tasks in the RI domain, but this goes beyond the subsidiary role assigned the SNSF by law. Over-

all, a coherent funding policy is lacking that would set out clear responsibilities and processes which the research community could orient itself by. It is not always evident to researchers and potential project proposers how the responsibilities for the various RI projects are distributed in the current system.

### **Previous RI funding practices have been incoherent and confusing.**

Inconsistencies in the regulatory framework have resulted in correspondingly highly fragmented funding and evaluation practices. The assigning of funding object, funding entity, and funding itself is not consistent, and in some cases follows what seems to be an arbitrary logic, particularly in the intersection with university funding. There are also cases where particular RIs are funded through project-specific contributions from the SUC, though this was not meant for longer-term RI funding.

The national government supports a variety of national and international research infrastructures, of differing sizes and relevance, through various funding channels. It can exercise direct influence on RI funding policy (through the ETH domain) as well as over national and international research funding (through Art. 15 and 28 of RIPA). However, an overall budget for RI is lacking, one that could be reserved for projects listed in the roadmap.

The incoherence in the system means that comparable RIs are funded through different channels and credit lines, and are then also evaluated by different bodies. The overlap between funding national RIs through Art. 15, RIPA, and funding them through the SNSF, the Swiss academies, or SUC contributions, does not seem to be objectively justified.<sup>48</sup> On the other hand, the confusion and incoherence in the funding of RIs has the advantage that it allows for *ad hoc* solutions in individual cases.

In the absence of clear and comprehensive rules, the SNSF's RI funding policy has been insuffi-

<sup>46</sup> According to Langfeldt, Liv; Ramberg, Inge; Gunnes, Hebe (2014), *Swiss Research Funding*, researchers in Switzerland assess the infrastructure situation at the universities positively. According to an SNSF report, the funding it provides for overhead is largely invested in the country's research infrastructure (research apparatuses, laboratory equipment, spatial infrastructure, IT costs). See SNF (2011), *Overhead-Erfahrungsbericht für die Jahre 2009–2011*, Bern, p. 9.

<sup>47</sup> For example, research universities lack an explicit legal basis for their responsibility to help finance cost-intensive RIs that are of national significance.

<sup>48</sup> Examples of such inconsistencies and overlaps include editorial projects in the humanities funded by the Swiss academies and the SNSF, as well as the repeated national support, through various channels, for RI projects such as the European Social Survey ESS and SEON (SNSF, Art. 15, SUC). There is also duplication in content (e.g., the SAHS's DDZ and the SUC's "Scientific Information" programme).



ciently defined. This has not led to problems in the system itself, because RI funding has thus far only been a relatively small share of the SNSF's overall budget. However, commitments to regularly fund RIs over the longer term may create limitations in the ability of the SNSF to act independently.

#### **The ability of the system to formulate strategy for RI funding is poorly developed.**

The research culture in Switzerland follows principles of competition, doing things in a bottom-up manner, subsidiarity, and self-coordination. In consequence, the system for research funding is strongly institutionally anchored in autonomously-acting universities. This means the research-oriented universities, as part of the sovereignty they have over their budgets, invest in infrastructure projects and make the strategic decisions. As a result, RIPA explicitly assigns the relevant national organs subsidiary roles in RI funding. Beyond the coordination tasks RIPA defines, the national government thus only has direct or indirect responsibility when the costs of an investment exceed the budget of the individual universities and research institutions, and where a national interest exists. The current regulations also impose severe restraint, in the special domain of RI funding, on the national government in research policy strategy formation. Due to its importance in the RI domain, in practice the ETH Board occupies a special place and has considerable influence over strategy. Still, there is no authority which takes responsibility across the entire system for strategic coherence in the decisions to fund research infrastructures.

## 1.5 Funding RIs: Specifically Swiss Challenges

The challenges Switzerland faces in funding RIs are closely linked to international developments in the RI domain, and to pressure exerted, especially from the EU, to be in conformity with these dynamics. The funding of large-scale RI – seen historically – has been a driving force in the continued transnational institutionalization of academic research, and in the increasing intensity of cooperation efforts. With the creation of ESFRI, the 2006 publication of the first European Roadmap for Research Infrastructures<sup>49</sup>, the launching of the MERIL project, and planned funding measures as part of “Horizon 2020”,<sup>50</sup> the EU plays a leading role in the RI domain, and will remain a driving force into the future.<sup>51</sup>

The latest efforts in Switzerland in this area have basically reacted to developments originating in the EU. In recognition of the increasingly important role RI plays for research in Switzerland, the national government has placed a focus, for the 2013–2016 period, on RI investments that have strategic priority.<sup>52</sup> This measure is underscored by the insight that growing costs for funding larger RIs pose new challenges for the national government and necessitate increased coordination within the Swiss HERI sector and with partners abroad.

49 ESFRI's *European Roadmap for Research Infrastructures* listed 35 RI projects in 2006. A revised roadmap published late in 2008 included 10 new projects, and the 2010 revision lists a further six RI projects, specifically for research in energy and biomedicine.

50 Special funding, amounting to 2.49 billion Euros for European research infrastructures is planned in “Horizon 2020” as part of its emphasis on “research excellence”. See <http://ec.europa.eu/programmes/horizon2020/en/area/research-infrastructure>.

51 See MERIL (2013), *The Research Infrastructure Information Base in Europe – Summary of the Roundtable Debate of 6 November 2013*, Brussels, pp. 5–6: “ESFRI was a unique and high-impact experiment in prioritizing investment in support structures for research in all scientific domains. Now other regions of the world, including the USA, are interested in following the example of Europe and linking up with European processes.” In October 2013, an international expert group was called into life to serve as an advisory group to the European Commission, as part of the “Horizon 2020 EU Framework Programme for Research and Innovation”, in further developing Europe's leading role in RIs. For the “Horizon Advisory Group on European Research Infrastructures including e-Infrastructures”, see <http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=2940>.

52 See the ERI Dispatch for 2013–2016, p. 3128. See also Bundeskanzlei (2012), *Legislaturplanung 2011–2015. Strategie des Bundesrates*, Bern, p. 66: “Infrastructures strongly shape the quality of research. Since both the demands and the costs are rising, it is necessary to coordinate the programmes and investments both within Switzerland and with international partners.”

Differing approaches in RI funding are strongly shaped by the respective research cultures and HERI framework conditions in individual countries. The ability to compare RI funding policies across borders is thus severely limited, and there is no generally accepted model which could be applied to Switzerland.<sup>53</sup> Nevertheless, in light of existing international dynamics, it is possible to identify the following medium to long-term challenges for the funding of research infrastructures in Switzerland. These can be identified with reference to the individual steps involved in setting them up: strategy and planning, the roadmap process, evaluation, prioritization, and funding decisions.

### 1.5.1 Strategy and planning

For both financial and research policy reasons, RI funding requires decisions which the research community can neither generate nor make on its own. The basis for these strategic decisions to fund is knowledge of the whole, of what is in Switzerland's interest and aids its welfare. It requires a view that includes both national and international RI funding policies. Where the creation of large and cost-intensive RIs exceeds the budget of an individual university, it calls for a strategically coherent and broadly supported agreement among the affected stakeholders. The need for resources for such RIs extends across a number of phases – planning, preparation, realization and operating the RI. The incubation time for a complex RI project can be 15 years, not including construction time. There is thus a need to share the high and rising costs for RI projects, to make funding decisions together, and to plan long-term.<sup>54</sup> In the special domain of RI funding, it is imperative that one engage in careful, broadly supported strategic planning that can take existing national and international research infrastructures into account.<sup>55</sup> Research infrastructures funded over a longer time period in effect set research foci and thus have long-term structural effects on the entire system. The realization of large-scale RIs leads to path dependencies, with intended and unintended consequences for the

development of interdisciplinarity as well as for the relations between research disciplines. An orientation in research funding policy towards the needs of cost-intensive research infrastructures can be to the detriment of smaller, less costly research projects. Research infrastructures of middling cost (between 1 and 5 million CHF) and in less infrastructure-intensive areas of research lead to difficulties in research policy, potentially reducing the scope of action of the involved actors or diversity in the research and innovation system. In such a context, what is needed is a bureau which has particular knowledge of the whole, and which, in accordance with all the relevant stakeholders, can proactively shape RI funding policy from a comprehensive perspective that takes the national and international into account.

The relatively poorly developed ability among Swiss RI actors – particularly the national government – to formulate a strategy, can lead to duplication or skewed developments, or, because agreement on objectives is lacking, to missed opportunities. In conversations with HERI actors, the SSIC found that the awareness of problems was not equally shared among all stakeholders, creating a further challenge to agreeing on a coherent, long-term RI funding policy. The need for Switzerland to catch up to the European state of discussion is evident.<sup>56</sup> To date, Switzerland has reacted to rather than anticipated developments abroad. Various questions of strategic significance also need to be clarified, such as whether libraries, as research infrastructures of national significance, should over the middle or longer term also be included in the Swiss roadmap. To shape RI funding policy from a higher-level and strategic perspective, the Swiss national government needs a broader overview and knowledge than is now evident.

#### CHALLENGE I:

**The RI funding domain poses special strategic challenges for the national research funding system in Switzerland; these challenges call for broad consensus and coherent research and financing planning, a process currently not being adequately addressed.**

53 See Papon, Pierre (2004), European Scientific Cooperation and Research Infrastructures: Past Tendencies and Future Prospects, in: *Minerva*, 42, pp. 61–76. OECD Global Science Forum (2008), *Report on Roadmapping of Large Research Infrastructures*, Paris. OECD Global Science Forum (2010), *Establishing Large International Research Infrastructures: Issues and Options*, Paris.

54 Papon, Pierre (2004), European Scientific Cooperation and Research Infrastructures, pp. 62 et seq.: "The need to share costs has been prominent in the history of European cooperation in building rocket launchers (Ariane), satellites, particle accelerators, telescopes, and other sophisticated devices."

55 Science and Technology Committee (2010), *Setting Priorities for Publicly Funded Research. Volume II: Evidence, 3<sup>rd</sup> Report of Session 2009–10*, London, p. 506: "Investment in large research infrastructure, both national and international, must occur in a coordinated and strategic manner to ensure long-term sustainability."

56 In recent RI strategy documents, countries like France have created new structures (a suprainstitutional "comité directeur" and a science advisory "haut conseil" body) to create a governance structure for large RIs that is strategically coherent. See MESR (2012), *Stratégie nationale. Infrastructures de recherche 2012–2020*, Paris, pp. 37–38.

### 1.5.2 The “roadmapping” process

Using different approaches and degrees of formalization, “roadmapping” has established itself both domestically and internationally as a planning instrument for the RI domain. It is used not only for specific disciplines or research areas but also for national and supranational research systems.<sup>57</sup> Planning, stocktaking, and the coordinated surveying of RI needs also take place in Switzerland using a roadmap process, one adapted from the model used for selecting and deciding about NCCRs.<sup>58</sup> In the SSIC’s view, there are three key challenges for the Swiss roadmap process:

#### a. Setting objectives and scheduling

Depending on the objectives and how they are strategically embedded, a RI roadmap can be a research funding priority list – though it often instead seems to be more of a wish list.<sup>59</sup> The roadmap process is participatory, so it depends on optimal framework conditions and procedures understood by all the involved parties. This includes clearly-communicated objectives and a workable schedule for all the stakeholders. In conversations with HERI actors, the SSIC discovered that not all affected parties understood the purpose or rationale of the roadmap exercise, and some found the notification and call for proposal deadlines too brief. The lack of a link between the roadmap and an obligation to actually fund a research infrastructure is also perceived as a problem. At issue, in the end, is to give those who will fund and operate RIs more security and assurance in their planning.<sup>60</sup>

#### CHALLENGE II:

**Unclear objectives and the brief period for submitting proposals in the roadmap process make optimal participation in the planning process more difficult for the relevant stakeholders.**

#### b. Consultation processes

The consultation and negotiation processes foreseen by and in the roadmap serve as preparation for the decisions, for assessing the financial commitment of the interested actors, and to coordinate strategic interests among the various stakeholders. It is important for the success of the roadmap process that these processes are transparent and comprehensible to all parties involved. In Switzerland, the roadmap process favours a bilateral and relatively informal approach.<sup>61</sup> A fairly small circle of stakeholders (ETH Board, CRUS/KFH/swissuniversities, SUC, FHR, SNSF, Academies, SSIC) are involved.

In conversations with the SSIC, a number of stakeholders uttered the wish that exchanges between SERI, which plays the leading role, and the other actors involved be more transparently designed. Among the possibilities discussed are an increased formalization of the process, the introduction of a multilateral approach, and an expansion in the circle of stakeholders. This is against the background of developments elsewhere in Europe, where in recent years the traditional connection between RI funding and basic research has increasingly given way to opening out to private industry research.<sup>62</sup>

#### CHALLENGE III:

**The roadmap process speaks to a too narrow circle of stakeholders, and in its preference for bilateral consultation, hampers appropriately taking all relevant interests into account.**

### 1.5.3 Evaluation

The quality control of newly planned RIs serves as preparation for the funding decision. The complexity of the evaluation process in the RI domain poses particular challenges. In addition to assessing the “research

57 For an example of the first type of sectoral roadmap, see CHAPS (2007), *Roadmap for Astronomy in Switzerland 2007–2016*, Bern. Where possible, national roadmaps rely on such discipline-specific planning and prioritizing documents.

58 The earliest examples of roadmaps, usually from individual disciplines, come from English-speaking countries. Since the publication of the ESFRI Roadmap, numerous other countries (Germany, UK, Sweden, Norway, the Netherlands, Israel, USA, China, Japan, Australia, and New Zealand) – at times in direct response to ESFRI – have developed their own roadmaps. In the meantime, a degree of standardization has set in, though there continues to be considerable variation in individual roadmap processes with respect to objectives, scope, and procedures. See OECD GSF (2008), *Large Research Infrastructures*.

59 The first version of the ESFRI Roadmap explicitly stated that it was “not a priority list. Its aim is to facilitate discussion and allow for coherent planning”. See ESFRI (2006), *European Roadmap for Research Infrastructures – Report 2006*, p. 15.

60 The German BMBF, for example, links the inclusion of RI projects in its roadmap with a basic intention to fund them.

61 See the description of the procedure in SERI and SNSF (2013), *Call for Applications for New Research Infrastructures of National Relevance*, pp. 9–17.

62 A declared goal of EU research policy in the “Horizon 2020” programme is for collaboration between basic and applied research, and between universities and industry. Costly RIs are in the future increasingly to be funded through public-private partnerships.

quality and relevance” of RI projects in a narrower sense, a series of other aspects with quite different evaluation dimensions also need to be judged: “research potential”, “urgency”, “utilization”, “technical feasibility”, “ripeness”, “financial feasibility” and the “significance for the nation as a research location”. Standard peer review processes that focus on project proposals are used here for tasks they were never designed for.<sup>63</sup>

Non-research aspects can be just as significant to an RI’s chance of being successfully realized as its “research quality” in a narrower sense. Germany’s Council of Science and Humanities has observed in this context that “adequate standards or sufficient models do not exist, whether for the access to RIs, personnel, management, or for future evaluations, that could provide orientation for the conception or assessment of a research infrastructure.”<sup>64</sup>

In other countries, the task of evaluation falls to RTI boards or the research funding organisations mandated to do so. They often draw on external experts who are competent to assess the non-research aspects and who can offer discriminating individual assessments.<sup>65</sup> In Switzerland, the SNSF has the task of quality control, which is assigned to the Research Council Section competent in that area. These evaluate the RI proposals according to the criteria listed (see 1.2.1, above), and in the three-year cycle of project funding set out in the implementing regulation.

#### CHALLENGE IV:

**The complexity of the quality control of RI projects calls for expert knowledge adequate to the subject as well as functional evaluation structure and intervals; these are not yet optimal in the SNSF.**

#### 1.5.4 Prioritization

As a rule, RI funding needs exceed the financial abilities of the national government. The long “wish list” the roadmap represents thus requires weighing which RI projects should receive priority funding, a prioritization that is undertaken based on project evaluation. It is the SNSF’s responsibility, under current roadmap rules, to sort RI projects into three groups (A: of considerable importance; B: of importance with development potential; C: of limited importance), and then to prioritize them in terms of scientific or research relevance as well as urgency.

This prioritizing calls for an overall and comparative assessment of the various RI projects with respect to a particular disciplinary or interdisciplinary area, and presupposes knowledge of the domestic and international research and RI landscape. The weighting of projects which are of equivalent quality is not possible in terms of criteria inherent to academic research, including those which might be objectified, because strategic considerations flow into comparative judgments of relevance. Whether one project is preferred over another depends on which logic drives the prioritization. It thus matters for the system whether the priority is on creating new RIs in research areas which are not yet established, or instead on strengthening the infrastructure of existing research foci.

In many countries, the prioritization phase takes place in conjunction with intensive consultation with stakeholders that serves to reconcile diverging interests. This task is often assigned to organs which fund or consult on research policy. At the EU level, for example, this is ESFRI.<sup>66</sup> In Germany, it is the Council of Science and Humanities, a body which brings together the national government and the states, and

63 Nedeva, Maria et al. (2013), *Study of Research Funding Trends and Practices of Research Funding Organisations. Report to the Swiss Science and Technology Council*, Manchester (internal unpublished SSIC study), p. 8: “Globally, academic peer review systems are under strain due both to increasing volumes of grant applications and being tasked with evaluating non-scientific criteria (e.g. impact) outside of the scope of their original operating assumptions and know-how.”

64 Wissenschaftsrat (2013), *Bericht zur wissenschaftsgeleiteten Bewertung umfangreicher Forschungsinfrastrukturvorhaben für die Nationale Roadmap (Pilotphase)*, p. 9. The German Science and Humanities Council has developed a science-led evaluation process which is to serve as the basis for research and science policy decisions in the RI domain.

65 In Germany, for example, economic costs are not assessed by the Council of Science and Humanities but by the private VDI/VDE Innovation und Technologie GmbH firm. The EU Commission employs a separate expert group to assess the funding, governance and feasibility of RI projects. See Calvia-Goetz, Antonella (2013), *Assessing the Projects on the ESFRI Roadmap. A high level expert group report*, Luxembourg. In the results, assessments may come to differing conclusions about how “ready to implement” an RI is, because they take different aspects into account.

66 In April 2014, ESFRI presented a new report which prioritized three projects in the roadmap: the European Plate Observing System (EPOS), the European Life-Science Infrastructure for Biological Information (ELIXIR), and the European Spallation Source (ESS). The prioritization process has proven to be especially difficult. See ESFRI (2014), *Prioritisation of Support to ESFRI Projects for Implementation*, Brussels.

which undertakes a comparative evaluation of RI projects and then provides the corresponding recommendations. In Sweden, prioritization competence lies with the Council for Research Infrastructures, a mixed consultative and strategy body composed of representatives from the disciplines and from research funding organisations.<sup>67</sup> In the Netherlands, this task falls to an advisory committee appointed by the Netherlands Organisation for Scientific Research, the Dutch equivalent to the SNSF.<sup>68</sup> The SNSF's Research Council clearly differs from these European organisations in both function and structure, but as a genuinely scientific evaluation body, it also is not the right institution to strategically weight research infrastructures.

#### **CHALLENGE V:**

**In the current system, the SNSF is not the right institution for carrying out the strategic task of prioritizing research infrastructures.**

### **1.5.5 Funding decisions**

In the end, funding decisions about RI projects included and prioritized in the roadmap are for parliament to decide. SERI's draft proposals are strongly influenced by research policy considerations of a strategic and fiscal nature,<sup>69</sup> since RIs as a rule are cost drivers, with resource needs stretching over a number of phases (planning, preparation, realization, operation), and decisions taken can lead to major, permanent changes. As a result, a series of different types of costs – initial investment, operational costs, costs for personnel – thus need to be taken in account in planning the financing.<sup>70</sup>

Through the multiplication of potential funding channels at the European level, and due to the heterogeneity of disciplinary utilization practices, the complexity of the financial planning process has increased in the RI domain. Mixed forms of financing increasingly require a coordinated approach, intensive consultation, and clear agreements among the funders. In ESFRI projects, for example, this leads to varying funder geometries among the member states that participate financially in a given RI. The coordination between national RI strategies and long-term investment plans is plagued by special difficulties.

The sustainability of financing RIs also poses special problems for established systems of funding, particularly because the decision rhythms in politics follow a different, often short-term, logic. In many countries, RIs are supported through a ministry responsible for research, as in Switzerland, or in the budget of research funding organisations. In the UK, a Large Facilities Capital Fund was created for just this purpose. In Holland, the National Roadmap Committee also recommended such a solution, while in Sweden, funding competence lies with an RI Council. In Switzerland, domestic and international RIs are supported through various credit lines, but there is no separate or designated budget to fund RIs.

#### **CHALLENGE VI:**

**A long-term solution is lacking that could (sustainably) fund and manage the high, and often rising, operational and maintenance costs for existing RIs – and that could also guarantee the greatest possible flexibility in responding to new RI needs.**

67 See the information on the website of the Swedish Council for Research Infrastructures at <http://www.vr.se/inenglish/researchinfrastructure/councilforresearchinfrastructure.106.2b56827a13380c5abfd80001867.html>. There are considerations currently being made to more fully involve university administrations in this process.

68 See <http://www.nwo.nl/en/news-and-events/news/2014/six-large-research-facilities-receive-81-million-euros.html>.

69 See the political decision criteria developed by the SSTC: SWTR (2010), *Gesamtbeurteilung ex ante der Roadmap für Forschungsinfrastrukturen. Definitiver Zwischenbericht vom 31. August 2010*, Bern, pp. 7–10.

70 In its financial planning, the Swedish Council for Research Infrastructures also includes the costs for shutting down RIs.

## 1.6 Funding RIs: The Contours of a Future Swiss RI Funding Policy

In the following conclusions resulting from its analysis, the challenges identified, the position the SNSF takes, and the recommendations of the international experts' panel, the SSIC outlines the contours of a future Swiss funding policy for RIs.

### 1.6.1 The SNSF's position

In its self-evaluation, the SNSF basically rejects supporting larger RI projects whose financing ties up resources for more than 10 years.<sup>71</sup> In its view, the principle of competitively awarding funding is not compatible with this kind of long-term financing, particularly not if there are to be commercial uses. In general, the SNSF only wants to support those infrastructures that help in immediately carrying out research projects. RIs whose function is purely to coordinate (e.g., MRI, ISSI) should be funded by other organs. Currently in preparation, additionally, is an adjustment to the portfolio and a more coherent funding of humanities editing projects.<sup>72</sup>

It should also continue to be possible, in the context of the ESFRI Roadmap, for SERI to delegate the start-up, follow-through, and co-funding of RI to the SNSF.<sup>73</sup> Such subsidiary support should not last for more than 10 years. The SNSF claims a strategic decision-making autonomy for itself with respect to priority research areas in which it wishes to invest in the future, and regards this as a precondition for being involved in the RI domain. In the context of the SNSF's multi-year planning, such strategic decisions should be broadly discussed, using a "needs assessment" process, with all the relevant stakeholders and consensus reached as early as possible. The principle of a competitive proposal process would be guaranteed by launching the appropriate calls for proposals. The SNSF also ar-

gues for listing the services it provides in this context by name in its performance agreement with SERI.

For newer RIs which have shorter-term funding needs, the SNSF is willing to provide start-up funding for a period of no more than three years.<sup>74</sup> When this period ends, funding for these RIs should be completely provided by other parties.

The SNSF sees its primary role as the scientific evaluator of RI projects, following the criteria listed in the roadmap, and with evaluations carried out as a rule every five years. At the behest of SERI, the SNSF will continue to prioritize RI projects, and to this end will carry out foresight activities.

The R'Equip programme should be continued, though with a less restrictive interpretation of the financial participation rules.

### 1.6.2 The international expert panel's position

In the view of the external experts, RI funding has far-reaching strategic and research policy implications. As a result, it differs from normal project funding. They thus recommend grounding RI funding in Switzerland in a coherent national strategy that is generated in a bottom-up manner which comes via the strategic RI plans provided by individual research universities. Financing should come through mechanisms that permit sustainable RI funding, including the creation of funding consortia, separate budget lines, dividing or sharing responsibilities, and using transparent processes. Here, funding decisions would be made by the responsible political authorities, but the preparations for the decisions would lie in the hands of the research or research policy organs.

To this end, the international experts' panel recommends creating an independent structure for RI within the SNSF, a "Research Infrastructure Office". This RI Office would be the steering entity and attend to planning, evaluation, coordination, setting priorities, and governance for domestic RIs. The regular re-

71 On this, see SNSF (2013), *Evaluation of the Swiss National Science Foundation*, pp. 37–38.

72 On 31 Jan. 2014, the SNSF announced a call for such long-term projects that would be funded, after 2017, in the context of the next ERI Dispatch. The goal of the call is to analyze needs and take stock of editorial projects in the humanities. The SNSF would like to use this as a basis for making preliminary funding decisions for post-2017 funding. Submission of proposals was possible between April 1 and June 1, 2014. See <http://www.snf.ch/de/fokusForschung/newsroom/Seiten/news-140131-vorankuendigung-ausschreibung-editionsprojekte.aspx>.

73 SNSF (2013), *Evaluation of the Swiss National Science Foundation*, p. 58.

74 Ibid., p. 59.



view of the performance goals agreed upon with the respective RI would take place in intervals of from eight to ten years. Responsibility for the roadmap process and for implementing the national RI strategy would also lie with the SNSF, though relying on the RI strategies of the individual research universities to prioritize the RI projects. Clear yet flexible rules would be needed for funding RIs, ones that, on a case-by-case basis, would assign various funders responsibilities for particular costs and development phases. With respect to the R'Equip programme, the experts recommend conducting an evaluation of the suitability of this SNSF funding instrument.

### 1.6.3 The SSIC's conclusions

The SSIC agrees with the external experts that the funding of RI follows a particular logic which differs considerably from that of normal research project funding, not only due to the long-term nature of the RI planning and financing horizon but also the particular demands in evaluating them. The overlap between decisions and assessment that are made for purely research and scientific reasons on the one hand, and for strategic, policy, and political reasons on the other, turn RIs into funding objects whose hybrid nature challenges researchers and politicians equally.<sup>75</sup> A national RI funding policy should reflect this logic by setting out clear rules and responsibilities, as well as use transparent processes and a corresponding assignment of competencies in the right places. The SSIC therefore argues for unbundling processes and tasks, and more clearly assigning responsibilities to the individual actors who will fund RIs. The model suggested here consistently separates specialist types of activity from research policy activities.

#### a. The role of the national government

The national government has particular responsibility in the RI domain through its dual roles as coor-

dinator and funder. It is the most important actor in the RI domain, owing to its funding and credit lines, and because it has constitutionally legitimated competence over non-commercial research funding. With the advent of HEdA, in the SSIC's view, this responsibility for the entire HERI sector has been augmented. It would therefore make sense for the national government to be in charge of strategic coordination of the special domain of RI funding, and for it to develop a coherent, long-term RI funding strategy in collaboration with the cantons and the relevant stakeholders. In the view of the SSIC, the future Swiss University Conference (SHK), as the highest organ of the national government and the cantons governing universities, is the right institution for integrating cost-intensive domains into a system-spanning RI funding policy.

However, with enactment of both RIPA and HEdA, decisions over RI and over cost-intensive investment that should be linked for substantive reasons are actually separated, owing to the different legal bases for these two acts. The national government should ensure here that these two funding legitimations are strategically coordinated. Additionally, by taking both domestic and international RI perspectives into account, perspectives which go beyond the horizons of individual cantons, the national government can bring the necessary coherence to RI funding.<sup>76</sup> To this end, SERI should orient itself better to the strategic tasks that RI funding entails.

The SSIC also advocates optimizing the Swiss roadmap process and the coordination of RI strategies among the individual research universities and the cantons by making the consultation processes more transparent. To this end, the roadmap process needs to be announced enough in advance, given more generous submission deadlines, and have a clearer statement of objectives. Widening the circle of stakeholders and introducing a multilateral approach to consultation conversations would help build the confidence of participants in the process.

<sup>75</sup> In the context of the "big data" discussion and the growing needs of researchers for high-powered data processing systems, there is an increased call for "a social contract between funding agencies and the scientific community to accommodate 'bottom-up' integration and 'top-down' financing of databases and biorepositories on an international scale." See Schofield, Paul N.; Eppig, Janan et al. (2010), Sustaining the Data and Bioresource Commons, in: *Science*, 330/6004, pp. 592–593.

<sup>76</sup> See SWTR (2009), *Empfehlungen des SWTR zur nationalen Koordination in den besonders kostenintensiven Bereichen*, SWTR Schrift 2/2009, Bern.

One should consider whether industry research and its infrastructural needs should not receive more of a hearing in the roadmap process. Current trends suggest ever-closer collaboration between the universities and industry, especially in the use of research infrastructures.<sup>77</sup>

The four-year political cycle is not suited to sustainable RI funding decisions. The SSIC would welcome financing solutions instead that corresponded to long-term RI planning horizons and that would break through the three (SNSF) and four (ERI) year funding cycles. The creation of a separate infrastructure budget funded from different sources and under the aegis of the national government would make the guaranteeing of substantial and consistent funding over a longer time period possible. If one pursued the idea of varying funders, RI projects supported through consortia of different research universities could then also be supported by varying financing solutions. Under the condition that RIs were open to all qualified interests, the national government could continue to support strategically significant RIs in the ETH domain if the cantons and the universities were unable to.

#### **b. The role of the cantons**

In the Council's view, it would be sensible to have the cantons, which following HEdA are to be responsible for coordination in cost-intensive domains along with the national government, be more involved in questions of RI funding in the future. As funders, they are responsible for the basic financing of the universities, and thereby already participate, indirectly, in RI costs. By funding RI, they have a supportive and steering function in research policy. In light of the effects which long-term RI funding will have on public budgets, it would be an advantage to have early coordination of RI funding strategies at the cantonal level.

<sup>77</sup> In the ETH domain, for example, thanks to public-private partnerships, RIs such as the modular research and demonstration platform NEST (for new construction technologies) and the Swiss Coating Center are being established. See ETH-Rat (2013), *Budgetbericht 2014 des ETH-Rats für den ETH-Bereich*, Zurich, p. 16. In this context, the statement of Philipp Dietrich, responsible for marketing the SLS to industry, is interesting: "11% of SLS measurement time – considerably more than initially planned – is absorbed by industrial enterprises, twice as much as at other synchrotrons." See PSI (2011), *Zehn Jahre Forschung in der fliegenden Untertasse. Medienmitteilung des PSI vom 14.09.2011*, <http://www.psi.ch/media/zehn-jahre-forschung-in-der-fliegenden-untertasse>.

Cantonal interests are particularly involved when the question where RIs should be located arises. Given the size of the investments and the utilization of RI by various parties, the best location should be selected based on objective criteria, even if the benefit for an individual canton may then be only indirect.

#### **c. The role of the universities**

The current Swiss system for funding research, as it follows a bottom-up principle, gives the research universities considerable strategic autonomy. The SSIC has the impression that universities and research institutions still use the scope they have to formulate a common RI strategy too little. It therefore recommends to these institutions that they be more proactively involved in the roadmap process, for example by participating through discipline-specific or institution-oriented roadmaps.

#### **d. The role of the SNSF**

In the view of the SSIC, the SNSF should continue to concentrate on its task of evaluating RI projects in an academic or scientific manner. To do so adequately, some adjustments to its internal structure are recommended. In this vein, the decision preparations which are limited to science-led assessment dimension of evaluation should be located internally, for example, in an expanded Section for Strategic Programmes and Infrastructures or in a new and independent Section for Research Infrastructure. Such a competency-specific evaluation body would maintain close connections to the individual specialist Sections in the SNSF to ensure a complementarity between project and infrastructure support. The SNSF should also strengthen its scientific evaluation competence in the RI domain by establishing a system of experts who could meet the expanded demands. The intervals between RI evaluations should be extended to go beyond the current three-year rhythm.

In the future, the SNSF should no longer undertake a strategic prioritizing of RI projects which are of equal research quality. This task should be transferred to SERI, which, as part of a multilateral consultation process, would integrate the SNSF as one voice in a concert of other relevant stakeholders.

In the context of the R'Equip funding instrument, individual specialist committees of the SNSF's Research



Council should continue to decide about proposals, particularly in cases where research apparatus that is of limited cost is needed for immediately carrying out research projects. This research-driven funding mode has basically proven itself, and it should, whenever possible, have no structural effects or effects on the foci in the research landscape. However, one should examine whether the rules, in the R'Equip programme, for financial participation could not be structured more flexibly.

In the view of the Council, the non-competitive funding of RI at the behest of SERI should no longer be carried out through the SNSF. It leads to a mixing together of competitive and strategic evaluation and funding practices that are not clearly separated either conceptually or organisationally. Additionally, there are dynamics within large-scale international research infrastructures and programmes that put the SNSF under increasing pressure to reproduce certain developments in favour of researchers in Switzerland without being able to link this to funds approved through a competitive quality control process.

In sum, the SSIC is concerned by the consequences the SNSF's suggested funding policy will have on it. This funding practice will place the SNSF in functional contradiction to its core mission as a reactive funder of research. There may be longer-term losses of legitimacy, because the research community may come to question the SNSF as a superordinate reference entity for research excellence. By tying up funding resources over a longer term, it will also lose more and more freedom to act. By funding infrastructures, the SNSF will commit itself to longer-term financial obligations which go beyond the scope of its regular support for and funding of projects.

## 2 Funding Disciplinary Areas

### 2.1 Preamble

In the second set of questions in the SERI mandate, the SSIC has divided its considerations into five sections. In section 2.2, it lays out the normative tenets which underlie its argument, while section 2.3 compares proactive and reactive research funding approaches, examines their implicit premises, and discusses the chance and risks involved in implementing them both domestically and internationally. Section 2.4 depicts the SNSF's current funding activity with respect to the degree of self-determination which the individual funding arrangements grant the researchers. The future funding policy of the SNSF, from the SSIC's perspective, is the subject of section 2.5. Section 2.6 gives a justification for the SSIC's recommendation that a new funding arrangement for high risk/high reward research should be examined.

### 2.2 Tenets

In its analysis and weighing of the advantages and disadvantages of proactive versus reactive research funding, the SSIC starts from the following tenets:

**Basic research creates new knowledge and insights with multifarious and long-term uses. Research disciplines, regardless of their direct or immediate benefit to society, are of equal value.**

*There is a widespread assumption that research is only useful if it is orientated from the start to potential applications. By contrast, the SSIC believes that research activity generates a wide range of material and immaterial values and assets over the longer term, even if or when they are not immediately measurable.<sup>78</sup> This is particularly true when research can address basic questions without prejudice and without prior intent. No criteria exist within academic research which would allow one to rank different research disciplines by their "utility".*

**Autonomy guides the process of generating new academic knowledge. Such knowledge is generated in a non-linear fashion, in a process largely based on the intrinsic motivations and interests of researchers. Researchers will evade and withdraw from outside steering efforts, including those aimed at standardization.**

*Research and politics function according to fundamentally different logics.<sup>79</sup> In the SSIC's view, the guarantee of academic research freedom, a principle anchored in the Swiss constitution, ideally reflects the autonomous basis for generating knowledge. Where and when research innovations will emerge cannot be*

<sup>78</sup> See SWIR (2013), "Economization" of Science. Recommendations and Proceedings of the Seminar held in Bern by the Swiss Science and Technology Council on April 23, 2013, Bern. See also Folkers, Gerd (2013), Die Freiheit in der Forschung, in: Die Pharmazie. An International Journal of Pharmaceutical Sciences, 68(7), pp. 506–520, here p. 509: "The increasing tendency towards utilitarianism, to answer the eternal question 'but what is it good for?' massively curtails positive freedom."

<sup>79</sup> See Braun, Dietmar (1997), Die politische Steuerung der Wissenschaft. Ein Beitrag zum "kooperativen Staat", Frankfurt on Main / New York, p. 386: "At heart, the conflict between science and politics is between the advocates of science who try to limit selectivity criteria to the quality of the research, and political actors primarily trying to disburse resources from problem-solving points of view."

*formalized or planned in advance. Funding which adequately reflects researchers' autonomy hence needs to trust in the ability of academic research to self-regulate.*

**Diversity, a research environment that remains stable over a longer term, and flexible conditions are the basis for the continued success of the Swiss system of research. Non-commercial research depends on predictable and more permanent support from the public authorities.<sup>80</sup> However, individual academic disciplines have different needs when carrying out and funding their particular kind of research.**

*The combination of diversity, continuity and flexibility are the conditions for maintaining an innovative, reactive research environment in Switzerland. For academic research to thrive and develop, it is of decisive significance to find a balance between long-term, guaranteed, basic financing provided to institutions and shorter-term external funding provided for projects. The need for external funding varies by discipline or research area, and the quality of research results, or the ability of a discipline to produce, cannot be measured solely by how successfully it obtains external funding. The growing significance accorded to external funding carries the risk that certain fields will be favoured while others are penalized.*

## 2.3 Proactive versus Reactive Funding Policies

### 2.3.1 Premises

Strategic research foci can be defined in terms of disciplines or research areas (systems biology), research policy missions ("grand challenges"), functions (resources, infrastructures, human capital), or institutions (universities of applied sciences). They are expressed in the preferential allocation of public funding to particular research areas or disciplines.

The strategic funding of disciplinary areas follows particular premises, and is typical of a mission-orientated science policy. Such a policy often has the goal of setting research funding priorities in a manner closely linked to specific expectations of what the benefits of the research will be.

The focus of funding basically follows a binary logic. Either it provides additional support to what is already there, focusing resources on what appear to be particularly promising research topics or areas, or it can provide relief to the weak, and favour those research areas which are especially in need of support. In the first case, research diversity is reduced, in the second, increased.

Decisions about what to focus on and support are by their very nature strategic, and therefore lie in the political community's area of responsibility.<sup>81</sup> They demand a higher degree of coordination and harmonization with strategic decisions made by other stakeholders. Consensual decision-making has mainstreaming effects which run the risk of overlooking what is genuinely new in research. Setting (through prioritization) what is to come always means looking back at what has been – which one can dub "posteriorization".

<sup>80</sup> See Venkatraman Ramakrishnan (Nobel Prize in Chemistry, 2009): "I moved to the UK from the USA 15 years ago because of the first-rate intellectual environment and stable support in Cambridge for research that over the past 50 years has resulted in revolutionising our understanding of molecular biology." See [http://articles.economictimes.indiatimes.com/2013-12-13/news/45162452\\_1\\_uk-centre-nobel-laureates-sir-james-bevan](http://articles.economictimes.indiatimes.com/2013-12-13/news/45162452_1_uk-centre-nobel-laureates-sir-james-bevan). Speaking in a similar vein, Konstantin Novoselov (Nobel Prize in Physics, with Andre Geim, 2010), has emphasized how important the "playground" of Friday afternoon experiments were for research innovations. See <http://archive.sciencemag.com/ana/st/graphene/09febSTGraNovo/>.

<sup>81</sup> See Pagels-Fick, Göran (2010), *Setting Priorities in Public Research Financing – Context and Synthesis of Reports from China, the EU, Japan and the US*, Stockholm, p. 13: "Setting priorities of type A [Grand challenges] or B [National strategic issues or transdisciplinary themes] is mainly the responsibility of the political community."

In research funding that follows the “responsive mode”, inspiration comes from the researchers themselves. The funding agencies react to the bottom-up requests and proposals made by researchers, and directly fund topic-based research. Ideally, the competitive, quality-orientated selection process ensures that only the best projects receive support. This reactive funding practice operates on the premise that this approach is best suited to reflect the freedom researchers have to select their own topics for research, thereby supporting the developmental dynamics of knowledge-led basic research.

### 2.3.2 International developments and experience

Supranational and national policy priorities have exerted an ever-growing influence on research foci in the few last decades.<sup>82</sup> As part of the “grand challenges”, research funding has been oriented more and more to social and economic issues for which solutions from the sciences or technology are sought. The mission-oriented research programmes launched by the EU set topics and emphases that researchers are to orient themselves by when they apply for funding. These foci come in keywords identifying what are regarded as major future trends, and in most countries, the terms are quite similar: ICT, biotechnology, medical techniques and technology, the life sciences more generally, new materials and substances, and most recently, nanotechnology. All can be found in nearly

every important strategy documents in the OECD member states. Research policy efforts in the individual countries lead to prioritizing particular technology-heavy topics, thus to similar catalogues of what is being emphasized. It does not lead to national technological specializations distinct from one another or that pursue differing goals.<sup>83</sup>

The mainstreaming effects on research and innovation policy are due to deficiencies in how topics are selected and prioritized. Targeting research funding is time-consuming and readily subject to the influence of interest groups. Researchers also fear that the value they place on excellence in research will be lost the more specific topics become emphasized and funded.<sup>84</sup>

But there is a degree of scepticism today, particularly in Western Europe, towards a thematic orientation by government in science and technology.<sup>85</sup> The experience of the last decades indicates that a high degree of aggregation in setting themes hinders actually putting the funding policy into practice; the results of proactive funding policies remain relatively modest.<sup>86</sup> Setting a strategic focus, in short, largely serves to send general signals. Prioritizing certain research areas or topics often led researchers to engage in purely formal exercises at accommodation.

In many countries, the public authorities have realized they have limited means to influence the system of research. In terms of selecting specific topics to research in technology, the bottom-up principle has therefore come to be preferred.<sup>87</sup> The hope is that a reactive mode will create the ideal framework for inde-

82 Internationally, one has long seen a trend to prioritization in research policy, primarily manifested in use expectations. N.N. (2003), Research funding: the problem with priorities, in: *Nature materials*, 2/10, p. 639: “There is a general trend in Europe and the US for basic research to be directed towards the same areas: nanotechnology, materials for energy and photonics to name a few. Many of these areas are undoubtedly going to be important for the future development of science and technology in the UK. But what many researchers are concerned about is that funding for these managed programs is eating into the funding available for bottom-up blue-sky research.”

83 For these and the following considerations, see Polt, Wolfgang et al. (2014), *Breites Innovationsverständnis und seine Bedeutung für die Innovationspolitik. Begründung, Messung, Umsetzung*, Arbeitsdokument Geschäftsstelle SWIR 1/2014, Bern, p. 44: “South Korea can be considered as an ideal-typical example of a top-down approach to technological development. In the recent past, and based on a comprehensive Delphi method foresight process, ten ‘growth industries’ were identified (digital TV, intelligent robots, a new generation of semiconductors, etc.) along with 80 corresponding key technologies. Such a hierarchical and centralist planning orientation can no longer be found in this form in European countries.”

84 See Science and Technology Committee (2010), *Setting priorities for publicly funded research, Volume I: Report, 3<sup>rd</sup> Report of Session 2009–10*, London, p. 19: “...targeted research funding might, in some circumstances, result in a conflict with the principle of excellence: whereas funding for responsive-mode research is ‘highly competitive’ and ‘can raise standards’ [...], a targeted approach risked funding ‘poorer quality’ or even ‘mediocre’ research.”

85 On this, among others, Nedeva, Maria et al. (2013), *Study of Research Funding Trends and Practices of Research Funding Organisations*, pp. 102–103: “Top-down setting of priorities by government and funding agencies for thematic science and technology fields, for socio-economic or technological goal-related mission-oriented activity, and for functional priorities to address science system characteristics is becoming rarer globally.”

86 See Georgiou, Luke; Cassingena Harper, Jennifer (2011), From priority-setting to articulation of demand: Foresight for innovation policy and strategy, in: *Futures*, 43, pp. 243–251, here p. 245: “...the priorities that emerged had a rather limited effect and the [foresight] programme moved sharply towards its second, networking, objective, which saw priorities (in the sense of funded areas) emerge as bottom up projects at a much more focused level.”

87 For example in the UK. See Council for Science and Technology (2010), *A Vision for UK Research*, London, pp. 25, 28. An analogous development can be seen in Israel. See OECD (2012), *Science, Technology and Industry Outlook*, Paris, p. 178.

pendently-minded researchers who wish to pursue the new, free of requirements as to content. The goal is finding a balance between supporting self-selected and supporting goal-oriented research. However, as a result of the enormous expansion in competitively-awarded research funding, a demand-oriented research policy is increasingly reaching the limits of its capacities, because the time and effort re-

searchers need for assessment and evaluation keeps growing. The increasing numbers of proposal submissions also carry the risk of a gradually dwindling funding efficiency and effectiveness. One can summarize the international experience with the two research policy approaches as follows, in terms of chances and risks, or advantages and disadvantages:

	Advantages/Chances	Disadvantages/Risks
<b>Proactive funding policy</b>	<ul style="list-style-type: none"> <li>• additional funding for strong research branches</li> <li>• targeted funding for weaker research areas</li> <li>• strong influence on the strategic orientation of research institutions</li> <li>• research contributions to the resolution of current social and economic issues</li> </ul>	<ul style="list-style-type: none"> <li>• reduction in research quality and power to innovate</li> <li>• mainstreaming effects in selecting topics</li> <li>• research policy implementation difficulties</li> <li>• relatively greater administrative effort</li> <li>• deadweight loss effects by researchers adjusting their performance</li> <li>• loss in breadth and variety of research</li> <li>• interest group influence</li> </ul>
<b>Reactive funding policy</b>	<ul style="list-style-type: none"> <li>• research develops in accordance with existing competencies and capacity</li> <li>• support accords with the specific autonomy of research</li> <li>• release of innovative power and creativity in basic research</li> <li>• strengthening of research diversity</li> <li>• case-by-case quality evaluation</li> <li>• efficiency and relatively less administrative effort</li> <li>• ensures the flexibility and ability of the research system to react to content</li> <li>• minimizes the risk of poor investments</li> </ul>	<ul style="list-style-type: none"> <li>• low ability to steer</li> <li>• impossible to strengthen strategic areas</li> <li>• may reach limits of capacity</li> <li>• reduction in efficiency and effectiveness of support</li> <li>• mainstreaming effects generated by the peer review process</li> </ul>

Table 3 **Proactive versus Reactive Funding Policies: Overview of advantages and disadvantages**

### 2.3.3 The current national context

Research funding and support, which has been guided by the Swiss national government since 1973, is influenced by a liberal culture of science and research, one based on competition, and which links research freedom with research responsibility.<sup>88</sup>

The selection of topics to research, or the focus chosen is a matter for the researchers and the research universities. Topics largely emerge in a bottom-up manner from the researchers themselves, as well as from university administrations, who function autonomously in the choices they make about the strategic orientation of the institution's research. No central agency or organ exists in the Swiss HERI sector that is responsible for politically steering academic research. There is a general acknowledgment of the science-push model, and a strong degree of trust in the initiative and self-regulating abilities of researchers and disciplines.<sup>89</sup>

Correspondingly, the national government restrains itself from launching funding initiatives with research policy implications – that is, unless politicians decide, as was recently the case in energy policy, that research is to be drawn upon to help resolve a social or economic challenge.

Still, through its influence over the ETH domain (Art. 7, RIPA), over research institutions (following Art. 15, RIPA), the national research programmes (Art. 10, RIPA), research programmes of the national government in the context of research conducted by, for and in government agencies (Art. 16, RIPA), as well as through federally-run research institutes (such as Agroscope), the national government certainly has means available for shaping the content of publically funded research. It can also contract with research funding institutions and the CTI (Art. 7, RIPA) to carry out topic-oriented funding programmes, and in doing so, can set research policy priorities.

<sup>88</sup> Art. 20 of the national constitution guarantees basic academic and research freedom in the sense of a protection against limitations placed on the content of research activity.

<sup>89</sup> "Switzerland has not developed a culture of top-down funding, where scientific and technological elites or stakeholders define research frameworks." See Benninghoff, Martin; Braun, Dietmar (2010), *Research Funding, Authority Relations, and Scientific Production in Switzerland*, p. 103.

## 2.4 The SNSF's Funding of Disciplinary Areas

The funding activity of the SNSF, in terms of the degree of self-determination which it permits researchers, can be roughly divided into three categories:

### 2.4.1 Funding self-selected research projects and career advancement

The SNSF's support provided to research projects and for career advancement follows the demand-driven "responsive mode" and the bottom-up principle. Research funding is determined by the needs of researchers across all disciplines, and awards come with no conditions as to content or structure of the proposals. This freedom as to topic helps ensure openness in research. The only condition set is a three-year project maximum, though renewal for another three years is possible. The conditions for providing support are having the qualifications to engage in academic research, the quality of the proposal, and an institutional connection in Switzerland, or in the case of independent researchers, being resident in Switzerland. This reactive mode allows the SNSF to support autonomous research, as it is the responsibility of the individual researchers to decide about their research plans. Project selection and funding decisions lie wholly within the SNSF's area of competence, and are guided by evaluations of the academic or scientific quality of the proposals.

The SNSF invests about 80% of the funds it has available into self-selected research projects and career advancement.<sup>90</sup>

### 2.4.2 Funding which has structural objectives

The Sinergia and NCCR programmes link funding approval to specific conditions and formats. In the case of the Sinergia programme, the structural objective is

<sup>90</sup> If one adds the approved funding for projects and career advancement in 2013, along with the Sinergia programme, then this together equals a 79.2% share of the entire funding amount of 818.8 million CHF. See SNF (2014), *Portrait. Zahlen und Fakten*, Bern, p. 13.

to create a network of three or four (at most) research groups which are engaged in the research. Each institution in which a Sinergia research group is located must also express its explicit support of the endeavour in writing.

In the case of the NCCRs, the focus and structural objective serves to support research in areas deemed of strategic significance for Switzerland.<sup>91</sup> NCCRs are carried out on behalf of the national government, whose aim is to use this instrument to both optimize Swiss research structures and to sustainably renew them. NCCRs are meant to improve coordination and the division of labour between research institutions as well as strengthen their international linkages. The SNSF provides an academic or scientific assessment, but they are also assessed by SERI with respect to research and higher education policy objectives. The final decision about the creation of an NCCR lies with the EAER.

Topics in these funding vessels are not set in a top-down manner but are instead generated bottom-up by researchers.

### **2.4.3 Earmarked funding with structural and content objectives**

All SNSF instruments which have proactively-determined research topics (National Research Programmes, special programme in medicine and biology), or are research objects or aids (infrastructures, science or research communication) or programmes (such as DORE<sup>92</sup>) which were or are supported belong in this category of funding. Such funding takes place at the special behest of the national government, which uses its resources to pursue specific goals (for example, to strengthen scientific cooperation with certain non-European countries). Peer review processes are also used here, though in addition to academic excellence, other non-academic criteria are used in evaluating proposals.

<sup>91</sup> The SSIC has conducted an effectiveness study of the first NCCRs, with publication of the report scheduled for November 2014.

<sup>92</sup> From 1999 to 2011, DORE (Do Research) was an SNSF programme to fund practice-oriented research at the universities of applied sciences and at the teacher training universities.

## **2.5 Future SNSF Funding Policy**

The SSIC here summarizes the SNSF's future funding policy, taking the position of the SNSF as well as that of the international panel of experts into account.

### **2.5.1 The SNSF's position**

The SNSF intends to pursue its current funding policy into the future. The lion's share of its resources will continue to be distributed in the "responsive mode", and the funding of self-selected and excellence-oriented projects should remain the key means of providing support. SNSF funding will also continue to orient itself to the principle of research freedom, in the sense of remaining open as to the topics suggested in submitted proposals. This is meant to ensure an equality of opportunity, independent of institution, to those who propose projects.

Proactive funding should only take place where special needs are identified in the research system, or when research universities themselves are unable to develop coordinated and cooperative activities. In general, the SNSF wants to continue to exercise great restraint in the strategic funding of certain topics or research areas. The competency to set content priorities lies with the research universities. Should the SNSF support strategic long-term projects at the behest of the political authorities, then the resources needed should be integrated into the multi-year planning laid out in an ERI Dispatch.

The SNSF is of the view that very large research initiatives (such as the Swiss Initiative in Systems Biology) should not be integrated into its funding portfolio. Being involved early in the development and evaluation of such very large projects, on the other hand, would be desirable, in the SNSF's view.

It is an open question whether a new funding instrument should be introduced for midsized research consortia.

The SNSF intends to more intensively use foresight exercises and topic modelling to help identify special funding needs or to anticipate new research trends, and regards foresight exercises as an aid in focusing funding. It assumes these instruments will help identify



new research fields or approaches that are particularly worthy of support. Foresight work, in the sense of actively monitoring domestic and international research activity, is to be expanded upon in the next funding round.

### 2.5.2 The international expert panel's position

The external expert panel is of the view that the Swiss system of research funding has a balanced mix of instruments to support both self-initiated and goal-oriented research. The competitive and quality-oriented support the SNSF provides, following the bottom-up principle is a central condition for the internationally acknowledged success of the Swiss research system. The “reactive mode” of funding ensures a flexible development in the Swiss research landscape and permits a self-regulating accommodation to the different needs for support in the individual disciplines.

The international experts also felt there was no need to change the existing, strongly bottom-up orientation to funding or to install new strategic funding programmes. The advantages of the current system are too great. Instead, there is far greater risk of counter-productive effects should one move in the direction of strategy-driven top-down funding.

To augment the current funding portfolio, the panel did recommend creating a new instrument specifically for more risky research projects. This instrument would help give the necessary room for fresh and unconventional projects, and together with an ongoing monitoring of what kinds of proposals are being submitted, could serve to identify newly emerging research activities.

In order to more strongly orient the NFP to the “grand challenges”, the experts suggest looking to the foresight process at the European level as a point of departure for potential areas to support or fund.

### 2.5.3 The SSIC's conclusions

From the SSIC's point of view, the principle of research freedom legally anchors and ensures a system of public funding which best suits the dynamics of how research evolves. The SNSF's long use of, and ori-

entation to, the “responsive mode”, is one of Switzerland's strengths, seen internationally, as a place to engage in research. In this respect, the SSIC agrees with the assessment of the expert panel.

That the mode of funding is driven by academic research guarantees a high degree of flexibility and efficiency. However, the SSIC regards a more active steering of funding policy by the SNSF's Research Council as inexpedient, or even potentially risky to the reactivity and efficiency of the system as a whole. For the moment, the SSIC does not see any system-relevant problem or challenges that would justify a change of course in Swiss research policy. One also need not fear an increase *ad infinitum* of funding requests, as self-regulating forces would lead to a decrease in demands made on SNSF funding.<sup>93</sup> If the SNSF approval rates fall under a certain threshold, then one can anticipate a decline in the willingness to submit proposals.

However, the SSIC also feels that foresight studies and topic modelling efforts, in the manner suggested by the SNSF, are not suited to objectively anticipate potential research trends.<sup>94</sup> Early detection approaches of this kind cannot overtake the dynamics of a rapidly evolving research frontier. The SSIC also does not think that linking foresight studies to a proactive funding policy is compatible with support provided in the “responsive mode”, which under optimal conditions is the one best able to adequately capture new ideas and developments in research through its careful evaluation of research proposals. In addition, following Art. 11 of RIPA, the task of early identification lies in the hands of the Swiss academies.

In general, the SSIC tends toward the view that the hitherto successful balance between funding self-selected and funding goal-oriented research should be maintained, and that the SNSF's Research Council should not be transformed into a directive committee engaged in formulating research strategy.

93 The number of proposals submitted to the SNSF for project funding in 2012 was 8% lower than in the previous year. SNF (2013), *Jahresbericht 2012*, Bern, p. 13.

94 The Council came to this conclusion already in 2008, when, in exchanges with international experts and in the presence of the SNSF and the CTI, it conducted intensive discussions about the question of “foresight”. See CSST (2008), *Procès-verbal de la séance plénière du CSST du 17–18 janvier 2008*, Bern (available upon request from the SSIC).



## 2.6 A New Arrangement to Fund “high risk/high reward” Research

Peer review processes, based on decisions by a majority, have well-known mainstreaming effects.<sup>95</sup> Short-term project funding also leads researchers who submit proposals to be somewhat risk-averse.<sup>96</sup> The evaluation by peers of newly emerging disciplinary areas has also shown itself to be problematic.<sup>97</sup> To counter these undesirable tendencies in competitively-awarded research funding, the SSIC recommends examining the idea of creating a new arrangement for funding high risk/high reward research, as suggested by the SNSF in its current multi-year planning proposal.<sup>98</sup> Funding following the “responsive mode” principle could be enhanced by setting aside a limited portion of the funding available for self-selected projects in order to fund riskier, potentially paradigm-bending, research projects. Researchers themselves should be encouraged to declare their proposals as “particularly risky but potentially worthwhile” – and equally, the responsible Research Council members who read these proposals should bring a “willing to take a risk” attitude to their evaluations. This funding option was repeatedly mentioned in a recently completed SNSF survey of users.<sup>99</sup>

The background for this new and widespread international interest in funding arrangements for riskier research projects has been the recent shift in emphasis among public organisations that fund research in favour of competitively-awarded external funding.<sup>100</sup> Having research funding marked by competition and internationalization means an increase in the degree of non-scientific determination of the research system.<sup>101</sup> With the growing significance of competitively-awarded research funding, the acquisition of external funding has become a criterion for the quality of research. This logic goes hand-in-hand with an increasingly breathlessness of research activity, partly undermining the inner logic of academic knowledge acquisition processes and the ability to innovate in research endeavours. At the same time, the administrative burden on researchers that are associated with funding and evaluating research projects has also increased. Top researchers spend more and more of their time writing and evaluating proposals, which increasingly eats into the time and freedom they need for discovering the new.

Funding approaches of this kind have already been tried in other leading research nations.<sup>102</sup> Their aim is to strengthen the autonomy and creative freedom of individual researchers over a longer time-period.<sup>103</sup> American research funding organisations are pioneers

95 Reichert, Sybille (2013), *Jenseits der Leistungsüberprüfung – Diskussionspapier zur Suche nach einem neuen Umgang mit Qualitätssicherung an Hochschulen*, in: SWTR, *Leistungsmessung und Qualitätssicherung in der Wissenschaft. Zielgerichteter und vernünftiger Einsatz von Leistungsmessung und Evaluation in der Wissenschaft – Zehn Thesen*, SWTR Schrift 3/2013, Bern, pp. 22–51 and SWIR (2013), *The “Economicization” of Science*, Bern.

96 Heinze, Thomas (2008), How to Sponsor Ground-breaking Research: a comparison of funding schemes, *Science and Public Policy*, 35, pp. 302–318, here p. 304: “Short-term funding tends to encourage the exploitation mode which favours risk-averse research strategies and leads to proximate and often predictable outcomes, while high-impact research seems to be connected to the explorative mode conducted using long-term funding.”

97 This is confirmed by peer misjudgments about the path-breaking research conducted by various future Nobel Prize winners or by other outstanding scientists, with examples including negative reviews of Enrico Fermi, Rosalyn Sussman Yalow, Günter Blobel, Noam Chomsky or Karl Popper. See Reichert, Sybille (2013), *Jenseits der Leistungsüberprüfung – Diskussionspapier zur Suche nach einem neuen Umgang mit Qualitätssicherung an Hochschulen*, p. 31.

98 See SNF (2010), *Mehrjahresprogramm 2012–2016*, p. 26.

99 See also Langfeldt, Liv; Ramberg, Inge; Gunnes, Hebe (2014), *Swiss Research Funding*, pp. 76–78: “Lack of funding or risky/blue sky and interdisciplinary research, international project collaboration and projects without preliminary research are frequently commented upon in the free text replies. [...] Hence, retaining the relatively high success rate for Project funding and possibly including high-risk research as a particular concern in the review process, may be a better way of ensuring funding for blue sky/high-risk research.”

100 For the following, see also Nedeva, Maria et al. (2013), *Study of Research Funding Trends and Practices of Research Funding Organizations*, p. 105: “Changing the balance between block grant funding to research organisations and project-based funding to the extent where the former is dramatically diminished, has two important consequences. First, research performing organisations are losing their capacity to act as ‘playgrounds’ for the conception, testing and growth of highly-innovative and risky ideas. Second, responsibility for ensuring that highly risky, path-breaking research is still carried out is being transferred to (taken on by) research funding organisations.”

101 Elzinga, Aant (2012), Features of the current science policy regime: Viewed in historical perspective, in: *Science and Public Policy*, 39/4, pp. 416–428.

102 Both the British Wellcome Trust and the American Howard Hughes Medical Institute have been particularly innovative and successful in coming up with new funding arrangements.

103 As one representative example, see the recommendations of Britain’s Royal Society (2010), *The Scientific Century: securing our future prosperity*, London, p. 48: “A flexible and responsive research funding system must remain carefully balanced and continue to support projects, but there now needs to be greater emphasis on autonomy for excellent individuals.”

in this regard. For some years now, the NIH has had a number of high risk/high reward programmes in its portfolio, under names such as the NIH Director’s Pioneer Award, New Innovator Awards, Transformative Research Awards or Early Independence Awards.<sup>104</sup> The most developed of these instruments, the Pioneer Award, has been evaluated, and the results were positive.<sup>105</sup> The NSF recently introduced a similar funding instrument, the Early-concept Grants for Exploratory Research.<sup>106</sup>

Germany’s Volkswagen Foundation has also introduced the postdoctoral *Freigeist* [free spirit] Fellowship, targeted at “a young researcher with a strong personality, a creative mind, an ability to identify and use freedom, dedicated to overcoming resistance, [...] enjoying the unexpected, even unexpected difficulties.”<sup>107</sup> Through its *Reinhard Koselleck* Projects, the German DFG offers “outstanding researchers with a proven scientific track record” an opportunity “to pursue exceptionally innovative, higher-risk projects”.<sup>108</sup> At a lower level of support, Israel’s Science Foundation pursues a similar goal through its Focal Initiatives in Research in Science and Technology.<sup>109</sup>

104 See among others, IDA STPI (2011), *Outcome Evaluation of the National Institutes of Health (NIH) Director’s Pioneer Award (NDPA), FY 2004–2005. Final Report*, Washington DC or IDA STPI (2012), *An Outcome Evaluation of the National Institutes of Health (NIH) Director’s Pioneer Award (NDPA) Program, FY 2004–2006*, Virginia.

105 See Department of Health and Human Services / National Institutes of Health (2014), *Common Fund. FY 2015*, Washington, p. 8: “Comparison of research from Pioneer Awards, ROIs, and research funded by the Howard Hughes Medical Institute (HHMI) showed that the Pioneer program has been successful in attracting and supporting research that is more innovative and has greater impact than ROIs, and it is comparable to HHMI-supported research.”

106 See [http://www.nsf.gov/about/transformative\\_research/submit.jsp](http://www.nsf.gov/about/transformative_research/submit.jsp).

107 Fellowships are awarded for an initial period of five years, which can be extended for three more years. See <https://www.volkswagenstiftung.de/nc/en/funding/persons-and-structures/freigeist-fellowships.html>.

108 See [http://www.dfg.de/en/research\\_funding/programmes/individual/reinhard\\_koselleck\\_projects/index.html](http://www.dfg.de/en/research_funding/programmes/individual/reinhard_koselleck_projects/index.html).

109 See [http://www.isf.org.il/english/path.asp?path\\_id=7](http://www.isf.org.il/english/path.asp?path_id=7).





# Recommendations

The SSIC's recommendations are drawn from the information presented above, experts' reports, and the experiences of its own members. They are directed at the actors listed below, and make reference to different though interdependent spheres of activity. A comprehensive solution to ensure the Swiss system of research funding continues to thrive can only be found if the various responsible actors continue to productively cooperate. The SSIC's recommendations are not based on any rigid casuistry or definition of research infrastructures and disciplinary areas, because how a research project that is worthy of funding can best be supported must be decided on a case-by-case basis. In the SSIC's view, it is important that no funding gaps are created.

## **A Promotion of Research Infrastructures**

### **The SSIC recommends to the involved HERI actors and stakeholders that ...**

- ... they press ahead with discussions between the national government, the cantons, the universities and the funding organisations over the future of research infrastructure funding in Switzerland.
- ... they pool their strengths in the interest of Switzerland as a research hub and emphatically try to find a quick and sustainable solution for the still open question of financing.
- ... the discussion about funding research infrastructures of national significance be more open to the needs in humanities and social science research (libraries, collections, archives).

### **The SSIC recommends to the national government/SERI that it ...**

- ... more proactively attend to the special coordination, decision-making, and funding responsibilities in the area of research infrastructure so as to create system-wide coherence in research infrastructure funding, especially at the intersection between RIPA and HFKG.
- ... be more attuned to the strategic tasks of funding research infrastructures and that it press ahead with the acquisition of strategic planning knowledge and an overview of the international developments in the domain of research infrastructure.
- ... better define and communicate the objectives and schedule of the roadmap processes to the relevant stakeholders.
- ... take over the responsibility for prioritizing research infrastructure projects that are worthy of funding.
- ... base the strategic weighting of research infrastructure projects on a multilateral consultation process.
- ... extend the circle of stakeholders to include the cantons and research-oriented industries, and to more fully, and earlier, involve them, together with the research universities, in examining strategic questions concerning research infrastructure funding and the roadmap process.

... work on a longer-term solution for financing, together with the cantons and the affected stakeholders, to establish a separate budget for infrastructures managed by SERI, and to fund research infrastructure projects in a case-by-case manner which relied on varying funders and consortia.

**The SSIC recommends to the SNSF that it ...**

- ... focus on the academic and scientific dimensions in evaluating research infrastructures.
- ... establish an expanded Section IV for strategic programmes and infrastructures for the academic and scientific evaluation of research infrastructures or create a new, independent Section V for research infrastructures.
- ... expand its expertise in the evaluation of large research infrastructures, on this basis, in the direction of utilization, technical feasibility, and financial feasibility.
- ... abstain from prioritizing research infrastructure projects of equal academic quality and transfer the task of strategic weighting to the national government.
- ... carry on with the R'Equip programme, and depending on the case, diverge from the 50 % participation rule.

**The SSIC recommends to the involved cantons that they ...**

- ... develop a common research policy position particularly with respect to research infrastructure funding.
- ... actively participate in discussions with the national government about funding research infrastructures and cost-intensive domains.

**The SSIC recommends to the universities that they ...**

- ... more intensively use the leeway they have to engage in common strategic planning in the RI domain.

## **B Promotion of Disciplinary Areas**

**The SSIC recommends to the SNSF that it ...**

- ... not pursue a proactive funding policy in the manner the SNSF has suggested but instead to continue on with the proven practice of funding basic research in the “responsive mode”. This would enable the SNSF to respond appropriately to new research needs through suitable organisational and governance structures.
- ... not launch new emphasis programmes which go beyond the NFP and the NCCRs.
- ... not engage in foresight studies that are linked to research policy funding measures.
- ... consider creating a new funding arrangement for high risk/high reward research.



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# Abbreviations

<b>Art.</b>	Article	<b>EVD</b>	Federal Department of Economic Affairs, Education and Research
<b>BBi</b>	Federal Register [Bundesblatt]	<b>F&amp;E</b>	Research and Development
<b>BBT</b>	Federal Office for Vocational Education and Technology [Bundesamt für Berufsbildung und Technologie]	<b>FHR</b>	Swiss Universities of Applied Sciences Council
<b>BFS</b>	Federal Statistical Office [Bundesamt für Statistik]	<b>FIFG</b>	Forschungs- und Innovationsförderungs-gesetz [= RIPA]
<b>BMBF</b>	Federal Ministry of Education and Research [Germany: Bundesministerium für Bildung und Forschung]	<b>FINES</b>	Fund for Developing Astronomical Instruments
<b>BUB</b>	Grisons Book of Early Documents [Bündner Urkundenbuch]	<b>FJME</b>	The Jean Monnet Foundation for Europe
<b>CERN</b>	European Organization for Nuclear Research	<b>FLARE</b>	Funding Large International Research Projects
<b>CHAPS</b>	College of Helvetic Astronomy Professors	<b>FORCE</b>	Fund for Research at CERN
<b>CRUS</b>	Rectors' Conference of the Swiss Universities	<b>FORS</b>	Swiss Centre of Expertise in the Social Sciences
<b>CSCS</b>	Swiss National Supercomputing Centre	<b>GMBA</b>	Global Mountain Biodiversity Assessment
<b>CTI</b>	Commission for Technology and Innovation	<b>HEdA</b>	Higher Education Funding and Coordination Law or Higher Education Act [= HFKG]
<b>CTU</b>	Clinical Trial Units	<b>HERI</b>	Higher Education, Research and Innovation
<b>DDS</b>	Diplomatic Documents of Switzerland	<b>HFKG</b>	Hochschulförderungs- und -koordinations-gesetz [= HEdA]
<b>DDZ</b>	Data and service centre (SAHS)	<b>HLS</b>	Historical Lexicon of Switzerland
<b>DFG</b>	German Research Foundation	<b>ICOS</b>	Integrated Carbon Observation System
<b>EAER</b>	Federal Department of Economic Affairs, Education and Research [= WBF]	<b>ICT</b>	Information and Communications Technology
<b>ECRIN</b>	European Clinical Research Infrastructure Network	<b>IDA</b>	Institute for Defence Analyses
<b>EDK</b>	Swiss Conference of Cantonal Ministers of Education	<b>IFS</b>	Swiss Inventory of Coin Finds
<b>EFV</b>	Swiss Federal Finance Administration	<b>IHES</b>	Institute of Advanced Scientific Studies [Institut des Hautes Etudes Scientifiques]
<b>EMBC</b>	European Molecular Biology Conference	<b>ILL</b>	Institut Max von Laue – Paul Langevin
<b>EMBL</b>	European Molecular Biology Laboratory	<b>IRSOL</b>	Istituto Ricerche Solari
<b>EPFL</b>	Swiss Federal Institute of Technology Lausanne	<b>ISSI</b>	International Space Science Institute
<b>EPOS</b>	European Plate Observing System	<b>ITER</b>	International Thermonuclear Experimental Reactor
<b>ERC</b>	European Research Council	<b>KFH</b>	Rectors' Conference of the Swiss Universities of Applied Sciences
<b>ESA</b>	European Space Agency	<b>KIP</b>	Cooperation and innovation project [Kooperations- und Innovationsprojekt]
<b>ESFRI</b>	European Strategy Forum on Research Infrastructures	<b>MERIL</b>	Mapping of the European Research Infrastructure Landscape
<b>ESO</b>	European Southern Observatory	<b>MESR</b>	Ministry of Higher Education and Research [France: Ministère de l'Enseignement supérieur et de la Recherche]
<b>ESRF</b>	The European Synchrotron	<b>MRI</b>	Mountain Research Initiative
<b>ESRO</b>	European Space Research Organisation	<b>NCCR</b>	National Centres of Competence in Research [= NFS, SNSF]
<b>ESS</b>	European Social Survey	<b>NEST</b>	Next Evolution in Sustainable Building Technologies
<b>ESS</b>	European Spallation Source		
<b>ETHs</b>	Swiss Federal Institutes of Technology [e.g., ETHZ and EPFL]		
<b>ETHZ</b>	Swiss Federal Institute of Technology Zurich		
<b>EURATOM</b>	European Atomic Energy Community		
<b>ETH-Rat</b>	ETH Board		

<b>NFP</b>	National Research Programme [Nationale Forschungsprogramme, SNSF]	<b>SSIC</b>	Swiss Science and Innovation Council [= SWIR]
<b>NFS</b>	Nationale Forschungsschwerpunkte [= NCCR, SNSF]	<b>SSTC</b>	Swiss Science and Technology Council [= SWTR]
<b>NIH</b>	National Institutes of Health [U.S.]	<b>STPI</b>	Science and Technology Policy Institute
<b>NSF</b>	National Science Foundation [U.S.]	<b>STS</b>	Swiss Theatre Collection Foundation [Stiftung Schweizerische Theater- sammlung]
<b>Par.</b>	Paragraph	<b>SUC</b>	Swiss University Conference [= SUK]
<b>PASC</b>	Platform for Advanced Scientific Computing	<b>SUK</b>	Schweizerische Universitätskonferenz [= SUC]
<b>PSI</b>	Paul Scherrer Institute	<b>SWIR</b>	Schweizerischer Wissenschafts- und Innovationsrat [= SSIC]
<b>R'Equip</b>	Research Equipment	<b>SwissFEL</b>	Freie-Elektronen-Röntgenlaser [see X-FEL]
<b>RI/RIs</b>	Research infrastructure/s	<b>SwissTransmed</b>	Platforms for translational research in medicine
<b>RIPA</b>	Research and Innovation Promotion Act [= FIFG]	<b>SWTR</b>	Schweizerischer Wissenschafts- und Technologierat [= SSTC]
<b>RTI</b>	Research Technology Innovation	<b>UFG</b>	Federal Law on Financial Support to Universities
<b>SAGW</b>	Schweizerische Akademie der Geistes- und Sozialwissenschaften [= SAHS]	<b>WBF</b>	Eidgenössisches Departement für Wirtschaft, Bildung und Forschung [= EAER]
<b>SAHS</b>	Swiss Academy of Humanities and Social Sciences [= SAGW]	<b>WSL</b>	Swiss Federal Institute for Forest, Snow and Landscape Research
<b>SAMS</b>	Swiss Academy of Medical Sciences	<b>X-FEL</b>	X-Ray Free-Electron Laser
<b>SATW</b>	Swiss Academy of Engineering Sciences		
<b>SBF</b>	State Secretariat for Education and Research		
<b>SBFI</b>	Staatssekretariat für Bildung, Forschung und Innovation [= SERI]		
<b>SCNAT</b>	Swiss Academy of Sciences		
<b>SCTO</b>	Swiss Clinical Trial Organisation		
<b>Sect.</b>	Section		
<b>SEON</b>	Swiss Earth Observatory Network		
<b>SERI</b>	State Secretariat for Education, Research and Innovation [= SBFI]		
<b>SHARE</b>	Survey of Health, Ageing and Retirement in Europe		
<b>SHAS</b>	Swiss Academies of Humanities and Social Sciences		
<b>SHCS</b>	Swiss HIV Cohort Study		
<b>SHK</b>	Schweizerische Hochschulkonferenz		
<b>SHP</b>	Swiss Household Panel		
<b>SIB</b>	Swiss Institute of Bioinformatics		
<b>SIK</b>	Swiss Institute for Art Research		
<b>SIKJM</b>	Swiss Institute for Child and Youth Media		
<b>SLS</b>	Swiss Light Source (at the Paul Scherrer Institute)		
<b>SNBL</b>	Swiss-Norwegian Beam Lines		
<b>SNF</b>	Schweizerischer Nationalfonds [= SNSF]		
<b>SNSF</b>	Swiss National Science Foundation [= SNF]		
<b>SSA</b>	Swiss Social Archives		

# Appendix

## A Federal RI Funding lines

### 1 RI funding in the ETH domain

Following the Federal Council's current performance agreement, RI funding is one of the seven strategic foci in the ETH domain for 2013–2016.<sup>110</sup> The ETH domain plays a correspondingly central role in RI funding, and a number of them have developed out of ETH entities. Of the 14 RI projects on the Swiss roadmap in 2011, funded by the current ERI Dispatch (a total of 457 million CHF in support), five are assigned to the ETH domain (supported by about 279 million CHF). They include, among others, the completion of the SwissFEL at the Paul Scherrer Institute, the CSCS in Lugano-Cornaredo,<sup>111</sup> the Blue Brain project at the EPFL, and participation in smaller RI projects such as ICOS and EPOS.<sup>112</sup>

Outside of the roadmap context, there are a series of smaller and larger RIs in the ETH domain that are, at least partly, of national significance.<sup>113</sup> In some cases, these RIs were created in conjunction with national agencies, though in administrative areas external to HERI.<sup>114</sup> As part of its budgetary autonomy, the ETH Board also sets the corresponding strategic priorities for the RI domain. It is responsible for the regular quality control of RI projects, inasmuch as the academic or scientific evaluation is not – as in the SNSF co-financed ICOS project – carried out through the SNSF itself.

110 See the performance agreement noted at [http://www.ethrat.ch/sites/default/files/Leistungsauftrag%202013\\_2016\\_d.pdf](http://www.ethrat.ch/sites/default/files/Leistungsauftrag%202013_2016_d.pdf).

111 The CSCS is associated with the ETHZ, but as an RI it is available to all Swiss universities and research institutions for academic and research projects. It can also provide services, with full cost accounting, to private sector users.

112 ICOS researches the influence of CO<sub>2</sub> and other greenhouse gases in the atmosphere on the terrestrial and marine biosphere. Six million CHF were allocated for this project during the 2013–2016 period. See <http://www.gl.ethz.ch/research/closed/icos>. On the EPOS project, see the documentation at [https://www.rdb.ethz.ch/projects/project.php?proj\\_id=25908](https://www.rdb.ethz.ch/projects/project.php?proj_id=25908).

113 To this one can add the SLS or the Binnig and Rohrer Nanotechnology Center operated by the ETHZ in collaboration with IBM Research Zurich. The website <https://www.ethz.ch/de/forschung/forschungsinfrastruktur.html> gives an overview of the various technology platforms used at the ETHZ. However, the ETH Board does not have an overview of the expenditures in the ETH domain for research infrastructures (in 2012) which goes beyond this summary information, at least not in the sense of a breakdown of expenditures per year or by research projects individual institutions carry as part of the basic financing they receive. See the email from PD Dr. Kurt Baltensperger, ETH Board member responsible for this area, 3 June 2014.

### 2 RI funding following Art. 15 of RIPA

RIPA's Art. 15 gives the national government the competency to provide subsidiary funding to non-university research infrastructures which are of national significance. With this funding instrument, the national government supports, for four years, academic or research services and infrastructures that provide complementary contributions from outside the universities to the development of disciplinary or transdisciplinary research activities.<sup>115</sup> Overall, the national government invested 74.8 million CHF in the current funding period, under this Article, for such national research infrastructures.

In addition to academic or scientific quality, conditions include substantive cost-sharing by third parties, broad accessibility, and use by academic and scientific research in Switzerland.<sup>116</sup> National government support amounts to at most half the total investment and operations cost. Proposals are submitted to SERI, which gives the SSIC the task of examining most of the proposals as well as the multi-year plans of Art. 15 institutions. The SSIC's recommendations serve as a basis for SERI's request to the EAER. Final decisions are made by the head of the EAER.

114 This is the case, for example, for the new plant protection laboratory of the WSL, which was co-financed by and which came into existence in cooperation with the Federal Office for the Environment and the Federal Office for Agriculture. See ETH-Rat (2013), *Budgetbericht 2014 des ETH-Rats für den ETH-Bereich*, Zurich, p. 16.

115 Nine institutions (FJME, FORS, SSA, IRSOL, SIB, SIK, SIKJM, SHAS, STS) of differing sizes and disciplinary moorings received federal subsidies during the 2013–2016 period. Amounts in 2013 ranged from 135,000 CHF (FJME) to 9 million CHF (SIB). See the SERI website at <http://www.sbf.admin.ch/themen/01367/01679/index.html?lang=de>.

116 The two last-named criteria are only explicitly mentioned in the text of the dispatch. See Botschaft zur Totalrevision des Forschungs- und Innovationsförderungsgesetzes vom 9. November 2011, BBl 2011, p. 8884: "Following letter a., research infrastructures [...] are facilities or entities which make a clear contribution to the development of research activities in a discipline or in several research areas, and as such are used for academic and scientific research in Switzerland and are broadly accessible."

### 3 RI funding following Art. 28/29 of RIPA

The instrument of Art. 28/29 of RIPA is used by the Swiss national government to support and fund Swiss participation in establishing and operating international research organisations and infrastructures. Such participation is based on agreements under international law,<sup>117</sup> and in this manner, the Swiss national government has a voice and can influence the further development of large-scale international facilities and equipment. Since mandatory national contributions primarily serve as basic financing, the monies provided cannot as a rule be targeted to support specific infrastructures. Such Swiss participation is presented to the national parliament either in the context of annual budget decisions or through the funding framework of the respective ERI Dispatch.<sup>118</sup> In the 2011 national budget, Switzerland contributed about 120 million CHF to international RIs.

Precondition for this participation, under these Articles, is that a national interest exists, that realizing the infrastructure proposed exceeds the financial abilities of the relevant institutions and that a national government financial contribution is therefore imperative. The quality of the RI facilities is generally evaluated and ensured by international research organisations. In addition to funding technical infrastructures, the Swiss national government also supports the experiments which Swiss researchers carry out using the equipment at the large-scale international facilities.

In the area of particle physics, astrophysics, and astroparticle physics, the national government delegates this task to the SNSF.<sup>119</sup> In the performance agreement, the SNSF pledges it will take the recommendations of the FLARE managing committee into account in distributing the funds among the individual research areas.<sup>120</sup> FLARE proposals are evaluated by a panel of experts which includes three members of Dept. II of the SNSF's Research Council as well as three national experts from the three disciplinary areas in FLARE's remit.

117 Switzerland participates financially in, and is a member of, various large international research infrastructures in Europe, including CERN (high-energy physics), ESA (space travel), ESO (astronomy), EMBC and EMBL (molecular biology), ELIXIR (RI for biological information), as well as in materials research and in the ESRF (synchrotron), ESS (spallation source), ILL (neutron science), the European X-FEL (x-ray laser), and in SNBL (Swiss-Norwegian beam lines). A part of the funding for large RI projects flows through mandatory contributions to EU research framework programmes, in particular here, participation in EURATOM and ITER.

118 The former is the case for participation in CERN (46.3 million CHF), in ESO (7.8 million CHF), in EMBC and EMBL (together, 4.4 million CHF) and in ESRF (5 million CHF). The mandatory contributions to ESA (35.9 million CHF), used for establishing and operating RI, also belong in this category, though they are dealt with outside the roadmap. Swiss participation in ILL (4.6 million CHF), in the European X-FEL (5.2 million CHF) and the ESS (amount not yet set), however, is determined through the ERI Dispatch. All figures are for 2011. EFV (2012), *Staatsrechnung 2011, Vol. 2B: Verwaltungseinheiten. Begründungen*, Bern.

119 In the current period, the dispatch estimates a total of 26.5 million CHF.

120 SBF; SNF (2012), *Leistungsvereinbarung 2013–2016 zwischen der Schweizerischen Eidgenossenschaft und dem Schweizerischen Nationalfonds zur Förderung der wissenschaftlichen Forschung*, Bern, 12 December 2012, p. 10.

## 4 RI funding by Swiss academies

Following Art. 11 of RIPA, the Swiss academies support, in a manner subsidiary to the SNSF, the national government and the research universities, data collections, documentation systems, academic journals, editions or platforms that serve as research infrastructures in the development of disciplinary areas in Switzerland.

Thus, the SAGW funds a series of long-term humanities projects that have infrastructural characteristics.<sup>121</sup> These are primarily long-term editorial projects which rest, in different degrees, on a digital databank. In addition, running under the label of “digital humanities”, a pilot project is currently underway to build a data and service centre (DDZ) for humanities research data.<sup>122</sup>

Platforms which themselves do not develop any research activities are also considered to be research infrastructures if they take on important coordinating, networking, monitoring, or informational tasks in the development of a particular research area. In various topics and areas, SCNAT maintains six national co-ordination platforms that provide services to the research community which are not wholly covered by the universities or established funding institutions. The activities of these platforms range from representing the professional associations to early detection through to the pooling of expert knowledge.<sup>123</sup>

As part of its support for clinical and biomedical research, SAMS funds the establishment of research platforms which are integrated into the national CTU network.<sup>124</sup> These funding activities are coordinated with the SNSF.

The individual scientific academies in Switzerland themselves regularly evaluate the use and academic quality of these infrastructures.

## 5 RI funding through the SUC

In the current funding period, a series of research infrastructure projects are funded through project-specific SUC contributions. These projects are of common strategic and research policy significance both for the national government and for the universities. The amount expended is about 56.5 million CHF.<sup>125</sup>

Such project-specific funding supports RI projects such as the CRUS-led study of “Scientific Information: Access, Processing, and Storage”,<sup>126</sup> which, as a top-down initiative, was launched without a call for applications, as well as competitively-awarded cooperative and innovative projects including SEON, PASC Swiss-Transmed. There RI projects were selected by SUC and CRUS; the formal decision to fund lies with SUC.<sup>127</sup> SERI is responsible here for administering the credits, for auditing, and for project controlling. The final evaluation of SUC programmes and KIP, which the UFG requires after every funding period, is contracted out to external agencies by SUC.

121 These include the national dictionaries, the Yearbook of Swiss Politics, the holdings at the Swiss Folklore Institute of the University of Basel, the IFS, the Repertorium Academicum Germanicum, the Swiss Text Corpus project, Infoclio.ch, and the HLS, which is to be continued on as an RI once it is completed. In the current funding period, these humanities research infrastructures and long-term projects have an annual budget of about 11 million CHF. SAGW (2014), *Förderung der Geisteswissenschaften in der Schweiz im Zeitraum 2002–2012. Grundlagenbericht im Auftrag der Schweizerischen Akademie der Geistes- und Sozialwissenschaften (SAGW)*, authored by Sabina Schmidlin, Bern, pp. 70–72.

122 See the performance agreement between the national government and SAGW, Bern, 15 April 2013, available at: [http://www.sagw.ch/dms/sagw/info\\_sagw/lv/2013–2016/LV\\_SAGW\\_final\\_signiert](http://www.sagw.ch/dms/sagw/info_sagw/lv/2013–2016/LV_SAGW_final_signiert).

123 In the current period, the SCNAT has 864,000 CHF of federal funding available to provide additional support for research infrastructures and collective research goods. See the performance agreement between the national government and SCNAT, Bern, 12 April 2013.

124 See the performance agreement between SERI and SAMS for the 2013–2016 funding period, 10 April 2013, p. 5.

125 <http://www.cus.ch/wDeutsch/beitraege/2013–2016/index.php?navid=14>.

126 <http://www.crus.ch/information-programme/projekte-programme/isci.html?L=2>.

127 SUK (2012), *Schlussvaluation der mit projektgebundenen Beiträgen nach FG geförderten Projekte 2008–2011. Schlussbericht*, authored by Dora Fitzli et al., Bern.

## B List of HERI Sector Interlocutors

Between March and August 2014, the SSIC held a series of conversations with Swiss HERI sector actors about the evaluation questions raised in the SERI mandate. They are listed below:

Institution	Date and Place	Interlocutor
<b>CRUS</b>	Wednesday, 5 March 2014 Bern	Prof. Dr Antonio Loprieno (President) Dr Raymond Werlen (Secretary-General)
<b>KFH</b>	Monday, 17 March 2014 Bern	Prof. Dr Thomas D. Meier (President) Thomas Bachofner (Secretary-General)
<b>Swiss Science and Research Academies:</b>		
<b>– SAMS and SATW</b>	Friday, 28 March 2014 Basel	Prof. Dr Peter Meier-Abt (President, SAMS), Prof. Dr Ulrich W. Suter (President, SATW)
<b>– SCNAT and SAHS</b>	Monday, 31 March 2014 Bern	Prof. Dr Thierry Courvoisier (President, SCNAT), Prof. Dr Heinz Gutscher (President, SAHS), Dr Markus Zürcher (Chair, Management Board)
<b>ETH-Board</b>	Tuesday, 29 April 2014 Zurich	Dr Fritz Schiesser (President), PD Dr Kurt Baltensperger (Head, Sciences)
<b>CTI</b>	Monday, 26 May 2014 Bern	Walter Steinlin (President) <sup>128</sup>
<b>EDK</b>	Friday, 20 June 2014 Bern	Dr Christoph Eymann (President) Madeleine Salzmann (Director of University Coordination)

<sup>128</sup> Dr Klara Sekanina, Administrative Director, could not participate in the meeting as planned.



## C Panel of International Experts

### 1 Experts' panel

The SSIC invited a panel of international experts to participate in its plenary meeting of 29 April 2014 to discuss the questions raised by the SERI mandate. The following experts were part of this panel:

**Prof. Dr Rudolf Stichweh, University of Bonn (Germany) and University of Lucerne (Switzerland)**

Rudolf Stichweh (b. 1951), former rector of the University of Lucerne (2006–2010), is the current director of the “Forum for International Science” and holds the Dahrendorf Chair for the “Theory of Modern Society” at the University of Bonn. From 2003 to 2012 he was Professor for Sociological Theory and General Sociology at the University of Lucerne.

He studied sociology and philosophy at the Freie Universität Berlin and at Bielefeld University. In 1983, he obtained his PhD in sociology; his doctoral thesis was on the emergence of physics as a scientific discipline. From 1989 to 1994 he worked as a research assistant at the Max Planck Institute for European Legal History. He joined the University of Lucerne after having been Professor of Sociology at Bielefeld University from 1994 to 2004, and since 2012, has held an appointment as Permanent Visiting Professor in the Faculty of Humanities and Social Sciences at the University of Lucerne. His main research interests include systems theory, the sociology of science, and the sociological theory of world society.

**Prof. Dr Dr Andreas Barner, Stifterverband für die Deutsche Wissenschaft (Germany)**

Andreas Barner (b. 1953) is currently president of the Stifterverband für die Deutsche Wissenschaft, a member of the DFG's Steering Committee, and since 2012, CEO of the pharmaceutical company Boehringer Ingelheim. He has been head of pharmaceutical research, development and medicine, and head of the corporate board division at this company.

He obtained both medical and doctoral degrees from the University of Freiburg im Breisgau and a doctoral degree in mathematics from the Federal Institute of

Technology Zurich. He worked in the research department at Ciba-Geigy in Basel, joining Boehringer Ingelheim in 1992. He is a member of numerous advisory boards, both public and private, in science and technology fields, and is a former member of the German Council of Science and Humanities.

**Prof. Dr Jakob Edler, University of Manchester (United Kingdom)**

Jakob Edler (b. 1967) is Professor of Innovation Policy and Strategy at the Manchester Business School, and since 2010, has been Executive Director of the Manchester Institute of Innovation Research. Previously, he was Head of Department for Innovation Systems and Policy at the Fraunhofer Institute for Systems and Innovation Research in Karlsruhe.

He was awarded his PhD in political science (with distinction) in 1999 by the University of Mannheim. Jakob Edler regularly advises the EU, OECD and a range of governments on innovation policy. His research interests include policy and governance in innovation systems, and the research and innovation strategies of companies and research institutions.

**Prof. Dr Jean Jouzel, Conseil stratégique de la recherche (France)**

Jean Jouzel (b. 1947) became a member of the French Conseil stratégique de la recherche in 2014, is a member of the administrative board of the Agence nationale de la recherche, and a former president (from 2009–2013) of the Haut Conseil de la Science et de la Technologie. He works as a glaciologist and climatologist at the Laboratoire des sciences du climat et de l'environnement near Paris, and is a recognized expert in major climatic shifts based on his analysis of Antarctic and Greenland ice.

He studied chemistry at the Ecole supérieure de chimie industrielle in Lyon and obtained two PhDs in physical chemistry (1973) and natural sciences (1974) at the University Paris-Sud; his doctoral thesis was on hailstone formation. Research director at the Commissariat à l'Energie Atomique since 1995, then assistant director of the Laboratoire des sciences du climat et l'environnement, with which he is still affiliated, he was director of the Institut Pierre-Simon Laplace from 2001 to 2008. In 2002 he was awarded the CNRS gold medal, the highest distinction in French science.



In 2007, as a member of the Intergovernmental Panel on Climate Change IPCC, he received the Nobel Peace prize.

**Prof. Dr Juni Palmgren, Swedish Research Council**

Juni Palmgren (b. 1949) is General Secretary of the Council for Research Infrastructures and represents the Swedish Research Council in ESFRI. She chairs the Swedish Research Council e-science subcommittee and works actively for the funding of Nordic research infrastructures. She has been Professor of Biostatistics at the Department of Mathematical Statistics of Stockholm University since 1997, and is currently Guest Professor of Biostatistics in the Department of Medical Epidemiology and Biostatistics at the Karolinska Institute.

She studied mathematics at the University of Helsinki, obtaining her PhD in statistics in 1987. She coordinated and led medical biostatistics groups at Helsinki's National Public Health Institute, and was Assistant Professor at the Swedish School of Economics and Business Administration and at Helsinki University. She coordinated the bioinformatics platform of the Wallenberg Consortium North for Functional Genomics (2003–2005) and is a leader in biostatistics research related to population genomics. In 2011, she was elected to the Academy of Finland and appointed Finland Distinguished Professor at the Institute for Molecular Medicine Finland.

## 2 Terms of Reference for the External Experts

The following “Terms of Reference” of 21 March 2014 form the basis for the SSIC's charge to the international panel of experts:

### 1 Purpose of the Terms of Reference (TOR)

The following TOR govern the rights and obligations of the panel of external experts on the one hand, and of the Swiss Science and Innovation Council and its staff on the other. These TOR also set out the procedures to be followed and the deadlines to be adhered to.

### 2 Purpose of the evaluation by the Swiss Science and Innovation Council (SSIC)

In accordance with the official mandate of the State Secretariat for Education, Research and Innovation (SERI) of March 2013, the SSIC will conduct an external evaluation of the Swiss National Science Foundation (SNSF), and will focus on the questions of research infrastructure funding and the setting of priorities in research funding. The internal evaluation of the SNSF was carried out by the SNSF itself.

The external evaluation to be conducted by the SSIC focusses on the following aspects within the Swiss Education, Research and Innovation (ERI) system:

**A The role of the SNSF as a provider of research infrastructure funding**

**B The role of the SNSF in the strategic development and funding of research fields**

### **3 Questions guiding the assessment by the panel of external experts**

Based on its interpretation of the SERI mandate, the SSIC would like to invite the panel of external experts to answer the following questions:

#### **A The funding of research infrastructures**

- A1 What is a viable and appropriate concept of “research infrastructure” for defining a national funding policy for research infrastructures that responds both to scientific and political requirements?
- A2 Which are the best procedures for determining the scientific potential and the future utilization of proposed research infrastructures?
- A3 Which institution or body should ultimately decide on research infrastructure funding?
- A4 What type of institution or instrument is most appropriate for funding research infrastructures over the long term?

#### **B The strategic development and funding of research fields**

- B1 Which premises underlie the idea of setting priorities and the idea of strategic research funding?
- B2 Which instruments (such as foresight studies) allow one to detect the appropriate research priorities within a national ERI system? What are the advantages and disadvantages of the different approaches?
- B3 Should the SNSF develop a strategic and proactive funding policy?
- B4 What might the possible effects of such a strategic and proactive funding policy be?
- B5 If need be, how could the SNSF implement a strategic and proactive funding policy? Which procedures and selection criteria should guide such research funding prioritizations?

### **4 Basics, structure and objective of the assessment by the panel of experts**

The assessment by the panel of external experts is primarily based on preliminary findings and strategic options for future SNSF funding elaborated by the SSIC, and secondarily on the SNSF’s self-evaluation report as well as on the SERI mandate. The assessment is to be structured along the following lines:

- a) Based on documentation provided by the SSIC, the panel of external experts will meet with the SSIC, comment on the questions guiding the assessment (see 3, above), assess the preliminary findings and strategic options elaborated by the SSIC, and critically discuss them from an international perspective.
- b) Based on discussions with the SSIC, the panel of external experts will draw its own conclusions against the background of funding practices and experiences in other countries.
- c) Based on its independent assessment, the panel of external experts will provide a report with its findings, conclusions and suggestions as to how the SNSF should define its future funding policy with respect to research infrastructures and research fields to better serve the Swiss ERI system.

The SSIC will use the results of the external experts’ assessment to formulate recommendations to the Swiss Federal Government.

## **5 Assessment procedure by the panel of external experts**

The assessment procedure consists of six steps:

- a. The SSIC will provide documentation to the panel of external experts on April 15<sup>th</sup>, 2014 at the latest.
- b. On April 29<sup>th</sup>, 2014, the external experts will meet with the SSIC in Bern and present their comments on the questions guiding the assessment (see 3, above). The objective is to have a discussion with the SSIC on the strategic options for future SNSF funding. After this discussion the panel of external experts will meet to decide on the main directions their report will take.
- c. The external expert panel will deliver a first draft of its report to the SSIC by May 15<sup>th</sup>, 2014.
- d. The SSIC will then provide feedback on the first draft. If necessary, the SSIC will address additional questions to the external experts by May 23<sup>rd</sup>, 2014.
- e. By May 30<sup>th</sup>, 2014, the external experts' panel will decide on making revisions to their report, based on the SSIC's comments. The panel will then produce a final report and send it to the SSIC by June 16<sup>th</sup>, 2014 at the latest.
- f. The SSIC will use the external experts' report to make recommendations to the Swiss Federal Government and will inform the external experts about subsequent decisions the Swiss Federal Government and the SNSF make in this area.

## **6 Timetable for the assessment by the panel of external experts**

The timetable for the assessment by the panel of external experts is as follows:

15 <sup>th</sup> April 2014	The SSIC provides documentation to the panel of external experts.
29 <sup>th</sup> April 2014	The panel meets the SSIC in Bern.
15 <sup>th</sup> May 2014	The panel delivers the first draft of its report.
23 <sup>rd</sup> May 2014	The SSIC delivers feedback on the panel's first draft.
30 <sup>th</sup> May 2014	The panel decides on possible revisions to its report.
16 <sup>th</sup> June 2014	The panel finalizes its report and forwards it to the SSIC.

## **7 Constitution of the panel of external experts**

An international panel of independent external experts will carry out this assessment. The SSIC is responsible for selecting this panel.

A chairman, nominated by the SSIC's President, will lead the panel. The chairman is responsible for coordinating the panel members. All questions related to scientific purpose should be directed to the chairman of the external experts' panel. Every member of the panel can address the SSIC's Secretariat if they have administrative questions.

## **8 Documentation**

The SSIC will provide the panel of external experts with all the necessary documentation and information. This includes:

- a) The preliminary findings and strategic options elaborated by the SSIC (not more than 15 pages);
- b) The SNSF's self-evaluation report (40 pages, plus 80 pages of appendices);
- c) A summary of the SERI mandate (4 pages).

On request, the SSIC will provide general information about the Swiss ERI system and the SNSF.

## **9 Tasks and responsibilities of the external experts**

At their discretion, the external experts may gather additional information they regard as relevant. In its report, the panel must disclose these sources of additional information.

The SSIC will receive the final report from the chairman of the external experts' panel no later than June 16<sup>th</sup>, 2014. This report will contain the panel's findings and suggestions as well as a statement about the methods and documentation the panel used.

The report will be in English. It will be no longer than 20 pages, including a one-page executive summary. The report must be delivered in electronic form (praesidium@swir.admin.ch), both as a .pdf and as a Word file. The report is meant to have group authorship. If the panel cannot reach a consensus, each member of the panel will sign his or her own text.

## **10 Independence, confidentiality and conflicts of interest**

The members of the panel work independently and do not represent any organisation.

The identity of the panel members is confidential. This confidentiality may be suspended if all panel members explicitly agree to do so.

Discussions between the panel of external experts and the SSIC are not public and their content is confidential. No official minutes will be kept, but all participants are free to take notes for their own use.

Panel members may not make any use of, and may not divulge to third parties, any non-public information they learned or accessed in the process of working on this panel, including but not limited to information, knowledge, documents or other matters communicated to them or brought to their attention.

The report of the panel of external experts is to be sent to the SSIC. It is to be treated confidentially until the end of the assessment process.

Panel members are required to declare any personal or other conflicts of interest. They must disqualify themselves if they can in any way benefit from a positive or negative statement concerning SNSF funding.

### 3 Experts' Report

#### **Evaluation of the Swiss National Science Foundation (SNSF) from the perspectives of funding research infrastructures and developing and funding research fields**

Report of the External Expert Group on the basis of the meeting with the SSIC (Swiss Science and Innovation Council), April 29, 2014

#### **Experts**

**Prof. Dr Rudolf Stichweh**, University of Bonn (D), Chair

**Prof. Dr Jakob Edler**, University of Manchester (UK)

**Prof. Dr Jean Jouzel**, Conseil Stratégique de la Recherche (F)

**Prof. Dr Juni Palmgren**, Swedish Research Council (S)

**Prof. Dr Shimon Yankielowicz**, Israel Science Foundation (Israel)

**Prof. Dr Andreas Barner**, Stifterverband für die Deutsche Wissenschaft (D)

According to the terms of reference for the external experts the purpose of the evaluation by the Swiss Science and Innovation Council (SSIC) at the request and in line with the official mandate of the State Secretariat for Education, Research and Innovation of March 2013 is to conduct an external evaluation of the Swiss National Science Foundation with the focus on research infrastructure funding and the setting of priorities in research funding.

More specifically, the expertise should contribute to the two following questions:

#### **A The role of the SNSF as a provider of research infrastructure funding**

#### **B The role of the SNSF in the strategic development and funding of research fields**

#### **A The Role of the SNSF as a provider of research infrastructure funding**

##### **1 Present Swiss funding of RI**

The self-evaluation of the SNSF, and the mandate to the panel, suggest that today the policy for funding RI in Switzerland is quite diverse. It probably has – as in many other countries – grown out of contingencies and many layers of historical logics.

It is noted that public sector funding for research is allocated to the ETH domain, including the Paul Scherrer Institute and other sites of major RI importance, to the SNSF and as basic funding to 10 cantonal universities, to Universities of Applied Sciences and to a large number of research institutes outside the university sector funded under the so called RIPA Art. 15. All types of universities enjoy a relatively high level of institutional funding and thus have a potential to act as players when it comes to RI of national interest.

It is further noted that more than 2/3 of all R&D funding of Switzerland is spent by the private sector, with a strong role for pharma and the biotech industry. An RI policy of national interest should be based on clear principles for the interaction with industry concerning planning, financing and access.

Between 2008 and 2012, the SNSF invested between CHF 42 and 50 million annually on new and existing RIs. These range from large scale equipment and its operation in the natural and engineering sciences via biobanks to surveys and cohorts in the social sciences. As evident from the Swiss university structure and the various sources of science funding, the SNSF funding for RI today only constitutes a fraction of the total RI funding.

The following is worth noting concerning SNSF funding for RI: Swiss RI are often a part of larger international structures, where SNSF pays for the Swiss membership contribution. RI in the fields of biology and medicine (cohorts, clinical trials units etc.) are part of larger national initiatives for capacity building in research and are thus formally classified as research rather than RI. Between 1/4 to 1/3 of the annual SNSF contribution to RI are used to purchase new instruments for research programmes (R'Equip), which

are local and often short term and thus are not classified as RI in the strict sense.

In this report the panel distinguishes between the following types of SNSF funded RIs:

- a) Equipment for research programmes – local;
- b) Distributed facilities and data structures – mixture of local and national;
- c) Large scale facilities – national.

Category a) RIs are crucial for excellence in research, but in many countries their funding would be the responsibility of the local university/universities hosting the research programme. A national funding body like the SNSF would in turn focus on RIs of national interest. A reason to avoid channeling national RI funding to individual research programmes is difficulty in prioritization, the risk of duplication and inefficient use of university specific instrumentation. For SNSF funding to be useful it is important that matching funding comes from the universities, and that the management and use of the equipment is followed.

The panel understands that a suggestion to move the responsibility for R'Equip from SNSF to the local university level could initially be difficult for a broad range of Swiss research. It would, indeed, require the universities to set up their own local strategic processes for investment in local instrumentation, and to share the use of these instruments efficiently between several local groups. This strategic process within universities may nevertheless prove to be useful, unless the rather high R'Equip university co-funding should already have achieved optimal usage and high efficiency at the university level. The panel recommends a national follow-up study of the efficiency of coordination and use of local instrumentation funded through the SNSF R'Equip funding scheme.

The rest of this report will focus on category b) and c), i.e. on RIs of national interest. While some of category b) and c) RIs could be exclusively Swiss, many – if not most – would have a natural interface to corresponding international RIs. An important feature of a national funding system for RI would be to consider the reasons and the volume of national RI funding relative to funding spent on membership in RIs outside of Switzerland.

## 2 Definition, prioritization and funding of RI

The panel finds the current SNSF definition of RI adequate for the purpose of this report. This states that RIs should

- offer high-quality services with at least national relevance
- offer researchers from Switzerland (and other countries) access via transparent processes based on the applicants' scientific track record
- have a stable and efficient management structure

A more detailed set of criteria, similar in spirit, could be that an RI must

- provide potential for world-class research and scientific breakthroughs
- be of broad national interest and enhance international impact
- have a long term plan for scientific goals, maintenance, financing and utilization
- be used by several research groups/users for high-quality research
- be open and easily accessible to researchers, industry and other actors
- have a plan for access to and preservation of collected data and/or materials
- be extensive enough so that individual groups cannot manage them on their own
- introduce new cutting edge technology (if relevant)

The primary role of RIs is to provide tools and services to the research community. The often large costs and long term of RI inevitably also lead to the established RIs shaping the national research profile and thus having policy implications.

A key to establishing a systems approach for funding RI is to set up a transparent prioritization process which tries to balance the research profile of the country and its investment in research tools and services. It has, however, proven difficult/impossible to carry out an objective priority process for RI's of national interest, based on assessments referring to scientific excellence and scientific potential. The structure and costs of RIs in e.g. social science data archiving, material science or astronomy are not comparable and objective evaluation criteria for choosing one over the other do not exist. This difficulty of prioritization was

manifest when ESFRI was to identify a small number of mature projects for the INFRADEV3 call of H2020 and similar difficulties have been encountered in individual European countries.

Different approaches to the prioritization of RIs of national interest have been suggested, e.g.

- (i) to acknowledge the difficulty/impossibility for objective prioritization described above and instead set up a body of (political) policy makers to prioritize which infrastructures to fund as part of a national policy strategy, or
- (ii) to set up a system with shared responsibility for prioritization and funding between several stakeholders, in particular national funders and the universities/other HEIs.
- (iii) to formulate a hybrid process with elements of (i) and (ii).

The panel finds that process (i) on its own would unduly increase administrative influence on the research system with a higher risk that short-term political constellations and shifting interests take over.

The panel strongly argues that the more comprehensive process (ii) has the potential to provide a better balance between research needs and the investment in RI. A central agency of self-observation and self-organisation of the Swiss Scientific Community, such as SNSF, should take the role as national coordinator, in dialogue with the more local and regional perspectives of the individual Swiss universities. The panel perceives the competition and even tension between the local, regional and national levels in strategic planning as potentially advantageous for the advancement of Science in Switzerland, provided that all segments of the institutional structure of Swiss science are involved and that the roles and procedures are transparent and mutually agreed.

Based on a detailed review from a system of type (ii) the final decisions could be made by a policy body of type (i). The important feature in such a hybrid process (iii) is that decisions are prepared in a process mainly internal to the Swiss science system. Decisions can then be taken in an institution which includes political points of view and priorities derived from them.

### 3 Different stakeholders and roles in a Swiss RI system

Understanding the Swiss research landscape is of primary importance in order to set up and sustain a coherent process for national funding of RIs over different levels and types of RI.

#### A coherent national framework

A coherent national funding policy for RI should include all segments of the institutional structure of Swiss science (SNSF, ETH domain, cantonal universities, universities of applied sciences, research institutes, industries) and should develop transparent procedures for the prioritization, co-funding and managing of RI. When setting up such a policy it would be important to create mechanisms (budgetary and other) by which very long-term projects could be managed.

Processes from the ESFRI level can partially serve as guidance also on the national/federal level in the form of a Roadmap process and of processes to form consortia with varying sets of participants (EU: varying sets of national states support different pan-European RIs; National: varying sets of universities support different RIs of national interest through explicit formation of consortia).

#### The role of universities

It would be important to encourage Swiss universities to formally investigate their RI needs and to set up an RI strategy for each university which identifies priorities on the local, national and international level. This would form an integral part of building a coherent national process for RI in Switzerland. The university could be prepared to fund local instrumentation and equipment (cf. panel reasoning for R'Equip) and they should co-fund RIs of national interest in Switzerland and/or abroad.

University co-funding of national/international RIs serves the purpose to aid in sharp prioritization and implies university responsibility also in the management of RI at the national and international level. An efficient university management and co-funding procedure should ideally be based on formal consortia agreements between several universities and the national funding body(ies).

### **The role of SNSF and other national funding bodies**

A national funding body such as SNSF should have a central function in looking at the planning of RIs in all segments of the institutional structure of Swiss Science, offering transparency and rationality to the planning of and deciding on RIs in Switzerland. SNSF is well equipped to deal with rationalization and coordination between the direct local RI funding, the funding of the National Centers of Competence in Research and the SINERGIA program as well as other RI funding of national interest, including the ETH domain.

Since prioritizing, coordination and long term follow-up of RI is a fundamentally different activity from handling short-term research projects/programmes a national SNSF RI Office should be set up, ideally in partnership with other national funding bodies. This RI office would be the “home” for a steering committee on RI and its various subcommittees. The steering committee should be responsible for a continuous update of the RI Roadmap, integrating the recommendations of the sub-committees and its own ideas, and setting up priorities as well as assessing the currently operating national RI and also the Swiss use of international RI. This RI office would also take responsibility for the handling of legal, economical and administrative procedures relating to coordination and co-funding of RI in Switzerland and abroad.

Below we list RI related actions, that could fall under the responsibility of SNSF, in partnership with other national funding bodies:

#### **a. Coordination**

Through its co-funding scheme SNSF would foster the setup of formal RI consortia in specific areas (e.g. facilities in material science, biobanking and bioinformatics resources, environmentally distributed RIs, longitudinal personal data sources etc.) including several universities having identified the RI in question as strategically important. Coordination between the national and international levels would, when pertinent, be part of this coordination process. Consortia receiving national funding would need to adhere to steering and access policies set up by the SNSF. For prioritized RIs the national funding would depend on a formal consortium agreement being set up and signed by partners.

#### **b. Prioritization**

Prioritization between RIs of national interest put forward by the university RI strategies could be carried out either by pure negotiations between SNSF and the universities (as in Denmark) or through a set of open (as in Norway) or directed (as planned in Sweden) calls carried out by SNSF, with applications from the Vice Chancellors of the respective universities, followed by an international evaluation for scientific, technical, organisational and financial merit.

#### **c. The RI Roadmap process**

The Swiss RI Roadmap could form an integrated description of the Swiss RI landscape based on researcher needs, strategies of universities and ideas originating within the RI steering committee and its various sub-committees. The Roadmap could be viewed as a sharp prioritization instrument (as in Denmark), as a framework for an open RI call process (as in Norway) or as the bases for directed RI calls (as planned in Sweden).

#### **d. Calls and competitive evaluation of applications**

If decisions on funding RI of national interest are based on calls, then these calls should cover planning as well as construction and operations.

Grant applications arguing for the scientific need for new RIs of national interest could be filed from single research groups. After evaluation and filtering such new RIs would enter a second phase of scientific, technical, organisational and financial planning as well as the build-up for a consortium involving several universities.

Calls for investment in RIs of national interest could open at regular intervals where new RIs would compete against existing RIs to ensure dynamic adaptation to changes in the research landscape. Existing RIs would be up for sharp evaluation, say, every 8 or 10 years.

The interval between calls should depend on the number of RIs in the system and on the funding period granted to these RIs in order to guarantee enough competition at each call. Also of interest is the mode of national funding, whether it is only focussed on investment or if the costs of operations in some long term perspective will be included. In



the former case the responsibility for an RI of national interest would naturally transfer to the university consortium after a period of initial funding.

#### **e. Funding**

The principles for funding RI of national interest, and in particular principles for co-funding between SNSF (and other national funding bodies) on the one hand and consortia of universities on the other hand need to be transparent and simple.

National funding could be allocated solely to initial construction costs, leaving costs of operations to be covered by the consortium of universities. Many distributed data-oriented RIs, however, have little construction cost and the main part of the funding involves operations. Here a simple splitting of the full costs of the RI could be agreed upon between funding partners, possibly for a limited period of time (6–8 years) after which the responsibility for the RI will be transferred to the consortium of universities.

#### **f. Follow-up and decommissioning**

Consortia of existing RIs of national interest should report to the SNSF and to other national funders annually on the basis of a set of key indicators on usage and scientific output. Clear terms have to be set up under which national funding could be discontinued during the funding period.

Importantly, a decommissioning or transfer plan needs to be formulated at the beginning of the funding period, which states terms for stepping down from the RI or transferring activities, property and funding as soon as a decision for the discontinuation of national funding to the RI has been taken.

### **B The role of the SNSF in the strategic development and funding of research fields**

#### **Bottom-up funding vs. strategic funding**

There was agreement among the experts of the group that Switzerland performs distinctly above average looking to scope, productivity and overall results with regard to education, research and innovation.

The investment of Switzerland for research and innovation as percentage of the GNP (gross national product) is one of the highest in Europe and internationally. The universities appear to be, in comparison to other European countries, well-funded; and this is even more clearly the case for the Swiss Federal Universities of Technology in Zurich and Lausanne; the attractiveness for foreign graduate students as well as for PhD students from foreign countries is high; it would appear that recruiting for senior academic positions is as well – possibly due to the good conditions – more successful than in other European countries. Also the success rate in competitively run programs such as the ERC grants would appear to be significantly above average.

If one looks for explanations for the successes of the scientific landscape in Switzerland in addition to the convincing financial support of higher education and research by both the federal (Eidgenossenschaft) as well as the local (Kantone) institutions one has to point to the quality orientation and the competitive funding approaches the Swiss National Science Foundation has established for research funding as an important condition of these successes.

The volume of support of the SNSF of more than CHF 2 billion (from 2008 to 2012) of which the largest proportion (more than 80%) was falling into the main funding scheme called the “responsive mode”, i.e. bottom-up requests open to all research disciplines and topics, and secondly the average success rate of the applications of more than 40% demonstrate the importance of the SNSF for the Swiss science and research system. The Expert Group, however, recommends to make sure that the comparably high success rate should not come at the price of insufficient funding of individual projects.

Another circumstance which shows the importance of the funding agency is that 30% of researchers em-

ployed at the Universities and the ETHs were counted as “customers” of the SNSF, i.e. either had ongoing project support or sent project proposals to the SNSF in a given year. According to the self-assessment report the inclusion rate of researchers was highest in the area of mathematics/informatics/natural sciences/technical sciences, followed by biology/medicine and participation is much less frequent and especially more heterogeneous in the humanities and social sciences. The significant differences between disciplines in their propensity to make use of the funding possibilities made available by the SNSF may be seen as a strong argument in favour of an evolutionary approach which does not believe in the possibility of a strategy which knows better than individual researchers where the next relevant developments will probably happen.

Beyond the SNSF bottom-up funding there are two important funding approaches of relevance:

The **National Research Programs** which cover a variety of scientific areas; following the announcement to apply with the SERI (State Secretariat for Education, Research and Innovation) for funding, research groups, individuals and organisations can apply for funding of a national research program. The SNSF is involved in the quality control, however the final decision which request is being funded as a National Research Program is taken by the federal government (Bundesrat/Federal Council and SERI). Thanks to the fact that there are no limitations regarding potential research areas one can propose and due to the fact that ultimately the government decides which program will be funded, this can be considered as an approach ensuring that research in those areas relevant to society at large is pursued. Reviewing the list of former and current National Research Programs one can conclude that a broad variety of questions frequently called Grand Societal Challenges are addressed through this instrument.

The second approach are the **National Centres of Competence in Research (NCCRs)**, which are longer term (12 years) approaches to establish new research areas. Here the Federal Government charges the SNSF with the task to select the right topics and appropriately qualified institutions and research groups.

It is important to note that according to the impressions available in the public domain both approaches i. e. the National Research Programs as well as the National Centres of Competence in Research are well accepted and fulfil the need for identifying new research fields or strengthening existing research fields.

The expert group was somehow concerned regarding the implications of the recent referendum for the working situation of foreign scientists in Switzerland. The consequences regarding the participation of Switzerland in European research programs may be serious and could well limit the recruitment possibilities of highly talented scientists for the Swiss ETHs or universities. The implications for research and innovation in Switzerland could be significant.

### The questions asked to the expert group

B: The strategic development and funding of research fields

- B1: Which premises underlie the idea of setting priorities and the idea of strategic research funding?
- B2: Which instruments (such as foresight studies) allow one to detect the appropriate research priorities within a national ERI system? What are the advantages and disadvantages of the different approaches?
- B3: Should the SNSF develop a strategic and proactive funding policy?
- B4: What might the possible effects of such a strategic and proactive funding policy be?
- B5: If need be, how could the SNSF implement a strategic and proactive funding policy? Which procedures and selection criteria should guide such research funding approaches?

### Deliberations of the expert group

The expert group was of the unanimous opinion that there is no need for a newly established priority for strategic research funding. The group was of the opinion that the threefold structure consisting of National Research Programs, National Centres of Competence in Research and the bottom-up SNSF funding does suffice.

The two main mechanisms with which thematic approaches are defined and funded are regarded as appropriate and sufficient. The first is a top down approach, whereby questions that society regards relevant (Grand Societal Challenges) are covered through the National Research Programs. In those programs projects are selected within politically set priorities, based on quality assurance through the SNSF. This way of steering research towards societal challenges outside the direct prerogative of the SNSF was considered appropriate.

The second approach strengthens existing or establishes new research fields through the bottom-up process for establishing National Centres of Competence in Research (NCCRs), administered and implemented by the SNSF. In looking at the NCCRs the expert panel recommends to define as systematically as possible the long-term strategical intentions coupled to the NCCRs. In which ways are the NCCRs meant to establish permanent centres as part of the science landscape in Switzerland beyond the first 12 years of funding?

The expert group was of the opinion that the evolutionary change in the research space through the bottom-up requests would allow for a continued non-radical change in the focus areas. This evolutionary process operates via the changing number of requests per research field and it depends on the maintenance of a high quality standard on the basis of which Switzerland has been particularly successful in the last decades.

In addition to the existing instruments, the panel recommends that the SNSF should be encouraged to develop a reasonably sized, not too large, funding tool for “new, out of the box, higher risk, but not unreasonable” research ideas which might in particular be suitable for researchers who have proven themselves by producing a track record of high quality research. Furthermore, the question was raised as to whether on a case by case basis cooperation with similarly quality oriented funding organisations in other countries should be considered.

A continuous and careful analysis of the evolutionary changes visible from the bottom-up requests in the normal program on the one hand and of research ideas coming from the high risk funding tool described above should allow to determine early enough newly emerging science and research fields.

Regarding the question B2, the current approach via both the National Research Programs as well as the National Centres of Competence in Research could be used for setting research priorities through funding decisions.

While the Competence Centre program appears to be a legitimate mechanism for the self-organising of scientific capacity around future scientific areas that the scientific community regards as relevant, setting priorities especially for the National Research Programs is a political task. It follows political priorities of the government in conjunction with the research capabilities and profile of the country. The panel is not sufficiently informed about the priority setting process for those programs. It would seem logical to derive those priorities from the societal challenges defined by politics in Switzerland. This should be supported by a well-organised discourse including societal actors as beneficiaries, political decision makers, scientific knowledge providers and industry as the two main innovators, a discourse who would help to define those priorities and make the priority setting process itself transparent and participatory.

The answer to question B3 would be in line with the answers to the first two questions. In addition, it is noteworthy, that Switzerland participates quite actively and definitely also very successfully in the European research programs. The Horizon 2020 is largely thematically oriented (exception ERC), and the broad themes covered in the program can be expected to be highly relevant for the Swiss research landscape, industry and society.

Therefore, if the foresight process on the European level is done in an intelligent way, Switzerland does benefit by being a part of this process and therefore by an indirect way of setting funding priorities.

The expert group (B4 and B5) was of the opinion that to the extent argued above a strategic and proactive funding policy of and within the SNSF might be counterproductive, the evolutionary changes initiated through the well-functioning bottom-up process as well as through the other pillars of research funding described should suffice. But there might be some changes to the national research programs. These strong national programs are additionally important for the ability of the country to coordinate and pool resources with other countries in designated areas. It

might be possible to improve the selection criteria for the National Research Programs – and this in the direction of a more explicit orientation towards relevant challenges of societal development.

In conclusion it has to be said once more that the proven track record of the Swiss science landscape is such that major changes should not be recommended. This was a shared opinion among the members of the expert group.

As much as the expert group knows in no comparable country there is a superior approach towards strategy decisions. The experts believe that the Swiss system with its frequent interactions between different parts of the society and its track record of competitively funded research projects and its participation in European approaches – in particular for large infrastructure needs – is functioning so well that with the exception of the rather subtle changes recommended above no major change in direction should be considered.

Finally, the expert group would like to point to the utmost importance of collaborations between Swiss research programs and institutions and foreign counterparts both at the European and International levels. In particular, it is important for the Swiss scientific community to continue to be a most successful member of the EC scientific programs.

## Appendix, June 25, 2014

Answers to two additional questions of the SSIC

### **1 Transparency**

By using the word “transparent” what is meant is that the process of setting up priorities and reaching decisions on RI will be conducted in a coherent way. It should be based on open discussions leading to an agreement by all stakeholders. The roles and responsibilities of each partner should be clearly defined and accepted. The scientific community (i.e. the “customers”) should be aware of the process, be heard and participate in the discussions. Once decisions have been taken the whole community should be aware of them. The role and responsibilities of the “new body”, which is recommended to be set up as a national coordinator of the RI policies and support, should be “public knowledge”. This body will be responsible for defining and carrying policies, updating the road map, coordination with the EC program and setting up “brain storming” meetings on topics related to RI support. As such the new body should gain the trust of all players involved, notably of the scientific community. This is essential for the success of the choice processes and for avoiding unnecessary duplications. In carrying out the decisions based on the policies it should be made clear to the community what are the roles of the various bodies involved with RI support in Switzerland.

### **2 Profile of the SNSF**

It is proposed that the SNSF will continue its role in supporting RI in the responsive mode. The SNSF should be in charge of local/national RI funding, in particular those associated with the needs of the responsive mode research. In our view the SNSF should continue to initiate competitive calls for RI in the responsive mode. This should especially be the case for more expensive equipments which are harder for one institution to purchase and which serve several groups of researchers (notably researchers whose work is supported by the SNSF). The SNSF should also continue to support RI in the centers it established.

We also see the SNSF as having an important role in helping to upgrade/replace/renovate laboratory equipments.

All those activities of the SNSF should be done on a matching basis (dependent on contributions by other stakeholders).

The SNSF should at a minimum be an important member in the “new body” which will be set up looking at the national and international RI scene. This body will be in charge of policies, upgrading the road map, coordination with the EC, monitoring/controlling the effective and successful use of the RI. In these functions there is an overlap with the activities of the SNSF. Since this new body will coordinate the RI support within Switzerland, the input and expertise of the SNSF is essential.

One alternative possibility could be that this new body will be an autonomous body sitting near to the SNSF and getting administrative support from the SNSF. The SNSF has the experience of following up projects and evaluating their success and it should continue to be “the arm” of the “new body” in this respect.

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