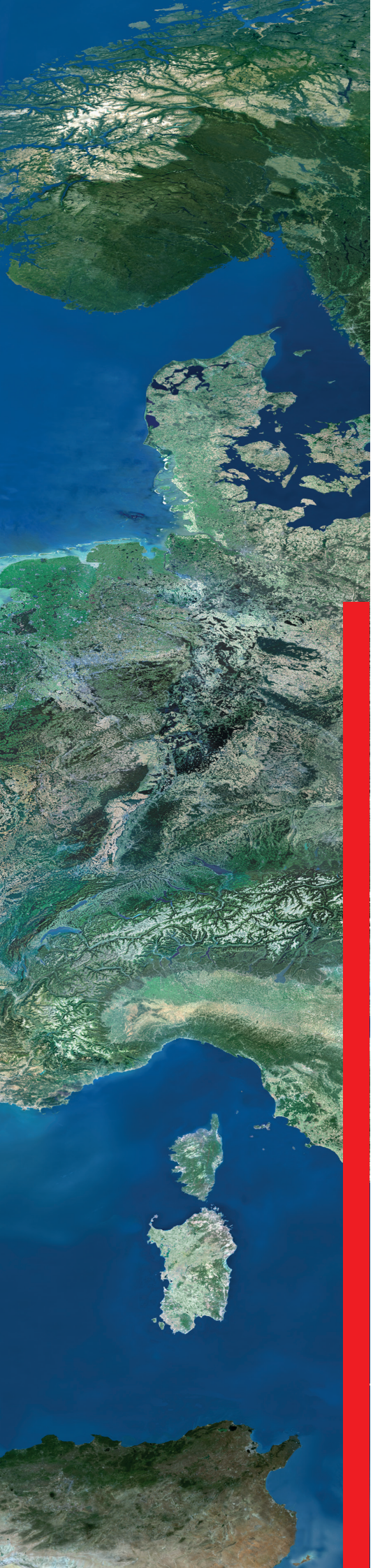

External evaluation of the Swiss Space Center

Final report

September 2019

STRATEGOS

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Executive summary

The Swiss Space Center

The Swiss Space Center SSC serves the entire Swiss space community with tasks such as networking, support to access space projects, specific training and dissemination of space-related information. Its mission is to contribute to the implementation of the Swiss space policy SSP and is linked to the Swiss Space Office SSO by an according performance mandate. Within this mandate, the SSC implements the SSO funding instruments, Call for Ideas CfI and Mesures de positionnement MdP. The Center federates thirty-eight member organizations from industry and research, who are represented in its Steering Committee.

Incepted in 2011, the SSC is an EPFL entity with a Board of Directors comprising representatives of the SSO, EPFL and ETH Zürich with a hub in Zürich.

Evaluation objectives

The main objectives were:

- to assess whether the SSC has achieved its target state and its contribution to the SSP, including the relevance of its positioning and role in relation to other space players;
- to outline possible directions of impact for a renewed SSC.

Evaluation methods

The evaluation was conducted according to the principles of the Swiss Evaluation Association SEVAL and the Appreciative Inquiry methodology, which seeks to build on successes to imagine a future state.

An evaluation model linking the SSP to the impact of the SSC provided the roster for the evaluation questions. Data was collected through desk research, interviews as well as a dedicated workshop. A logical flow was built between answers to the evaluation questions, key findings and final recommendations.

Key findings

Respondents aspired to an enabling operational engine, such as the SSC, to foster collaboration and help leverage relevant opportunities. The mission of the SSC is perceived as relevant as well as its instruments (funding, training, coaching, networking, dissemination). Refining its goals beyond contributing to the SSP could add clarity and help manage the expectations of the Swiss space ecosystem SSE.

Yet its actual governance and affiliation creates confusion as most stakeholders still perceive the SSC under the sole responsibility of the EPFL. Further the positioning of the SSC comes across as blurred, due to its location and its PhD staff as well as to the branding used by the next door EPFL Space Center (eSpace). Similarly, the SSC leadership is prone to receive contradictory injunctions from its various governance stakeholders, while trying to serve at best the Swiss space players.

The MdPs are especially valued, by academia and industry alike. Further, an ongoing internal monitoring and an external evaluation have demonstrated their positive impact. Yet, there is a call for a sharper strategy, greater communication on the process and on the ongoing coordination with other funding instruments.

Respondents thought that the present membership concept and the larger service portfolio had the potential to meet stakeholder needs and expectations even better. Several possible enhancements were mentioned. First, the SSC could play a stronger role in fostering cross-sectoral collaboration, especially between academics and industry, for instance in supporting the inception of space-related

projects, potentially emblematic projects. Second, the future SSC is seen to increase its support in access to funding, including to private investments. Thirdly, mapping the SSE (technologies, products and services, capacities, knowledge and ongoing projects) is seen as an important upcoming task. Fourthly, proposing intelligence on space trends and opportunities was called for by interviewees and workshop participants alike.

From an organizational perspective, formal processes defined in the Terms of Reference TOR are diligently implemented. Still, the processes are not used to serve at best SSC's mission and its members, as the potential leverage of such tools is much greater, including to ensure the required accountability. Further, the SSC successfully implements a large range of activities, yet it misses the opportunity to collect, analyse and publish as adequate qualitative and quantitative data on key activities, which impacts its accountability and learning processes.

The role of a federal body (i.e. the SSO), comprising its role in policy drafting and implementation, is most valued. Still, respondents asked for more clarity regarding the respective roles and tasks of SSO and SSC as well as within the Federal Administration. Today a common Swiss narrative on how the global, and more importantly the Swiss space ecosystem could look like in a decade hasn't been articulated. Hence, an important building block is missing to imagine a successful future Swiss Space Center, serving at best the country's interests. This is commonly a collective endeavour under political leadership.

Based on these findings, the mission, the goals and the operational model of the future SSC needs refining or possibly a complete review, depending on the target impact and the means needed to achieve it.

Main recommendations

The recommendations are outlined along two avenues: enhancing the present SSC and exploring the outlines of a future SSC.

a. Enhancing the effectiveness and efficiency of the current SSC

The mission and the associated tasks of the SSC were assessed as fully relevant. Networking activities were particularly valued. This process could be enhanced in transforming the SSC from a respected networking event organizer to an ecosystem facilitator. Such a role could include the identification of cross-sectoral projects as well as the reassessment of certain activities, such as the Working Groups. To ascertain that new activities correspond to actual needs and produce the target impact, these should be developed in consultation with the SSE and associated with KPIs. In the same way, a possible support to the SSE in accessing new markets as well as the launch an investment forum for space should be explored.

Several recommendations to enhance SSC's positioning as Swiss space facilitation body as well as its performance could be implemented immediately: using only swisscenter.ch email addresses, changing the affiliation of PhD students and clarifying its positing and role in relation to the neighbouring EPFL Space Center (eSpace).

To prepare the next phase, the SSO could start a discussion with various SSE players to outline respective expectations and available resources regarding the design of the future space facilitation scheme. SSE actors should take advantage of such an opportunity and participate actively in the process.

b. Exploring the outlines of a future SSC

The current transformation of the space sector was one of the factors which triggered this evaluation. The present facilitation scheme, especially the SSC, was perceived as having to evolve to meet new needs and allow the SSE to unfold its full potential. This opportunity window could also be used to update the 2008 Swiss space policy using the typical Swiss consultation process and develop a common narrative about the future SSE. This collaborative platform could further be used to design the future space facilitation scheme and define its impact priorities by considering needs, policies, targeted results, feasibility and resources. Broadening the scope of the SSC by involving relevant public administrations and non-space actors as well as including market development support and access to private funding should be considered. Once the new facilitation scheme in place, all relevant information should be published on an easily accessible webpage.

The exact outlines of the future space facilitation scheme and even more of the future SSC were on purpose left open. The main reason is that this should be part of an inclusive process involving the SSC as well as representatives of relevant stakeholders. The evaluators would like to emphasize that gathering a significant number of functionalities under one roof would enhance synergies and possibly create a physical location for space actors to meet. Contributing to the implementation of the Swiss Space Policy is likely to stay at the center of the mission of the future SSC. Therefore, reinforcing the coherence between its internal governance documents with that policy would help the SSC reach its target state. Further, moving the SSC to a more central location and equip it with the adequate organizational form would be conducive to the successful fulfilment of its role as a national space center. Finally, a diverse, multidisciplinary and representative board of directors would serve the same purpose as well as enhance its performance.

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Abbreviations and acronyms

AA	Annual Assembly
AI	Appreciative Inquiry
ANC	Activités Nationales Complémentaires
ASA	Aeronautics and Space Agency of Austria
BoD	Board of Directors
CFAS	Federal Commission for Space Affairs
CRM	Customer Relationship Management System
EAER	Federal Department of Economic Affairs, Education and Research
EIB	European Investment Bank
ERI	Education Research and Innovation
ESA	European Space Agency
ESA BIC	ESA Business Incubation Centre Switzerland
EU	European Union
ICT	Information and communications technology
IKAR	Interdepartmental Coordination Committee for Space Affairs
IP	Intellectual Property
KPI	Key Performance Indicators
PoC	Point of Contact
PPP	Public-Private Partnership
PSI	Paul Scherrer Institute
RTI	Research Technology and Innovation
RTO	Research and Technology Organisation
SC	Steering Committee
SERI	State Secretariat for Education, Research and Innovation
SEVAL	Swiss Evaluation Association
SMEs	Small and Medium Entreprises
SNSA	Swedish National Space Agency
SSE	Swiss space ecosystem
SSIG	Swiss Space Industries Group
SSIP	Swiss Space Implementation Plan
SSO	Swiss Space Office
TRL	Technology Readiness Level
UAS	Universities of Applied Sciences and Arts
WSL	Swiss Federal Institute for Forest, Snow and Landscape Research

1. INTRODUCTION

The evaluation report is structured in nine parts: (1) Introduction, (2) Methods, (3) Context, (4) The current Swiss Space Center, (5) Exploring the outlines of a future SSC, (6) Implications and recommendations, (7) Concluding remarks, (8) Acknowledgements and (9) Appendixes.

The evaluators aimed to deliver a coherent and accessible document with well-founded and traceable recommendations. This report should further serve as a reference while defining and deploying a renewed SSC.

1.1 The Swiss Space Center

The Swiss Space Center SSC serves all Swiss space industry and science players, with a focus on the following areas:

- National and international networking,
- Support for access to space projects,
- Provision of specific training courses,
- Dissemination on the relevance of space exploration.

Incepted in 2011 by the SERI, EPFL and ETH Zurich, the SSC is headquartered at EPFL, which comes up for its legal and administrative duties. Legally, the SSC is a unit of EPFL and has a hub in Zurich.

The SSC is funded by EPFL, ETH Zurich and its members. This funding is complemented by an annual subsidy from the SERI within the framework of the Federal Act on the Promotion of Research and Innovation (LERI, Art. 29) and the Federal Dispatch for the Promotion of Education, Research and Innovation, through a performance mandate. The founding members (SERI, EPFL and ETH Zurich) constitute its Board of Directors BoD.

At the beginning of 2019, the SSC features 38 member organizations from the academic and industrial sectors (universities, R&D organisations, companies).

1.2 Evaluation framework

a. Purpose of the evaluation

A periodic evaluation of a subsidy recipient, such as the SSC, is a legal obligation by Federal Law[1]. Given the complexity of its mission, its affiliation and the fast-evolving space environment, the SSO used the opportunity to scope the evaluation with the following objectives[2]:

- assess the extent to which the SSC has achieved its objectives and how it contributes to the implementation of Swiss space policy, particularly in relation to the major goals of the *Activités nationales complémentaires* ANC[3];
- highlight the contribution of the SSC towards implementation of the strategic objectives of the Federal Council for the ETH Domain, particularly related to the strengthening of the ETH's leadership position in international research;
- identify potential overlaps between the SSC and other academic and industrial actors as well as conflicts of interest that may arise as a result of current governance (real or perceived by the community);

[1] Article 25 of the Subsidies Act provides the legal basis for the evaluation: the competent authority must ensure that the beneficiary of a grant performs the task entrusted to it (616.1, Loi fédérale sur les aides financières et les indemnités, Loi sur les subventions, LSu).

[2] From the Terms of references of the evaluation

[3] The ANC is the budget devoted to Swiss national space activities complementing the financial Swiss contribution to ESA.

- analyse the division of tasks between the SSO and the SSC as it has been done so far;
- examine possible scenarios for the development of the Center, in particular the possibility of extracting it from the ETH Domain.

b. Object of the evaluation

The evaluation covers the Swiss Space Center, including:

- the various task areas that relate to the mandate of the SSO and those that are not directly related to it;
- its governance structure;
- the interfaces between the SSC and the SSO, the two Federal Institutes of Technology, Swiss universities and industry (members and non-members of the Center);
- its international activities.[4]

The period under review is primarily 2015 to 2018.

Out of scope are the day to day operations of the SSC as well as its detailed organisational set-up, including the roles and responsibilities of its staff as well as the internal processes.

c. Evaluation stakeholders

Broadly speaking, a stakeholder is a person, group or organization that has interest or concern in an organization and who can affect or be affected by the organization's actions, objectives and policies.

The main stakeholders of the evaluation are those with a primary interest: The SSC leadership and staff, its governance (Board of Directors and Steering Committee), its main funder and sponsor of the evaluation (SSO and its governance), its members (academia, industry and Research and Technology Organisations RTOs) as well as its clients (such as members having a service agreement beyond the standard membership counterparts). Stakeholders with an indirect interest are the private sector and universities, as well as students and the Swiss population.

The interview targets and the workshop participants were essentially stakeholders with a primary interest. They were chosen in consultation with the sponsor.

1.3 What is at stake?

Considering the Swiss space policy and its implementation plan, the SSC governance and mission as well as the evolving Swiss ecosystem, the evaluators perceive the following challenges:

- How to further the impact of the SSC and increase its freedom of action while building on its reputation, experience, activities and network of seven years of activities?
- How to sharpen its strategic goals and strengthen its agility to enhance the capabilities of a shifting ecosystem, while clarifying its role as a contributor to the implementation of Swiss space policy and to the promotion of research and innovation?
- How to better position the SSC compared to other education, research and innovation promotion programmes, in order to leverage and not compete with existing entities?
- What adjustments to make to clarify its portfolio of activities, governance and interfaces to avoid conflicts of interest and competition with its members?
- What processes to develop to ensure that scientific and industrial actors have direct and structured access to relevant scientific, technological and commercial information, particularly related to ESA?
- How to ensure a clear and efficient division of tasks – subsidiarity – between the SSC and the SSO?

[4] Ibidem

1.4 Limits of the evaluation

A first limitation of such an evaluation is the establishment of clear links between actions and impacts, direct or indirect. Multiple stakeholders and a complex system make it difficult to attribute an impact to specific measures.

As usual for the evaluation of an organization in a complex system, resources also constrained the process, for instance in terms of number of interviewees. In Switzerland, 26 persons were interviewed on a one to one basis. This limited sample means that a granular numerical interpretation by sector was statistically not significant. Therefore, the evaluators chose to mostly return the answers as proportions rather than as actual numbers.

To be considered as well is that neither the students nor the general public were consulted, both significant audiences of the SSC.

2. METHODS

2.1 Approach

The evaluation was conducted according to the principles of the Swiss Evaluation Association SEVAL[5].

The summative aspect, a comparison between the postulated and achieved target state, was conducted according to the current evaluation standards. In other words, did the SSC achieve the target state set out by its mission and its strategic plan?

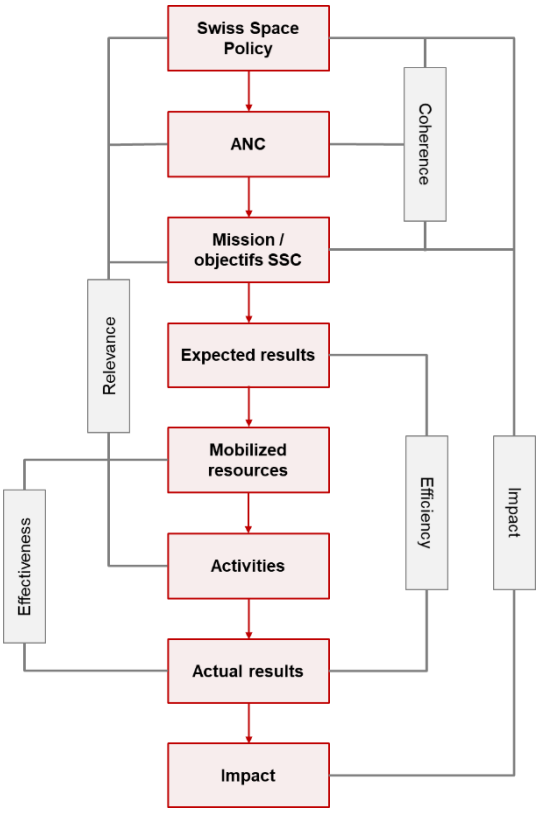
Based on the results achieved, possible interventions or corrections were developed in order to increase the probability of achieving the target state. The formative aspect of the evaluation was enhanced with the Appreciative Inquiry methodology, be it in the interviews, the workshop or the evaluators' approach.

> "**Appreciative Inquiry** AI is described as the cooperative search for the best in people, their organizations, and the world around them. (...) AI has been applied to evaluation in ways that build upon strengths and generate support for improvements. An initial criticism of AI can be that it focuses only on positivity and fosters an unrealistic view of human experience. Contributing to tension with the AI process is a mistaken belief that negative phenomena will be ignored. However, evaluators using AI have found that its appreciative questions, reframing, and generative features set the stage for sound assessment of worth as well as offer potential for powerful solutions."[6]

2.2 Evaluation model and questions

To ensure that all aspects the impact model (concept, implementation, outputs, impacts and outcomes were covered the following evaluation model was developed.

Figure 1 : Evaluation model



[5] (2016). SEVAL, standard https://www.seval.ch/app/uploads/2018/01/Standards-SEVAL-2016_f.pdf

[6] (2014). MacCoy, J. (n.d.). Appreciative Inquiry and Evaluation – Getting to What Works. The Canadian Journal of Program Evaluation.

The evaluation questions were drafted by matching up the impact model, the evaluation model, the sample evaluation questions of the terms of references and the reformulated questions based on the learnings from the kick-off meeting[7].

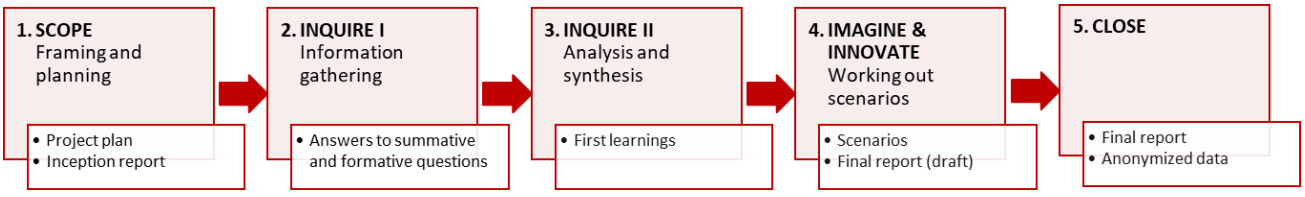
The corresponding evaluation questions are:

Coherence between Swiss space policy and SSC mission and objectives	- Is the mission of the SSC appropriate to implement the partial aspect of space policy to be analysed?
Relevance of the missions in the context of Swiss space policy	- What is the nature, extend and quality of the contribution of the SSC to the Swiss space policy?
Relevance of activities in regard to the mission of the SSC	- Do the services of the SSC correspond to its mission?
Efficiency of activities in relation to the expected results	- Do the results obtained correspond to expectations?
Effectiveness of activities in achieving actual results in relation to the mobilized resources	- Are they sufficient in relation to the resources committed?
Impact of the activities	- Have key scientific, technological and industrial skills as well as competitiveness of Swiss actors in the space sector been strengthened? - Are actors of the Swiss space ecosystem using the services of the SSC? Could the SSC strengthen its expertise? Has it strengthened the network between Swiss space stakeholders? - How is the role of the SSC perceived? Does it facilitate access to and implementation of space projects for research institutions, industries and all stakeholders in Switzerland?
Effectiveness of the whole system	- What changes might make the ecosystem more effective?

2.3 Methodology

The evaluation unfolded according to the five planned phases:

Figure 2 : Evaluation phases



To answer the evaluation questions, the team drew on data collection methods, such as data and document review, face to face interviews, workshops or observation[8]. Contributions were collected via 29 interviews and a workshop with 17 participants[9].

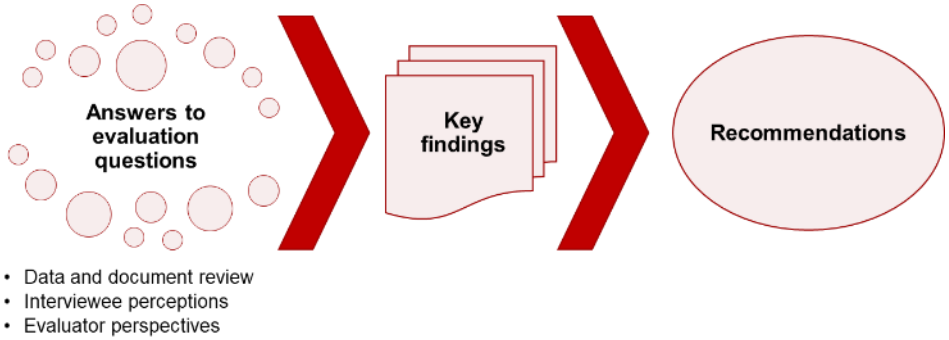
[7] See appendix A.1 Interview canvas in reference to evaluation model, page 68
[8] See appendix A.2 Data collection methods, page 70
[9] See appendix A.3 Anonymized list of interviewees and workshop participants, page 72

For each set of evaluation questions, the answers were considered from three different perspectives:

a. Data and document review (SSC public and internal documentation);
b. Interviewee perceptions
c. Evaluator perspectives

From these perspectives, a set of findings were drafted at the end of each section. Finally, recommendations were drawn from a summative and formative viewpoint. These are written in a sober tone, to render them easier to refer to.

Figure 3: Abridged logical flow, from answers to recommendations



3. CONTEXT

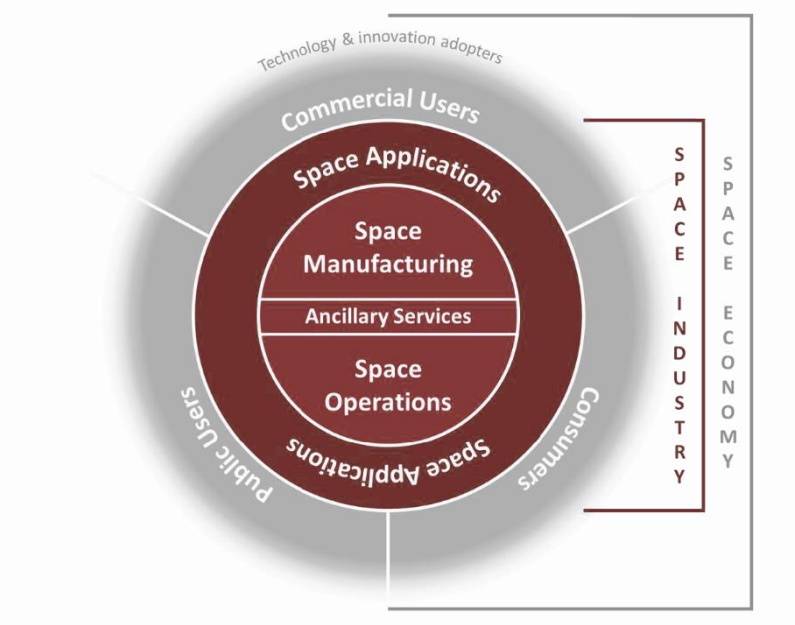
A common understanding of the context is needed to assess the present role of the SSC and possibly contemplate its future activities and impact. This include the space economy, the Swiss strategic framework and the relevant Swiss space bodies.

3.1 The space economy

Defining the space economy is no small endeavour, the more that it entails space and non-space actors. The OECD drafted the definition below, which is widely accepted:

"The space economy is the full range of activities and the use of resources that create and provide value and benefits to human beings in the course of exploring, understanding, managing and utilising space. Hence, it includes all public and private actors involved in developing, providing and using space-related products and services, ranging from research and development, the manufacture and use of space infrastructure (ground stations, launch vehicles and satellites) to space-enabled applications (navigation equipment, satellite phones, meteorological services, etc.) and the scientific knowledge generated by such activities. It follows that the Space economy goes well beyond the space sector itself, since it also comprises the increasingly pervasive and continually changing impacts (both quantitative and qualitative) of space-derived products, services and knowledge on economy and society."[10]

Figure 4: Space economy[11]



This comprehensive description applies to the Swiss space economy alike.

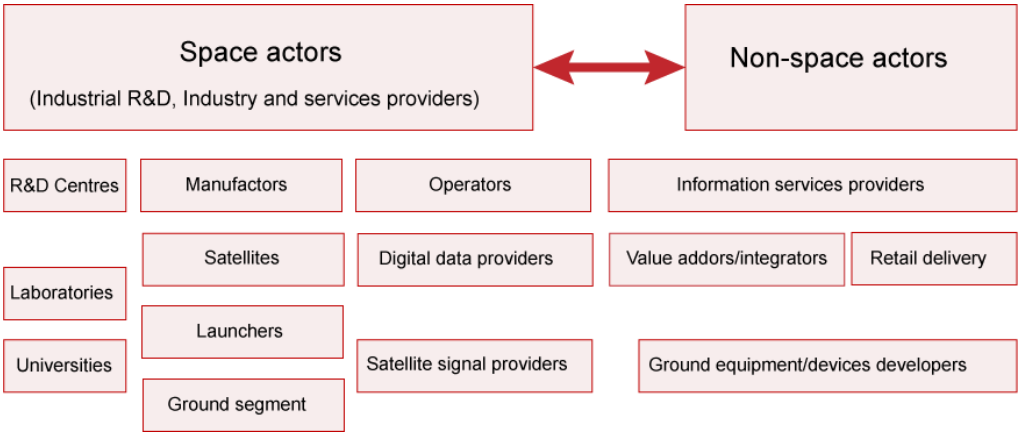
Swiss space actors prefer the term **Swiss space ecosystem** to the Swiss space economy as it includes actors connected through non-commercial relationships. The evaluators will therefore refer to the Swiss space ecosystem in the rest of the document.

[10] (2012). OECD Handbook on Measuring the Space Economy (OECD), page19
[11] (2019). Size & Health of the UK Space Industry 2018 (UK Space Agency. (n.d.). Size & Health of the UK Space Industry 2018.), page 3

a. The space value chain

Like in other industries, space-related products and services can be structured along a value chain. The space value chain usually starts with public or private research that aims to yield benefits for the public and private sectors as well as citizens. The space economy tends to include an increasing number of actors from the ICT sector compared to the aerospace or defence sectors given the growing potential of data exploitation.

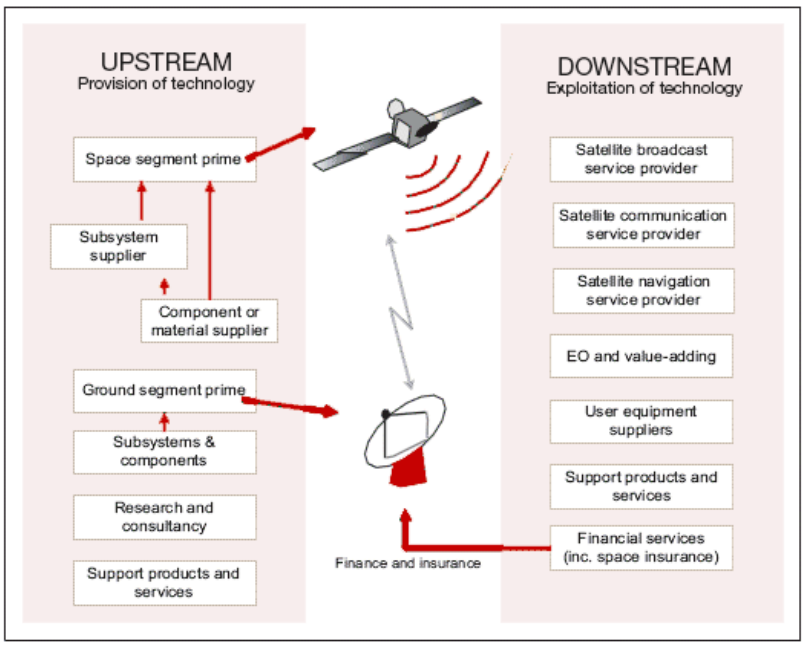
Figure 5: The space economy's simplified value chain[12]



b. The upstream and downstream segments

Another way of looking at the space economy is clustering it into upstream and downstream activities. The upstream segment entails the provision of technology such as space prime contractor, contract R&D, space component supplier, or space subsystems. The downstream includes the exploitation of technology like satellite broadcast services, Earth observation and remote sensing, financial services and satellite communications. The dominant area in terms of economic value is satellite communications in the downstream segment. R&D is involved in both segments.

Figure 6: The space sector: upstream vs. downstream[13]



[12] Adapted from (2011). The Space Economy at a Glance (OECD), page 15
[13] (2006). Size and health of the UK space industry (BNSC), page 4

To facilitate the linkages between the upstream research and industry segments and the downstream applications is one of the main arguments used for state involvement in the space economy: “Without the R&D-intensive, infrastructure-forming upstream segment, there would be no lucrative commercial infrastructure-exploiting downstream applications. Yet except the case of vertically integrated companies, there is no feedback or re-investment loop between them”[14]. This also touches upon the concept of space as public good, adding thus another rationale for such investments.

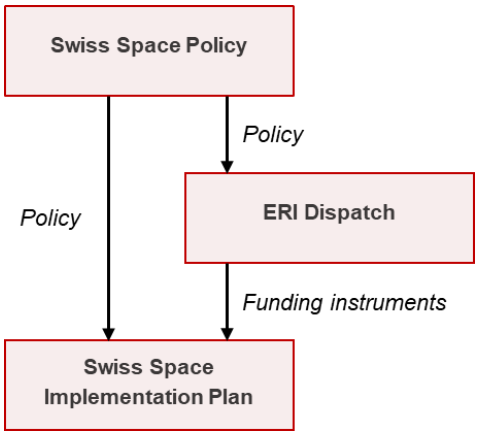
c. NewSpace

A further concept increasingly used in the sector is that of NewSpace: "NewSpace is an approach that focuses on lowering the barriers to entry to space industry, by providing cheaper access to space [and] more high-quality and affordable data from space that can be put to use here on Earth, for the benefit of scientists and the general public. ... [One] of the major characteristics of the NewSpace era [is the] the fundamental shift from an industry which was heavily dependent on government agencies (and taxpayers’ money) to a more agile and an independent private sector that relies on innovation, working with much smaller budgets than the early space industry.”[15]

3.2 The Swiss policy framework

The three main instruments are the Swiss space policy, the Swiss space implementation plan and the ERI Dispatch. The graph below illustrates how they relate to each other.

Figure 7: Context scheme of the Swiss strategic framework[16]



a. Swiss space policy

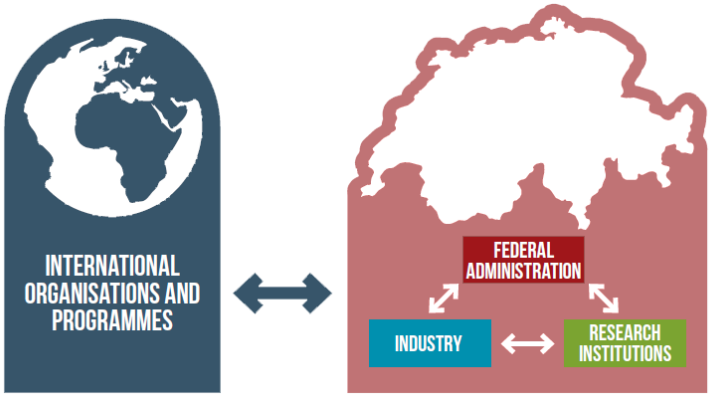
The Swiss space policy sets the direction for the Federal Administration and the country as a whole. Revised in 2008, it is based on the following three pillars[17] :

1. develop and use space applications to improve the quality of life for Swiss citizens;
2. ensure a long-term commitment to space exploration for the progress of innovation and the knowledge society;
3. provide significant scientific, technological and industrial contributions to make Switzerland a competitive, reliable and vital partner.

[14] (2015). London Economics. The Case for Space.
[15] (2019), Namta, Gurav, Let's talk about NewSpace, (SatSearch).
[16] (2013). Swiss space implementation plan 2014-2023, page 8
[17] (2018). Révision de la politique spatiale suisse.

The policy includes similarly the consolidation and development of the Swiss participation in specific space infrastructure, strengthening the leading position of Swiss scientists and maximising returns on investment in space technologies for the Swiss economy. Thus, national and international cooperation must be enhanced, specific areas and technologies supported, and federal instruments adjusted.

Figure 8: Context and main stakeholder groups for Swiss space activities[18]



Further, the Federal Council Dispatch on the promotion of education, research and innovation for the years 2017 to 2020[19] highlights the transformation of the sector: "Space activities are no longer only a multiplier of scientific and technological know-how, but also a global commercial sector"[20]. Therefore, the aim is to ensure that "Switzerland has access to public procurement, data and international cooperation in all space activities or programmes that it considers important for its national interest"[21].

In this context, the State Secretariat for Education, Research and Innovation SERI "consider that the space landscape is a business ecosystem: a dynamic structure which consists of interconnected small firms, large corporations, universities, research centers, public sector organizations, and other parties which influence the system "[22].

It is in this changing environment that the SSC is expected to accomplish its mission and contribute to the implementation of the Swiss space policy.

b. Swiss space implementation plan

The Swiss space implementation plan within Education, Research and Innovation ERI for 2018-2020 (SSIP) details how the corresponding sections of the Dispatch are being implemented. The SSIP stresses that a paradigm shift has taken place in recent years. First, the private sector is increasingly solicited to take on greater responsibility and shoulder larger operational risks. Further, the emergence of low-cost micro and even nanosatellites has lowered entry barriers to space. Thirdly, the number of national players in the space ecosystem increased by 10% per year between 2014 and 2017 with the arrival of subsidiaries of major integrators, a satellite operator as well as new companies.

The document states that the challenge for Switzerland, as a nation active in space, is to define its position more precisely regarding:

- its increased dependence on space infrastructure as a modern state;
- the promotion of its interests in an enlarged European Space Agency ESA, with new actors and initiatives;
- its role in European space efforts as a non-member of the European Union EU;

[18] (2016) Swiss Federal Department of Foreign Affairs FDFA. Switzerland in space: Cutting-edge research and high-tech solutions – for everyday life.
[19] (2016). Federal ERI Dispatch (16.025).
[20] Ibidem, page 3052.
[21] Ibidem, page 3053.
[22] (2018). SSIP 2018-2020, page 11.

- the limited market access for Swiss actors in space (no national market, limited access to EU markets);
- the growing global competition from public and private actors alike.

c. The ERI Dispatch

The four-year dispatches that the Federal Council submits to the Federal Assembly provide an explanation of the bills it drafts. The next ERI will cover the period 2021-2024 and will be put to the vote in 2020.

The present evaluation will be one of the inputs that the SSO will consider when drafting the section related to space activities.

3.3 Relevant federal bodies

Significant bodies for this evaluation are the Swiss Space Office, the Federal Commission for Space Affairs, the Interdepartmental Coordination Committee for Space Affairs and the ETH domain.

a. The Swiss Space Office

Positioned within the State Secretariat for Education, Research and Innovation SERI of the Federal Department of Economic Affairs, Education and Research EAER, the Swiss Space Office SSO:

- prepares the Swiss space policy and implements it in close cooperation with relevant federal entities;
- safeguards national interests by contributing to ESA policies and programmes;
- prepares and implements the complementary national activities ANC (Activités Nationales Complémentaires);
- ensures interdepartmental coordination via the Interdepartmental Coordination Committee for Space Affairs (IKAR);
- heads the Secretariat of the Federal Commission for Space Affairs CFAS;
- serves as point of contact at strategic level for scientific institutions, industry and users.

b. Federal Commission for Space Affairs

The Federal Commission for Space Affairs CFAS is an extra-parliamentary commission, which

- advises the Federal Council on matters relating to a coherent and forward-looking space policy by taking into consideration the European and global development as well as the national interests (amongst others of political, application-oriented, scientific, technological and industrial nature);
- issues recommendations to the Federal Council regarding the implementation of this policy;
- advises the Federal Council in terms of the evaluation of proposals for projects with important scientific or technological relevance.

The SSO serves as the secretariat for the CFAS[23].

c. Interdepartmental Coordination Committee for Space Affairs

The Federal Council has given the Interdepartmental Coordination Committee for Space Affairs IKAR a mandate to prepare official Swiss position papers on space. IKAR also coordinates the activities of various federal agencies involved in space affairs. IKAR is chaired by the Swiss Space Office, which also serves as the secretariat for IKAR.

[23] Federal space bodies (SBFI), https://www.sbfi.admin.ch/sbfi/en/home/research-and-innovation/space/bodies.html

d. The ETH Domain

« The ETH Domain comprises the two Federal Institutes of Technology ETH Zürich and EPFL, the four research institutes PSI, WSL, Empa and Eawag, as well as the ETH Board (a strategic management body) and the Internal Appeals Commission of the ETH (an independent appeals body).”[24]

The ETH Act defines the purpose of the two Federal Institutes of Technology and the four research institutes as follows:

- to educate students and qualified staff in scientific and technical fields and to provide permanent continuing education;
- to expand scientific findings through research;
- to foster upcoming young scientists;
- to render scientific and technical services;
- to perform public relations activities and to exploit research findings.

As the EPFL is its signing authority, the SSC is de facto in the ETH domain.

3.4 The Swiss space ecosystem

The Swiss space ecosystem SSE is “the full range of activities, (actors) and the use of resources that create and provide value and benefits to human beings in the course of exploring, understanding, managing and utilising space”[25] in Switzerland.

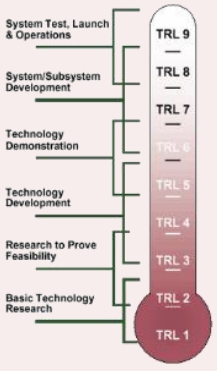
a. Data and document review

In its Terms of Reference, the SSC is set out to provide services to three stakeholder categories: academia, Research and Technology Organisations RTOs, industry[26]. Academia is mainly active in space-related fundamental or applied research that can be used for related infrastructure, instruments or applications, as well as in relevant education programmes. RTOs provide one of the bridges between basic research and industry, focusing on middle Technology Readiness Levels TRLs. The industry includes multinationals, SMEs and start-ups aiming to serve the market with performant and profitable space-related products and services. The Earth Observation and Remote Sensing community, mainly academia but also SMEs and public administration, can be seen as more at the margin of the sector given their specific focus.

Further SSE stakeholders, the public sector at large, and the end users or general public, are not SSC constituents.

Technology Readiness Levels TLRs are “a set of management metrics that enable the assessment of the maturity of a particular technology and the consistent comparison of maturity between different types of technology - all in the context of a specific system, application and operational environment”.
Figure 9 “provides a high-level illustration of the TRL scale, using the well known “thermometer diagram” as a metaphor for increasing technology maturity, in the context of the progression from basic research to system operations.”[27].

Figure 9: Technology Readiness Levels – Thermometer Diagram



[24] ETH Domain (ETH Rat) https://www.ethrat.ch/en/eth-domain/overview
[25] (2012). OECD Handbook on Measuring the Space Economy (OECD), page 19
[26] (03.10.2015). Swiss Space Center, Terms of reference. 7 I Rev. 0, page 5.
[27] (2008). Technology Readiness Levels Handbook for Space Applications (ESA), page 1-2

b. Interviewee perceptions

Lessons learned from past successes

In order to identify the key factors and facilitators within the space ecosystem and its framework conditions, the evaluators asked the interviewees to describe a peak experience or a major success related to space related activities in general.

The experiences described include, in decreasing order, the participation to ESA missions or projects, developing satellite parts or instruments or enabling others' successes in these two areas. Together, they made out over three quarter of the successful projects mentioned by the interviewees.

Iconic projects, such as Igluna[28], Ariane's payload fairing, Rosetta mission, SwissCube, etc. were of course mentioned, and in general, the stated experiences were mostly project driven (e.g. ESA projects, joint projects between academia and industry, or projects involving data usage).

Unsurprisingly, people and funding were seen as the main drivers of these successes. Networking and collaborations were therefore often mentioned (more than two third of the interviewees), especially academia and industry collaborations and effective leadership. Funding covered different realities, such as fundraising support, project funding (the Mesures de positionnement MdP mentioned three times), and the capacity to attract private investors for specific projects or to help young companies through the "valley of death". The political support to position Switzerland on the international space map was also pointed out as instrumental as a result of political lobbying, participation in ESA projects and the international reputation of the Swiss scientific community at large.

The **Mesures de positionnement MdP** is a SSO funding instrument aiming to reinforce the technological and scientific capabilities of Swiss entities in the space sector. Managed by the SSC, the funding entails a maximum amount of 250 000 CHF per selected study with a call for proposal taking place every other year.[29]

Coordination needs and practice

Interviewees were keen to participate in better relationship-building and coordination between space actors. A majority from academia and industry asked for an engine to drive this coordination in two main areas: (a) the ability to identify and share information regarding competences, opportunities, actual research topics and resources (infrastructure or people); (b) facilitation of networking, dialogue, events, workshops, courses or coaching.

More institutionalized, systematic and structured networking and coordination processes were called for by a third of the interviewees (academy and industry). Possible levers could be a facilitating body, digital platforms or regular events. Such levers are expected to focus on specific topics, such as ongoing research, access to funding, cross-sectoral collaboration, process optimization or digital developments. Emphasized was as well the value of conducive soft factors, like candid dialog, trust, transparency or clarity of roles.

Regarding the role of the state, some wished for a Swiss Space Agency, yet another said that the State should not intervene in the private sector at all. A clear minority either didn't have an opinion or thought that it should stay as it is.

Nowadays, collaboration is said to rely on personal contacts and networks, other associations (e.g. the Swiss Space Industries Group SSIG), specific projects and, for few, the SSC.

[28] Igluna is a student field project taking place on a glacier in Zermatt in July 2019. See 4.4 Activities and instruments, page 27 for details.
[29] SSC website, https://www.spacecenter.ch/activities/fundingopportunities/mdp/

The **Swiss Space Industries Group SSIG** is a Swissmem expert group consisting of industries and RTOs, with the aim to promote its members interests and collaboration[30].

c. Evaluators' perspective

Eventually, it is all about mobilizing the right people around the right project, about effective ecosystem facilitation fostering a bottom-up approach. Therefore, respondents asked for more coordination, and possibly implied a more assertive yet thought leadership.

Key findings

1. The role of a governmental body (i.e. the SSO), including the drafting a space policy matching the capabilities of the Swiss space ecosystem, is valued.
2. Respondents aspire to an enabling operational engine, such as the SSC, to foster collaboration and help leverage relevant opportunities.
3. Cross-sectoral collaboration, especially between academics and industry, is critical for the competitiveness of the Swiss space sector.

[30] SSIG website http://www.weltraum-schweiz.ch/#home-section

4. THE CURRENT SWISS SPACE CENTER

This section is devoted to the analysis of the current Swiss Space Center as part of the summative angle of the evaluation. It looks at the mission, governance, membership, activities and instruments, outputs and outcomes, impact, organizational set-up, internal processes and finance of the SSC, and includes an analysis of three foreign space entities.

4.1 Mission

a. Data and document review

The mission of the Swiss Space Center is to contribute to the implementation of the Swiss space policy. It is headquartered at the EPFL and has a hub at the ETH Zürich. It supports academic institutions, RTOs and industry in in accessing space missions and related applications and promotes interaction between these stakeholders. “Its main tasks are to:

- network Swiss research institutions and industries on national and international levels in order to establish focused areas of excellence internationally recognized for both space R&D and applications;
- facilitate access to and implementation of space projects for Swiss research institutions and industries for established actors as well as for newcomers;
- provide education and training;
- promote public awareness of space among the Swiss public.”[31]

b. Interviewee perceptions

The Swiss space policy is designed to set directions of impact for the Federal Administration. The mission of the SSC is to contribute to its implementation. Therefore, understanding the stakeholders’ perceptions on the following issues is key:

- Opportunities and challenges of the Swiss space ecosystem;
- Relevance of SSC’s mission regarding opportunities and issues of the SSE;
- SSC’s contribution to the Swiss space policy and policy relevance for the SSE;
- SSC’s contribution to the SSIP goals;
- Relevance of SSC’s mission and tasks for the SSE stakeholders.

Opportunities and challenges of the Swiss space ecosystem

The interviewees thought that the SSE is facing three main issues: competitiveness and market access for the industry players and availability of funding for the other respondents.

The industry linked competitiveness first to external factors such as local framework conditions, especially the Swiss franc exchange rate. Regarding market access, respondents mentioned Switzerland’s position within ESA (half of the respondents) and the related European Horizon 2020 programme[32]. Internal factors came up as well, such as innovation capacity, time to market, process efficiency, customer orientation, R&D funding or industrialisation methods and capabilities.

Academia saw the amount and allocation of funding as its main challenge, as the number of space actors is increasing, and the funding remains quite constant. Thus, the potential funding per actor tends to shrink. Researchers articulated several ideas concerning funding allocation: more funding should be directed towards:

[31] Swiss Space Center, Terms of reference, 03.10.2015, 7 I Rev. 0, page 5.

[32] « Horizon 2020 will enable the European space research community to develop innovative space technologies and operational concepts "from idea to demonstration in space", and to use space data for scientific, public, or commercial purposes.” Source: Space section, Horizon 2020. https://ec.europa.eu/programmes/horizon2020/en/h2020-section/space

- projects with high technology readiness level (beyond TRL 3 with proof of concept) up to marketable products and services,
- a full-sized Swiss project,
- mature non-space companies to “spacify” their products and services rather than only funding start-ups,
- applications, data processing, space logistics, or
- to Universities of applied sciences and arts UAS.

Regarding ESA, worries regarding a possible lower access to ESA projects and non-participation to the next phase of Copernicus were voiced as well. Academia found it at times challenging to work with companies. Reasons were intellectual property IP issues, technical certifications slowing down industrialisation processes or industry’s preference for recurring business.

Likewise, for the other interviewees, funding was an issue in terms of amount and allocation with an ask for clearer focus areas, more funding for research – also coming from the industry (e.g. financing a university chair), or the participation in the next Copernicus phase. A large proportion of interviewees called for more communication about the Swiss ESA and SSO budgets, Swiss space policy as well as about space in general. Further, Switzerland should deal with following issues to assert its competitiveness: enhance formalisation of business innovation cycle, strengthen academia-business collaboration as well as increase development and industrial process effectiveness. Finally, NewSpace emergence was mentioned by most as was the need to move towards commercial financial streams.

Relevance of SSC’s mission regarding opportunities and issues of the space sector

All respondents but a few considered the mission of the SSC to be most relevant. Some thought that specific tasks such as education or public awareness should be transferred to other actors (universities and SSO respectively). Another respondent pointed out that SSC’s mission regarding Earth Observation and Remote Sensing was unclear.

More than 60% of interviewees across sectors thought that something was missing in SSC’s tasks, such as:

- Facilitating access to and development of commercial projects (industry);
- Pooling of resources, especially in terms of space sector intelligence (industry and academia), and an industry was ready to pay for it as a service;
- Driving access to funding, knowledge transfer and altogether “managing and nurturing the ecosystem in a modern and effective way”.

Contribution to the Swiss space policy and policy relevance for the SSE

Overall, the picture is positive, and respondents agreed that the SSC is supporting the implementation of the SSP. Swiss competitiveness is considered to be the main pillar it is contributing to.

Industry actors thought that the third pillar (competitiveness) of the Swiss space policy was the most relevant one for the SSC. The SSC was seen to be primarily contributing through networking, training and public awareness. These contributions are of particular interest to actors with limited resources. As an example, regarding relevance, a respondent stated: “pillar 1 (space applications) is key, and the SSC should support it even more (including Copernicus). The SSC should also address the Digital Switzerland challenge and related initiatives (science and application development), as space must be an important player there”. Some industry stakeholders weren’t able to give a clear answer, either because they weren’t aware enough of SSC’s activities or missed means to assess it.

For the vast majority of academia interviewees, the SSC is contributing to the Swiss policy implementation. One person though thought that it didn’t, the reason being its EPFL affiliation and the lack of clear positioning due to the inclusion of research activities. Regarding relevance of the SSP for the SSC, a respondent noted “SSC’s mandate and goals are not clear: is it its intention to grow and use others as satellites (like an agency) and become the sole supervisory body? Where do people want it to be? “. In terms of relevance, competitiveness came first (pillar 3), followed by space exploration (2) and space applications (1).

Of the remaining interviewees, who were neither academic nor industrial, 6 thought that the SSC was contributing to the SSP, 2 didn't and one said he could not answer. In terms of relevance, the third pillar came first for most respondents, followed by pillar one.

SSC's contribution to the SSIP goals

The SSC was seen as clearly strengthening the Swiss space community with an evaluation of 7.5 out of 10, fostering competitiveness and excellence (6/10) and contributing to Digital Switzerland (3/10) (4 people didn't know). Actors from the public administration did not really feel affected by SSC activities, and, again, comments about the insufficient involvement in applications came up. Two mentioned that the SSC was not doing enough for established actors.

Relevance of the SSC mission and tasks for the SSE stakeholders

For almost all industry stakeholders, SSC mission regarding education was the most valued for their own business. For academia and the remaining respondents, relevance for their own work was spread between the four SSC main tasks.

c. Evaluator perspectives

Opportunities and challenges of the Swiss space ecosystem

The third task of the SSC is to facilitate access and the implementation of space projects for Swiss actors. As ESA is the main conduct for these projects, the substantial Swiss investment in ESA is conducive to the sector's development and fosters its innovation capacity and execution excellence. Still, the changing EU-relations as well as the developing NewSpace approach affect the Swiss space economy. EU-relations depend mainly on state-level negotiations, whereas the implementation of the NewSpace approach on the transformation capacity of the sector itself. Thus, competitiveness came up frequently as an industry worry, and possibly it should be also a greater one for the academic sector, given the rising competition from new actors. Finally, market access was key for industry and academia alike in the present setting.

Further, there is a need to make the sector more attractive for private investors, financially, but probably also regarding a better understanding of the stakes, processes and opportunities. The SSC could play a critical role as of furthering private investments in space projects.

Relevance of SSC's mission regarding opportunities and issues of the space sector

The mission was seen as relevant for the sector, together with the tasks set to implement it. Yet, most respondents weren't clear about SSC's goals, and therefore also questioned the content of some of its tasks. This confirms not only the need for a facilitating body such as the SSC, but also that the outlines of its mission correspond to the needs of the respondents. Regarding the tasks serving this mission, the evaluators see networking rather as a mean to reach a given goal than as a strategic task per se. In addition, an opening emerges to evaluate further tasks such as the pooling and sharing of resources (intelligence, infrastructure, knowledge-transfer and access to funding) and to better spell out the possible role of the SSC in application-related projects.

Contribution to the Swiss space policy and policy relevance for the SSC

The SSC was perceived as contributing mainly to the third pillar (competitiveness) and was expected to support more first pillar (applications). How the SSC can and should back space exploration more effectively demands further investigation.

SSC's contribution to the SSIP goals

The connection between the SSC and Digital Switzerland does not seem to have fully taken place yet. If such a collaboration would make sense depends on the involvement of the SSC in the downstream sector.

Relevance of the SSC mission and tasks for the SSE stakeholders

The mission and tasks are relevant for stakeholders. Yet, these could be even more beneficial, if reviewed, the scope possibly adapted and the implementation more in line with the sector's needs.

Key findings	
4.	A range of issues affecting the Swiss space ecosystem depend on factors, which cannot be influenced by the SSC. These include the Swiss participation in ESA, the relations with the EU, the emergence of NewSpace or the commercialisation of space.
5.	The mission of the SSC is seen as relevant.
6.	An opportunity arises to renew its mission in light of the present opportunities and challenges to possibly include further tasks, such as the pooling and sharing of resources (intelligence, infrastructure, knowledge-transfer and access to funding) and better spell out its potential role in application-related projects.
7.	Refined goals beyond contributing to the SSP can add clarity and help manage stakeholders' expectations.

4.2 Governance

a. Data and document review

The primary stakeholders of the SSC are its three founding members (SSO, ETH Zürich and EPFL) on the one hand, and its members (academic institutions, research and technology organisations and industry) on the other hand.

The SSC has three bodies:

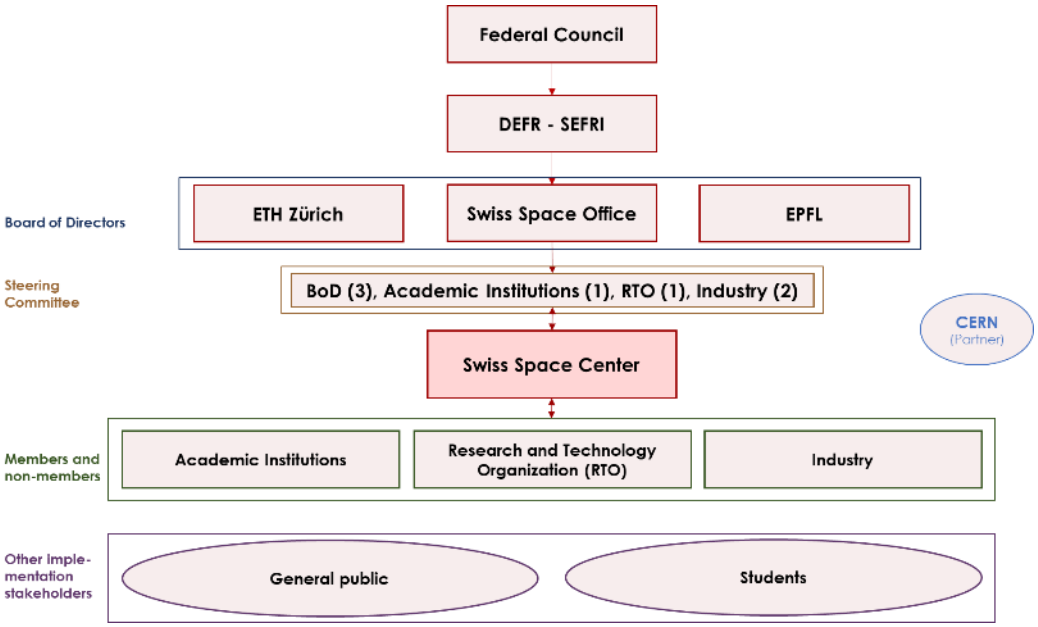
1. the Board of Directors BoD (founding members) defines the Terms of Reference TOR and strategy. It appoints the Director and approves the budget and implementation plans as well as related reports.
2. the Steering Committee SC (BoD and four members' representatives) monitors the implementation of strategic and financial guidelines. It approves new members and the creation of Working Groups. Further, it authorizes as needed projects outside the annual plan. Finally, the SC identifies, discusses and evaluates the technological and scientific fields in which the Swiss space community is or should be active. The SC reports to the BoD and the Annual Assembly.
3. The Annual Assembly AA includes all members of the SSC. It acknowledges the activity reports of the SSC and SC as well as comments on the strategic plan and the SSC Work plan[33].

The SSC Director takes all measures necessary for the management of the SSC, the execution of its tasks and the fulfilment of its purpose. The Director contributes to the strategic plan and the Work plan and implements the latter. He/she establishes the Financial Plan, the Annual Budget and the Financial Report. The Director edits the SC Activity Report, chairs the Annual Assembly and organizes the vote for the academic, RTO and industrial representatives in the SC. The SSC Director reports to the Steering Committee, which acts on behalf of the Board of Directors.

The SSC is headquartered at EPFL, which is responsible for all legal rights and duties on its behalf. Its institutional environment in Switzerland can be presented as follows:

[33] (03.10.2015). Terms of reference (SSC). 7 I Rev. 0, page 8-12.

Figure 10 : Institutional environment of the SSC



The relationship between SSO and SSC is formalized in an annual agreement, in which the tasks to be fulfilled by the SSC, for and on behalf of SSO, are specified.

b. Interviewee perceptions

On the one hand, several interviewees saw and welcomed the SSC as an extension of the SSO. On the other hand, some academia, who are not members, perceived the SSC as part of the EPFL. Thus, they believe that being associated with it would dilute the visibility of their own university.

c. Evaluator perspectives

The affiliation and therewith the positioning of the SSC is not clear-cut. The result is a blurred external positioning as well as possible internal tensions.

The SSC website conveys the image of an independent body, yet physically and organisationally the SSC is an integral part of the EPFL, which is common knowledge in the sector. This is substantiated by the call for an unambiguous SSC positioning at the workshop. Finally, the affiliation of ESA BIC to ETH Zürich (which includes AP Swiss) as well as the nearby EPFL Space Center (or eSpace) reinforces the perception of several facilitators for the space sector within the ETH domain.

The **ESA Business Incubation Centre Switzerland** (ESA BIC Switzerland) is a nationwide initiative that opened in 2016, powered by the European Space Agency (ESA) and ETH Zurich. The program offers broad support packages to entrepreneurs and young start-ups for exploiting space systems or technologies to develop their non-space business on earth or using a technology from earth for an application related to space.[34]

AP-Swiss is the Ambassador Platform of the ESA ARTES Applications programmes in Switzerland. It is funded by ESA and the SERI and part of ESA BIC Switzerland.[35]

The **EPFL Space Center** (eSpace) is an interdisciplinary unit responsible for the federation of space and drone activities at the School. Specifically, eSpace is coordinating space education at EPFL, developing state of the art nanosatellites, and fostering space research on campus.[36]

[34] About ESA BIC https://www.esabic.ch/about/
[35] About AP Swiss https://www.ap-swiss.ch/about_us/
[36] eSpace homepage, https://espace.epfl.ch/

As of its TOR, the mission of the SSC clearly relates to the Swiss space policy and its strategic plan to the Swiss space implementation plan. On the other hand, the SSC is administratively an EPFL entity and its mission should therefore fit into EPFL's mission, which is education, research and innovation[37]. This actual dual reporting line result in contradictory injunctions, which are not conducive to the highest performance.

The present governance set-up aims to mitigate this reality. The question remains about the means to ensure coherence between the demands of three distinct actors: the formal governing bodies (BoD and SC) convening a couple of times a year, the SSO conducting monthly bilateral meetings with the SSC and the EPFL providing the physical and administrative infrastructure as well as being the referent for the SSC PhD students.

Key findings
8. Today's governance and affiliation of the SSC creates confusion. Most stakeholders still perceive the SSC under the sole responsibility of EPFL. For the same reasons, the SSC leadership is prone to receive contradictory injunctions from various governance stakeholders.

4.3 Membership

a. Data and document review

Membership

Any Swiss institution or company with present or planned activities in space meeting ESA Convention criteria can become a SSC member[38]. As of February 2019, 38 organisations were members according to following SSC categories: 22 from the industry, 4 RTO, 9 academia as well as one partner (CERN) and an institution (SSO)[39]. The number of members has been steadily increasing with few of them leaving, mailing start-ups discontinuing operations. Membership fees and benefits are the following:

Membership fees				
Academia, RTO, Partners	**Industry**			
CHF 5 000	CHF 1 000			start-up (basically for two years)
	CHF 5 000	<	2 MCHF	yearly turnover in space
	CHF 10 000	<	10 MCHF	yearly turnover in space
	CHF 20 000	>	10 MCHF	yearly turnover in space

Membership benefits
- Participation in the vote for a representative of its membership category for the Steering Committee; - Participation in the Annual Assembly; - Preferential rates for events organized by the SSC; - Participation in Working Groups; - Participation in the SSC members' network.

Further, each member has a dedicated Point of Contact PoC. This person shall visit members at least twice a year "in order to present the news of the SSC, address the current situation of the entity, collect the needs, identify potential collaborations with other members and take actions if necessary".[40]

[37] EPFL missions, https://www.epfl.ch/about/overview/epfl-missions-and-values/
[38] (03.10.2015). Terms of reference (SSC). 7 I Rev. 0, page 6.
[39] See full list of members in appendix A.4 SSC members, page 73
[40] 5.1 Common Actions, page 6 in Workplan 2018-2019

Working groups

Working Groups "have been implemented where the members have the opportunity to present their activities and express their opinion"[41], yet their scope is broader. Initiated by the members, they are designed to contribute to the implementation of the SSIP. Each working group defines a charter, designates a chairperson and reports to the chairman of the SC. The SSC provides secretarial support to all WGs.

The current four WGs are (1) Education matters, (2) Miniaturization and Mini- or Micro-Systems, (3) High precision mechanisms & structures, (4) Earth Observation & Remote Sensing[42]. A further WG on Software for Operations was in preparation at the end of 2018[43]. The WG "High precision mechanisms & structures" was dissolved in 2017 and replaced by an informal structure.

b. Interviewee perceptions

Membership

Members mentioned tailor-made services as those providing the highest added value (e.g. executive education). Several respondents asked for more interaction with the SSC, be it through one-to-one conversations, specific newsletters directed at space professionals or participatory workshops. On the same line, a participant of the evaluation workshop shared the following observation: "There seems to be a mismatch between what is offered by the SSC and the perceived value by the members".

Working groups

Although WGs are primarily meant for members, they weren't mentioned during the interviews, except for stating that they weren't working as expected.

c. Evaluator perspectives

Membership

The evaluators received somewhat contradicting messages regarding membership, as on the one hand the number of members has been increasing continuously, and on the other interviewed members often voiced some dissatisfaction with the services provided. Thus, respondents were keen to obtain more value out of their membership, which included better communication on SSC activities and expertise. In addition, they asked for more involvement and participation, especially when framing membership benefits.

In this context, the SSC explained that most member contacts happen on a bilateral basis, so to better meet specific needs. Building on the respondents' feedback, the question arises on how to better communicate about and leverage these tailor-made services for the whole space community, without putting confidential information at risk. To start with, membership counterparts could be spelled out better on the website[44] to reflect the actual services provided.

In terms of member acquisition, visibility, independence and equal treatment is key especially for universities. Thus, the present affiliation and governance prevents some universities from joining, as they feel that the SSC is an EPFL entity and would hamper their visibility.

A potential for building a buoyant and more conducive ecosystem exists: members have common interests and want to collaborate, as was repeatedly stated in the interviews and as the lively informal part of the 2018 Annual Assembly showed.

[41] 4.3 SSC Working Groups, page 6 in Workplan 2018-2019. Note that WGs are also mentioned in the strategic plan 2014-2018.
[42] Workplan 2016-2017, 4.3 SSC Working Groups, page 7. More information in appendix A.4 Working Groups with corresponding strategic area and goal supported, page 70.
[43] BoB Minutes of Meeting of 28.11.18, page 3
[44] For instance, the preferential rate for members should be more specific as well as the types of events, and a basically free service "use of two vacuum test installations" mentioned as such.

Working groups

Working groups are confusing in terms of mission, TORs, actual and expected impact, and added value for members. Apparently, only two of them are still active. A reason for this could be that the benefits for the participants are not sufficient, not meeting their organisational needs.

Further, working together on joint projects came out as the most effective and productive way for valuable results. Today, conducive virtual or even physical spaces, structured around shared goals and project driven are not available. Thus, there is no strong enough engine able to truly leverage the existing collective intelligence to serve common goals for the benefit of space projects.

Key findings	
9.	The present membership concept could meet stakeholder needs and expectations better: on the one hand revenues from membership fees are not substantial, yet regular; on the other hand, members feel that they are not getting enough value out of their membership.
10.	The Working Groups are not yet performing to their full potential, as their role and impact expectations are equivocal and complementing convening platforms not used yet.

4.4 Activities and instruments

a. Data and document review

Activities

SSC activities are meant for the whole space community and in the TOR. They are structured into three areas: (1) space promotion, awareness, networking, (2) academic activities, and (3) consulting. Yet, they are far broader, and they are manifold. Each year the SSC submits an activity report to the BoD on the SSO “Mandat de prestations” related to the implementation of the ANC. An overview structured by category and year based on these internal annual reports from 2015 to 2018[45] is presented in appendix A.8 SSC activities summary (mandat de prestations SSO-SSC), page 78. In addition to these reported activities, interviews with the SSC and other stakeholders mentioned that staff also visits members and coaches member start-ups to access space projects. The SSC does not use a customer relationship management system (CRM), thus these activities tend to be underreported.

As organisations pay an annual membership fee, some specific counterparts can be expected. Activities meant exclusively for members are the Annual Assembly[46], Working Groups, a detailed profile in the annual member profile brochure and, the SSC complemented, two vacuum-tests per year. On the website, membership counterparts are described in general terms and membership fees are not specified on the dedicated webpage[47]; yet they can be found in the Terms of references also accessible online.

The SSC provides two kinds of tailor-made services:

1. Consulting services, as part of their mandate and free for the organisation served. Typically, they come in form of advice and support to draft ESA proposals or to obtain a given ESA certification.
2. Third party activities, which are paid services, such as assessments of specific technology trends

The majority of SSC activities are directed towards Swiss space professionals at large. These include workshops on specific topics, bilateral exchanges with selected countries (India, Poland, UK) or events. Further, the SSC is engaged in ESA-related activities, such as the support to the Swiss delegation in advisory groups or to local actors for accreditation.

[45] See A.8 SSC activities summary, page 77.
[46] The AA is exclusively for members every second year, open to all the other year.
[47] SSC Website, Become a member https://www.spacecenter.ch/aboutus/members/becomemember/,

To learn about the local space ecosystem, SSC staff visited three countries (India, China and Belgium) between 2015 and 2018 and attended 13 conferences abroad to interact with the international space community.

Education-related activities take in a large part in the SSC portfolio. These comprise events to promote a career in space, summer camps as well as continuous education. The SSC is also managing the selection of two to four graduates per year for the Swiss National Trainee Programme at ESA, including some mentoring during their stay.

From 2015 to 2018, the SSC with an academic partner organized **Summer Camps** for Swiss and foreign students around a specific topic with the aim to become acquainted with space and the Swiss environment. Students need to come up only for the transportation costs, everything else is being cared for. These camps were a success given the number of applicants and the fact that some participants were later hired by Swiss organizations. From 2019 onwards, the summer camps were integrated into the Igluna project. The SSC website also refers summer camps abroad, such as in Russia, China, Belgium and Austria.[48]

In 2018, the SSC launched the first **ESA_Lab@ project Igluna** with a field campaign on a glacier in Zermatt in July 2019. Student teams from eleven universities across nine countries developed a series of modular demonstrators, that aimed to establish building blocks for living in space and deployed them in Zermatt for public viewing. The event was supporter by numerous organizations[49] (universities, companies, tourism associations) and received substantial press coverage across the country. The Igluna project will be reconducted in 2020 and the corresponding call is open.

The SSO funded **National Trainee Programme** allows young Swiss graduates to work at ESA on selected projects, under the supervision and mentorship of ESA experts in the chosen fields for a period of 2 years. National trainees are on EPFL contracts during their stay abroad.[50]

To increase public awareness, the SSC organized a one-off ESA Citizen's debate in Lucerne in 2016, regularly promotes space-related activities at existing events. Further, it regularly sends out newsletters to 1000+ addresses as well as cultivates growing accounts on Facebook (2 200 followers in July 2019), LinkedIn (2 000) and Twitter (330).

Finally, a key supporting activity is the applications analysis for the CfI and the MdP to map the main industrial and academic competences for space applications in Switzerland.

Implementation of SSO funding instruments

The SSO delegated selected tasks to the SSC, among which the management of its two funding instruments, the Call for Ideas and the Mesures de positionnement. The SSO provides the corresponding funding and takes the final decision on the awards. Both calls are open to under specific conditions to Austrian stakeholders, due to a reciprocity agreement with the Aeronautics and Space Agency of Austria ASA.

Call for Ideas

The objective of the Call for Ideas CdI is "to foster and promote Swiss technological and scientific competences that have a clear potential for space products and services/applications. They take place A every uneven year maximum funding is CHF 20 000, that can be allocated to a single partner, industry and academia alike. More particularly, the Call for Proposals aims to:

- foster the development of novel ideas and disruptive concepts related to the space sector;
- trigger the interest of new entities, encouraging them to enter the space market and evaluate the potential of their proposed technology;

[48] SSC website, International Summer Camps, https://www.spacecenter.ch/activities/spacecareer/student/summercamps/international/.
[49] SSC website, Igluna sponsors, https://www.spacecenter.ch/igluna/sponsoring/.
[50] SSC website, National Trainee Programmes and open ESA positions https://www.spacecenter.ch/activities/spacecareer/ntp/.

- better position Swiss academia and industry with regard to future European and global activities and to support the development of novel technologies and services for future space science and technology applications.

Both the development of new space technologies and of new services related to space may be proposed."[51]

Mesures de positionnement

The main objective of the Mesures de Positionnement MdP is "to foster and promote Swiss technological and scientific competences that have a clear potential for space products and services/applications. More particularly, this call for proposals aims to:

- foster the development of innovative ideas and new products related to the space sector;
- promote the collaboration between Swiss industrial and academic partners to obtain a more stable and better structured Swiss space landscape;
- better position Swiss industry with regard to future European and worldwide activities so as to be ready to submit competitive bids when the respective calls are published;
- increase the technological maturity of ideas developed by academia and to promote competitive Space products thanks to partnerships with industry."[52]

The maximum funding available is CHF 250 000, which has to be shared between the academic and the industrial partner (a minimum of one third each). MdP were launched in 2010 and take place every even year.

The SSC is handling the whole process, from the publication of the call to the follow-up after the project closure. It evaluates and preselects the incoming proposals and the SSO makes the final decision and the payment. The presentation of the results of the previous call and the launch of the following take place during a single event.

SSC-related success stories

Thanks to a SSC initiated newsletter, the Fribourg start-up **Bcomp**[53] learned about the CfI, applied and won the funding. Bcomp develops flax- and wood-based high-tech products, that are used mainly in the sports, automotive and space industry. The following year, Bcomp was awarded a MdP, and later secured an ESA contract.

Another MdP alumni, **Astrocast**[54] offers a bidirectional and highly secure connection to any Internet of Things IoT device on Earth. It has already launched two test satellites and aims to provide IoT connections primarily for professional applications, such as for maritime, environmental as well as mine, oil and gas applications.

Swissto12[55] developed primarily a large range of additive manufactured antenna components, waveguide products and filter systems. The company is active in satellite communication, airborne connectivity, radio frequency as well as test and measurement.

Dübendorf-based **Micos**[56] was another MdP recipient. The company specializes in optical systems for space and industry as well as related services, such as testing.

All four companies are SSC members to this day.

Funding awards

During the period under review 2015-2018 (2 calls), 79 project proposals were submitted for the MdPs, out of which 23 were funded, monitored, presented in public and followed upon after the funding had ended. The same process took place for the CfIs (3 calls), with 50 project proposals submitted and 15 projects awarded.

[51] SSC website, Call for Ideas, https://www.spacecenter.ch/activities/fundingopportunities/cfi/
[52] SSC website, , Mesures de positionnement, https://www.spacecenter.ch/activities/fundingopportunities/mdp/
[53] Bcomp website, http://www.bcomp.ch/
[54] Astrocast website, https://www.astrocast.com/
[55] Swissto12 website, http://swissto12.ch/
[56] Micos website, http://www.micos.ch/

In 2015, the University of Applied Sciences and Arts Northwestern Switzerland evaluated these funding instruments on three key aspects and concluded[57]:

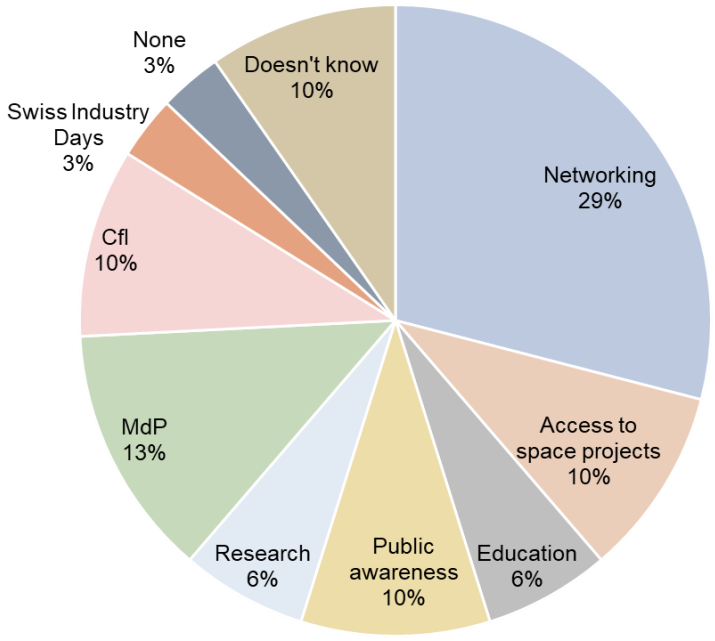
- relevance and consistency: "The overall positive response on the influence of public funding on space activities and the positive results of the supported projects confirm the relevance of the funding approach."[58]
- effectiveness: Given the scope of the evaluation, it was difficult to assess the univocal contribution of the SSC instruments to the Swiss space policy. Yet, it was generally seen as positive.
- effects of the funding: the outputs are considered to be conducive in terms of knowledge creation, product development, technology advancement and TRL advancement and critical seed funding; as positive outcomes were mentioned their role as leverage for academia specific effects (reputation, publication, staff competencies) and for industry for competitiveness and staff competencies.

b. Interviewee perceptions

Relevance of services provided by the SSC for the respondents

Networking-related activities came out first and with similar scores for all three stakeholder categories. Funding instruments (MdPs and CfIs) represented half of the mentions within industry. Access to space projects, research and MdPs were second for academia, as were access to space projects and public awareness for the remaining respondents. Altogether, tasks stated in SSC's mission represent more than half of the mentions, and the funding instruments almost a quarter.

Figure 11 : Most relevant activities of the SSC



§

c. Evaluator perspectives

Relevance of the service provided by the SSC in regard of its mission

Currently quantitative and qualitative data about the multiple activities of are only partially collected, analysed and, if adequate, published. This concerns for instance member engagement, workshops, courses, events,

[57] (2015). Barjak, Franz; Bill, Marc; Samuel, Olga, Evaluation of the existing Swiss institutional R&D funding instruments for the implementation of the space-related measures, D3 Final Report, University of Applied Sciences and Arts Northwestern Switzerland, School of Business

[58] Ibidem, page 4

digital outreach as well as public awareness activities. As a result, the SSC could use that data better for internal purposes, such as motivation, accountability as well as learning.

Networking was perceived as the most relevant activity. At the same time, networking can serve many of the other fields, as it is more of a mean than a goal.

SSO funding instruments

CfI and MdPs are a success, be it in terms of impact or appreciation among the supported organisations. Yet, many respondents would wish for a clearer strategy and focus and clearer communication along the process, especially in terms of feedback in case of unsuccessful calls.

As there have been discussions whether the SSO should fund space businesses in the future, the statement of the European Investment Bank may be interesting to keep in mind: “Space companies appreciate the volume, speed and ease of acquiring private capital but are also keen on the non-dilutive nature of public funding. In addition, public capital may be the only accessible funding source, and serves as a precondition for fundraising private risk capital.”[59]

Key findings	
11.	The SSC successfully conducts a large range of activities, yet it misses the opportunity to collect, analyse and publish as adequate qualitative and quantitative data on key activities, which impacts its accountability and learning processes.
12.	The MdPs are especially valued, by academia and industry alike. Moreover, an ongoing internal monitoring as well as an external evaluation have demonstrated their positive impact. Yet, there is a call for a sharper strategy, greater communication on the process upfront and regarding the ongoing coordination with other funding instruments.

4.5 Outputs and outcomes

a. Data and document review

The strategic plan is not geared towards measuring success of the undertaken activities, among which outputs and outcomes, as detailed in chapter 4.8. Institutional processes and finance below. Further, the logical linkages between the different items is not apparent, for instance as a Theory of change or a logical model. Therefore, the SSC was not in a position to report outputs and outcomes.

b. Interviewee perceptions

Activities in relation to the mission of the SSC and expected results

Networking was mentioned by roughly half of the interviewees when it comes to successful activities carried out by the SSC. It was mostly valued for newcomers, less for established actors. It was followed by increasing public awareness, but with a focus on the new generation rather than the general public and mainly related to education and training. The third success mentioned relates to the MdP, with a positive impact on competitiveness and cross-sectoral networking.

Regarding less successful activities, the picture is more diffuse. Cited by a fifth, Working Groups persons are considered to be too siloed. Some pointed out that the SSC is not especially active in some areas (EORS). Networking could be improved for a couple of actors, for example by providing support for the development of international collaborations and by considering it as a process rather than a portfolio of events.

[59] (2019). European Investment Bank. The future of the European Space Sector, page 62

Successful activities, conditions and criteria to assess success

Roughly half of the interviewees, including most industry members, could not mention a specific example for which they thought the results to have been outstanding, because of their insufficient knowledge of the SSC. The Igluna project was cited by a minority, all from the SSC or SSO team. Specific events were furthermore considered as especially successful, namely “Be a star in ESA’s universe” or the “Swiss Industry Days”. MdPs were highlighted as well. Motivation and competence of the team was considered to have been instrumental in these successes.

Since 2017, the SSC has organized five career events under the name **“Be a star in ESA’s universe”** across the country. The objective is to promote career opportunities at ESA and in the local space sector by presenting ESA’s, local space industries’ and academic activities to young professionals as well as to students from Swiss universities, federal institutes, universities of applied sciences. Areas of recruitment are management, engineering, science, administrative and technical services.[60]

The **Swiss Space Industry Days** were organized by the Swiss Space Office on 15-17 June 2017 at EPFL. Their aim was to provide up-to-date information to current and potential stakeholders on the various European institutional programs as well as a platform to exchange experiences on the fast-changing space landscape having an impact on business and cooperation models, industrial processes, standards and technologies.

In order to multiply these successes, interviewees made various proposals for evolutions at SSC level, namely:

- enhancing communications with its members, through participatory networking events or through further integration of all relevant staffs of their member organisations;
- bringing in more dynamics and not being afraid to stop certain activities to launch new ones;
- developing and better structuring educational programmes;
- clarifying the affiliation and positioning, particularly towards EPFL and its eSpace;
- providing more stability for the team;
- creating a collective for a topic of broad interest, able to mobilise the community, such as a Swiss flagship project.

With the aim to assess the contribution of the SSC activities to its mission, interviewees suggested a range of indicators, which can be grouped in five categories: participation, reputation, satisfaction collaboration and project development. They are listed in appendix A.9 Criteria to assess successes, page 82.

Nevertheless, it was fairly difficult for most interviewees to assess the contribution of SSC activities to the implementation of its mission, either because they considered not knowing it well enough or because they didn’t have adequate information. Half of the interviewees considered they could not give an assessment.

On average, and from the ones who gave an estimate, external actors, either from industry or academia, are judging the SSC contribution from medium to low, while the internal actors, from SSC or SSO, are more positive and consider the SSC contribution from valuable to especially valuable.

c. Evaluator perspectives

Networking is clearly at the heart of the activities of the SSC; yet, the expectations of the various actors are high and multiple, and the responses of the SSC are necessarily partial. It should be managed as a process rather than a portfolio of unique events in order to provide more coherent responses to these needs.

Interviewees expect the SSC to be a more effective driving force in collaborations, particularly cross-sectorial ones, as well as in partnership development.

Project funding, either directly (MdP/CfI) or indirectly, through coaching, has a high impact potential. Flagship projects were cited repeatedly, either as examples of great successes or as likely vehicles to position Switzerland

[60] SSC website, Be a star in ESA’s universe, https://www.spacecenter.ch/activities/events/career/#1538468582678-2f57292e-790a.

and its actors on the international stage. The SSC has a potentially most interesting and challenging role in the emergence of such projects, as it manages to combine intelligence, active partnership development, and the provision of space for ideation. In short, its impact is closely linked to its capacity to be a driving force across sectors to the benefit of the Swiss space ecosystem and the country as a whole.

The SSC is technology oriented, and its EPFL's ancestry marks its identity. It emerges from the interviews that, in order to fully play its role, the SSC could better leverage it's potential to mobilize all academic, technological and industrial players. From a different perspective, paying a greater attention to all sectors, in the upstream and downstream segments alike[61] has a potential to improve its impact.

The SSC uses different instruments to carry out its activity. The question is whether these are regularly evaluated in terms of added value, whether they could be adapted according to needs, or whether some of its resources should be reoriented towards new solutions in order to better meet the needs of the Swiss space community. This applies as well to the National Trainee Programme, which mobilizes a substantial part of the SSO funding to the SSC.

Key findings	
13.	Active, institutionalized and participatory networking managed as a process is key to drive high impact collaborations.
14.	The SSC is expected to play a stronger role in supporting the inception of space-related projects, in particular cross-sectorial projects and potentially emblematic projects.
15.	Interviewees feel that the added value of the various activities is not fully in line with the needs and expectations of the Swiss space ecosystem.

4.6 Impact

a. Data and document review

Impacts are defined as "the positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended"[62]. As stated in its TOR, the "SSC contributes to the Swiss space policy", which entails as mentioned above the following three goals:

1. develop and use space applications to improve the quality of life for Swiss citizens;
2. ensure a long-term commitment to space exploration for the progress of innovation and the knowledge society;
3. provide significant scientific, technological and industrial contributions to make Switzerland a competitive, reliable and vital partner.

The previous SSIP 2014-2023 and the current one 2018-2020 mainly address the third goal and state corresponding implementing measures. The first goal is touched upon as a secondary goal, under "foster application development", whereas rather from an application development perspective than from an end-user one, with the goal to benefit Swiss citizens at large. This is why the interviewees were asked about the competitiveness of Swiss actors and the relevance of the SSC services for them.

b. Interviewee perceptions

Competitiveness of Swiss actors

More than half of the interviewees (all backgrounds) considered that the sector's competitiveness had improved, due to more actors and a greater portfolio diversity. People wondered whether this was just the result of economic development, including globalisation, or whether it would have been different without the SSC or other

[61] See Figure 5: The space economy's simplified value chain and Figure 6: The space sector: upstream vs. downstream, page 11.
[62] OECD DAC Evaluation Criteria, http://www.oecd.org/dac/evaluation/daccriteriaforevaluatingdevelopmentassistance.htm

actors. For example, one person wondered if there could have been a greater impact with other supporting tools. Meanwhile the competitiveness of Swiss actors was considered by a fifth of the interviewees (also of various backgrounds) not to be more competitive today than five years ago (one of them emphasizing that it is because they have always been highly competitive).

The respondents could mention number of companies which had become stronger during the last five years: Astrocast (9 mentions), RUAG Space (7), Swissto12 (6), Apco (3), Viasat (3), Micos (2), Almatech (2), Spectratime (2), which were mentioned more than once.

The role played by the SSC was difficult to assess by most interviewees. Yet, the SSC was seen by a fourth of the respondents as having played a role, to a certain extent, in some of these successes: Through MdPs, for example for Micos, Swissto12, Bcomp or Astrocast. Support in form of networking, coaching or training were likewise mentioned in some cases.

Criteria used to assess competitiveness

The criteria mentioned were grouped in three categories (research and development, market share and revenues, business development) and are available in appendix A.10 Criteria to assess the impact of the SSC, page 82.

Usefulness of the SSC services

The SSC services meet their needs, with a potential for enhancement for some academic actors (i.e. ETH Zürich and EPFL), For the other ones, either they do not know the SSC well enough to articulate an opinion, or they consider that their needs are not fully covered.

For half of the industry players, some of these services are in line with their needs - education, public awareness or access to MdPs were mentioned, but the other half considered that they were not fully or not at all satisfying, or that not enough services are directed towards specific domains.

Valued were for instance the ESA_Lab@ (Igluna) initiated by the SSC on behalf of the SSO, training and networking activities, engineering training, or search for talents (hiring of ex-SSC staff), skills development and networking with start-ups.

c. Evaluator perspectives

The evaluation conducted has significant limitations in establishing links between actions and impacts, direct or indirect. Multiple stakeholders and a complex system make it difficult to attribute an impact to specific measures.

Furthermore, Switzerland is ranked among the world's most competitive economies in general (4th in the IMD World Competitiveness Rankings 2019[63], 4th in the WEF Global Competitiveness Report 2018[64]) and the space sector, as others, benefits from many positive factors such as the quality of the research institutions or university-industry collaboration in R&D. On the other hand, the Swiss market is small, and the space sector has numerous constraints (technological but also policy or defence related): it is much harder to become a sustainable space company here than in some other countries. Therefore, one of the general goals could be to uphold companies to grow to a size that can allow them to play in the international arena. In this context, and from a general perspective, the role of an actor like the SSC could be, at his level, to help better leverage existing assets and advantage and, at the same time, mitigate the risks and weaknesses peculiar to the Swiss economy.

[63] MD World Competitiveness Rankings 2019, https://www.imd.org/wcc/world-competitiveness-center-rankings/world-competitiveness-ranking-2019/

[64] The WEF considers Switzerland as « one of the world's 'super innovators' (3rd, behind Germany and the United States). […] In addition to research excellence, intense collaboration between the academic and business worlds yields innovative products with commercial applications. An array of factors supports the innovation process, including a conducive institutional framework (5th) ». http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf

Key findings	
16.	The Swiss framework conditions are most conducive. Yet the Swiss space industry face specific challenges related to the local market size and difficulties to enter the international space market.
17.	The various instruments used by the SSC (MdPs, training, coaching, networking) are important to address the needs of space actors.

4.7 Organisational set-up

a. Data and document review

SSC's headquarters are located on the EPFL premises, next door to the EPFL Space Center (or eSpace)[65]. The EPFL is in charge of SSC's administration, which includes human resources and financial management, as well as responsible for all legal rights and duties on its behalf. The hub at ETH Zürich is hosted by the Institute of Geodesy and Photogrammetry.

When visiting its website, the visitor is under the impression that 26 people work at the SSC[66]. Yet, when referring to internal documents, the featured persons actually fall into five categories: Senior management (5), international experts (2), staff (7), PHD students (3) and participants in the National Trainee Programme (8). According to the BoD status report of 28.2.19, these represented 22.1 full time equivalent[67]. All but two have a technical or scientific background. Every staff has EPFL contracts in line with the ETH salary scale.

The SSC director is also an EPFL adjunct professor and thus supervises PhD students within his academic responsibilities.

b. Interviewee perceptions

Except for the senior management, all staff has fixed-term contracts with often below market salaries according to SSC interviews. Some SSC staff mentioned that these terms of employment tend to result in a high turnover. Therefore, senior management has to devote substantial time training new staff and making sure that critical knowledge is not lost. Another staff pointed out that the SSC played an important role in terms of training and of linkage between academia and the private sector, as SSC staff tends to be hired by the industry.

The fact that the director also supervises PhD students within the SSC, which furthermore is located on the EPFL premises, next to the EPFL Space Center (eSpace), creates confusion about SSC's status and some lingering tensions with its neighbour.

When asked about SSC's activities, numerous interviewees spontaneously related the number of staffs featured on the SSC website to the perceived outputs, and they were under the impression that the SSC was not performing well in that regard.

c. Evaluator perspectives

Seven years in its actual set-up, the SSC deserves a clear scope, an unambiguous identity and a stable set-up. Therefore, the SSC does not serve that purpose when featuring PhD students on its website. Further, the fact that eSpace positions itself as EPFL Space Center (the former name of the SSC, abandoned and officially dissolved in 2011) adds to the disorientation, increased by the fact that both entities are same-floor neighbours. Finally, exploring new terms of employment for core staff would be beneficial. The aim should be to increase job satisfaction, diminish staff fluctuation, and therewith enhance organisational performance through better

[65] eSpace and EPLF Space Center are two names for the same entity as mentioned on the corresponding website https://espace.epfl.ch/ . The fact that, according to the SSC TOR, the EPFL Space Center was dissolved in 2011, and its ongoing activities transferred into the simultaneously created SSC adds to this confusion.

[66] SSC website, https://www.spacecenter.ch/home/team/, accessed February 2019

[67] See A.11 SSC staff positions by function, page 82

institutional memory and less frequent onboarding efforts by senior management for new staff, while keeping the needed flexibility.

Key findings	
18.	Today the positioning of the SSC come across as blurred, due to its location and its PhD staff as well as to the branding used by the next door EPFL Space Center.
19.	Employing a high proportion of staff under terms of employment meant for junior staff is not conducive to a performant organisation, as high job rotation demands frequent onboarding and impacts performance as well as motivation. On the other hand, the SSC plays a valuable training role as a first employer after graduation for the SSE.

4.8 Institutional processes and finance

a. Data and document review

Strategic plan, work plan and corresponding reporting

The central document of the SSC is its Terms of Reference, which are available on its website[68]. It details mission, governance, membership, organisation, activities and signing authorities.

The strategic plan 2014-2018 was developed in accordance with these TOR and integrates the national focal areas of the Swiss space implementation plan. Drafted by the Steering Committee, the document sets the main impact directions for the next five years. It is based on the SSIP structure and on SSC's main tasks; it is organised along 9 strategic goals (6 technology sections and 3 organisational ones):

Areas	Strategic goals
I. Networking Swiss actors in order to establish areas of excellence	
A. Technology	
1. High -precision mechanisms and structures	1
2. Atomic clocks	2
3. Technologies for scientific instruments	3
B. Emerging themes	
4. Small satellites	4
5. Miniaturisation	5
6. Further emerging themes	6
II. Facilitate access to international space projects	7
III. Education and training	8
IV. Promote public awareness	9

For each section, the relevant SSIP section was quoted and the corresponding goal, objectives, actions and indicators were drafted[69]. The document is entirely narrative.

The operationalisation of the strategic plan takes place through a biannual work plan drafted as well by the Steering Committee[70]. The document is descriptive and, for each strategic position, quotes the respective objectives and formulates actions in a shorter form than the strategic plan. Indicators are not reproduced.

The latest available reporting against the 2014-2018 strategic plan is from June 2018. In that presentation, the initially defined actions and indicators are not referred to. Actions are mostly reported as number of events or meetings organised, initiatives launched, or type of support provided. A frequently cited indicator is the number

[68] SSC website https://www.spacecenter.ch/aboutus/.
[69] Excerpts available in A.7 SSC internal reference documents, page 76
[70] Ibidem

of corresponding studies funded through the MdP or CfI (e.g. High-precision mechanisms and structures: “4 studies funded under the MdP 2014”).

Income and expenses

Synthetic income and expense statements are included in the internal activity report and thus not available publicly. Membership income made out 65% of the income, of which 57% comes from the SSO and the ETHs. The SSC generates 30% of its income through projects and mandates, the remaining 5 % are transitional. As expected, the main expense position are staff salaries (47%), followed by projects mandates (16%, salaries excluded), various administration and event costs (12%), and the remaining position is transitional (25%).

b. Interviewee perceptions

As neither the strategic plan, the work plan nor the statement of operations are public, these could not be discussed during the interviews. Yet, one respondent pointed out, that the critical SSO funding to the SSC constrained its independence. On the same line, during the workshop, several participants stressed the importance of SSC’s independence, which relates directly to its governance, affiliation and funding streams. Finally, an industry stakeholder asked for more reporting on what the SSC does, and another external person spotted the lack of Key Performance Indicators KPI to assess its performance.

c. Evaluator perspectivess

Terms of references

The TOR are well structured and contain the key sections mission, membership, organization, activities and signing authority. The interviewees noted at several occasions that SSC’s goals were not clear. These should be included within the mission statement, which should state the organisational purpose, its objectives and its approach to reach those objectives. Further, as the management of the funding instruments make out a substantial part of its activities, it would make sense to mention it in the TOR, under activities.

Strategic plan, work plan and reporting

The strategic plan has the ambition to link the SSC strategy directly to the SSIP. At the same time, a bottom-up approach is aimed at, to meet stakeholders’ needs. This tension is reflected in the present strategic plan: on the one hand, some goals are beyond SSC’s capacity such as “SSC to strengthen the international leading position of Swiss industrial and/or academic actors in selected key areas and potentially to help extending the areas of excellence”[71], with the indicator “number of innovative projects or new collaborations successful through the help of the SSC”. On the other hand, the stakes of the Swiss space sector and the corresponding needs are not stated.

The work plan is rather less detailed than the strategic plan. Are mentioned long-term objectives (from the strategic plan), yet objectives in the usual SMART format[72] are lacking. Actions are described in broad terms (e.g. “Bring together the main players in Switzerland within the (relevant) working group”) and the output (results) and outcomes (effects) are missing. Finally, no indicators and target values are stated. Thus, success cannot be measured adequately.

From the reporting against the work plan, it is not possible to assess whether the goals set in the strategic plan have been met. Actions and indicators are described generically, without a clear reference to the set targets. When an indicator reads as a list of 6 different types of activities funded (MdP, CfI, ESA studies, PHD thesis or NTP) without mentioning the title of the project, there is no mean to find out how these projects have contributed to the achievement of the set goal.

[71] Strategic plan 2014-2018, page 5.
[72] SMART: Specific, Measurable, Achievable, Relevant and Time bound.

Income and expenses

Regarding the presentation of income and expenses, a more detailed internal description of the various positions and a presentation of the yearly evolution would be helpful in terms interpretation, comprehensiveness and learning.

Key findings

20. The main purpose of the SSC to contribute to the implementation of the SSP is mentioned first in its TOR under mission. Yet, the corresponding goals and approaches could be better formulated, and the management of funding instruments mentioned. Further, the targeted bottom-up approach could be better taken into consideration.
21. Formal processes defined in the TOR are diligently implemented. Still, the processes are not used to serve at best SSC's mission and its members, as the potential leverage of such tools is much greater, including to ensure the required accountability.
22. The present strategic plan, work plan and monitoring processes are not conducive to adequately measure neither SSC's current contribution to the implementation of the Swiss space policy nor the full impact of its activities.

4.9 Analysis of selected public entities abroad

a. Data and document review

To broaden the perspective, the evaluators interviewed the space entities of Austria, Denmark and Sweden presented below.

National body	Mission	Affiliation
The Aeronautics and Space Agency of Austria (ASA)	Implements national aerospace policy and represents Austria on international aerospace committees.	Research and promotion agency co-owned by two ministries
The National Space Institute at the Technical University of Denmark (DTU Space)	Create and expand knowledge about Earth and space physics as well as related space technologies for the benefit of society (includes a survey and cadastre service) [73]	Technical university
The Swedish National Space Agency (SNSA)	Responsible for national and international activities relating to space and remote sensing, primarily research and development.	Space agency, incorporated as company fully owned by the Swedish Ministry of Enterprise and Innovation

b. Interviewee perceptions

The results are presented in A.12 The SSC in contrast to Austrian, Danish and Swedish entities, page 84.

c. Evaluator perspectives

This analysis cannot really serve as a benchmark or even as a comparison, as all three entities are dissimilar to the SSC in a way or another. Further, the resources available for the three interviews and the related desk research do not allow a comprehensive assessment.

In terms of set-up, the SSC is closest to DTU Space, if we exclude the cadastral activities, as it has similar features as the SSC before 2011: a national center within a state university, conducting research and building instruments. Yet, it is much larger, and probably more research driven. As for the SSC, the division of tasks between DTU Space and the supervising ministry is not self-evident. Instead, ASA and SNSA are both space agencies, yet in a different configuration: ASA is fully integrated in its supervising ministry, SNSA is an independent organisation, with a state appointed governance body.

As it includes aeronautics, ASA has the broadest scope, if one excludes the cadastral activities of DTU Space. For all centers but the SSC, downstream related activities take up a substantial space within their scope. This means that these space entities also contribute more to the digitalisation of their national economy. All but DTU Space are managing calls for proposals, and the two agencies, ASA and SNSA, are managing national ESA budgets as well. All engage in education. Autonomous entities (SSC and DTU Space) look at a variety of funding streams, including consulting and NASA grants for DTU Space. The SSC is the only one having a membership scheme.

A first common challenge is to keep up with the changing space ecosystem, especially with the upcoming NewSpace. A second is to grow the ecosystem to include non-space actors and to put space higher on the political agenda. National coordination does not seem to be much of an issue in other space entities. This

[73] "The National Space Institute (NSI) at the Technical University of Denmark (DTU) – known as DTU Space - was established in 2007 from the merger of the independent Danish National Space Center (DNSC) with research groups from DTU." http://www.space.dtu.dk/english/about_nsi/history, accessed in April 2019.

possibly relates to a single state language and a more centralized pollical system. Public availability of financial data and indicators is limited for all centers.

It is noteworthy that Austria[74] and Denmark[75] have both published extensive, well documented and accessible space strategies. The Swedish strategy is drafted in a legal format for their Parliament in the local language[76].

Key findings

23. The downstream segment, EORS, represents a substantial share of the activities of all three foreign centers. Therewith, these centers contribute significantly to the digitalisation process of their country and create more opportunities for business applications and thus economic value.
24. A state space entity with all activities (political and operational tasks, ESA relations and budget management) under the same reporting line and budget is more efficient. On the other hand, an autonomous entity can draw on additional funding streams, such as institutional mandates and consulting fees. Yet, the question arises whether other organisations such as universities or private organisations would not be more adequate for the latter activities.

[74] (2012). Weltraum Zukunftsraum: Strategie des bmvit für österreichische Weltraumtätigkeiten, https://www.ffg.at/sites/default/files/weltraumstrategie2012.pdf

[75] (2016). Denmark's National Space Strategy Growth Through Strengthened Cooperation, https://ufm.dk/en/publications/2016/files/space-strategy-2016.pdf

[76] (2018). En strategi för svensk rymdverksamhet. https://data.riksdagen.se/fil/7D457B8F-BE0C-4D44-9809-CB50CCE409B6

5. EXPLORING THE OUTLINES OF A FUTURE SSC

To imagine the future Swiss Space Center, the evaluators analysed existing resources, integrated the answers from the interviews and conducted a dedicated workshop. To put the future SSC in context, they started by looking at the future Swiss space ecosystem.

5.1 Imagining the future Swiss space ecosystem

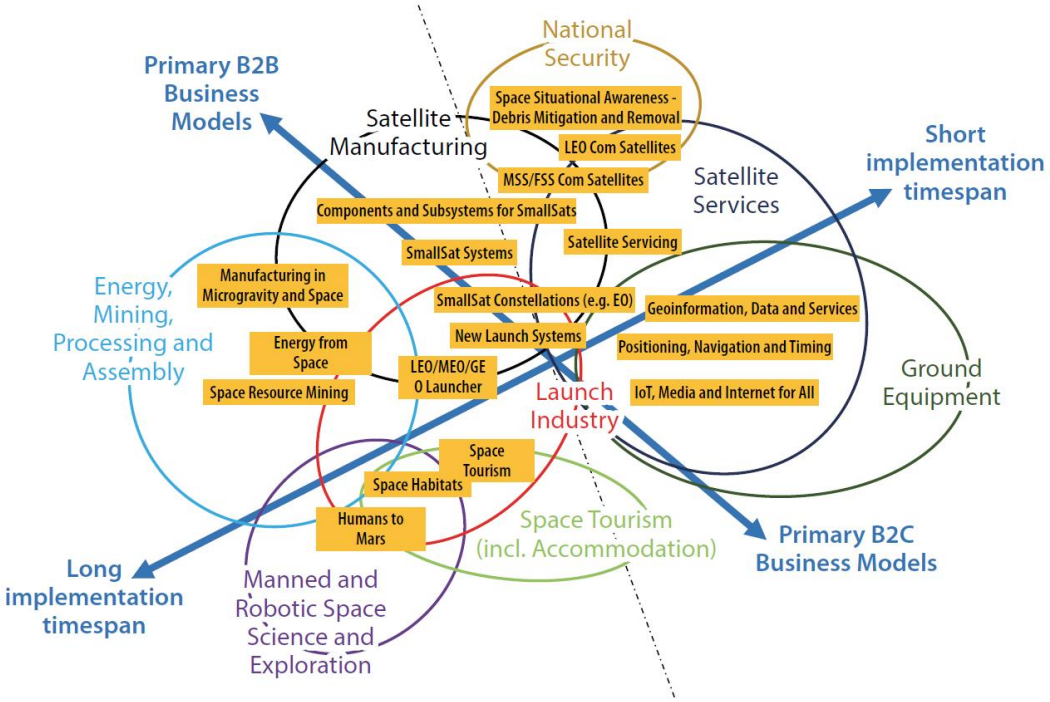
a. Data and document review

The Swiss space ecosystem is strongly linked to the European space ecosystem: Switzerland devotes the vast majority of its federal space R&D budget to ESA. The industry markets and research funding are greatly relying on ESA as well. This lead the evaluators to consider the 2019 report of the European Investment Bank EIB on "The future of the European space sector: How to leverage Europe's technological leadership and boost investments for space ventures" [77] as an relevant reference to explore the future evolution of the Swiss space ecosystem. This choice is also in line with the growing commercialisation of space, as mentioned in the SSIP.

Prevailing business models

The EIB assesses that business cases with a B2C business model and a short implementation timespan combined come with a lesser risk than those with a B2B approach and a long timespan. First, the institution drafted a simplified European landscape of eight business model segments: (1) launch industry; (2) satellite manufacturing; (3) satellite services; (4) ground equipment; (5) national security; (6) crewed and robotic space science and exploration; (7) space tourism (incl. habitation); (8) energy, mining, processing and assembly. In Figure 12, these segments are presented along business services (yellow boxes), with their interdependencies, a classification in terms of business character (B2B or B2C) and implementation timespan (long or short).

Figure 12 : A landscape of space business services, business models and segments [78]



[77] (2019). European Investment Bank, The Future of the European space sector, executive summary
[78] Ibidem, page 44

From a business perspective, the EIB interprets this landscape as follows: “Acknowledging that market opportunities are, in general, more favourable in a B2C dominated sector and that entry hurdles are lower in business segments where projects and business models may be realised within short time frames or where it is possible to thrive on short generation cycles, we can infer that the associated business models are less risky on the upper right-hand side of Figure 12 and come along with higher risk levels on the lower left-hand side” [79].

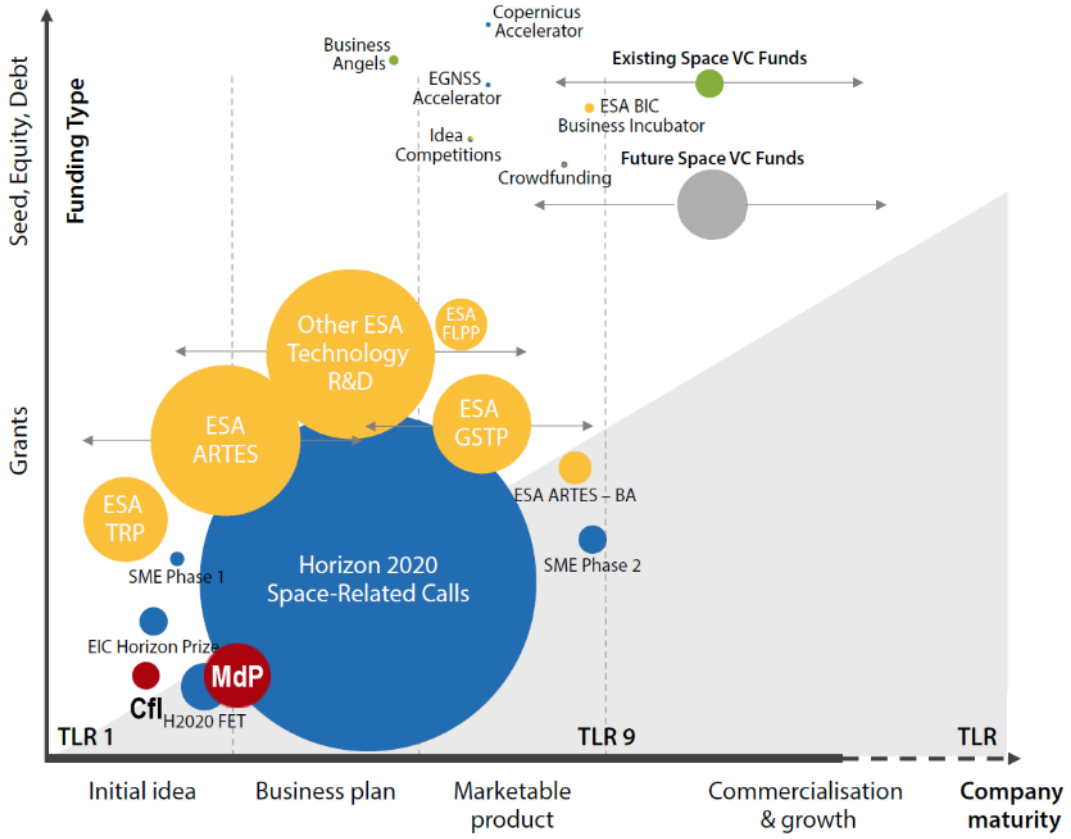
The report assesses the risks by market segment, which can be found in appendix A.13 Risk assessment of market segments and business models, page 89.

In the end, it is the business models and the technology trends, pondered by the risk factors, that primarily govern the ongoing innovation process within the respective market segments.

ESA and Swiss funding instruments by TRL level and funding time

As Swiss space research and industry rely strongly on ESA and Swiss funding, the following graphic gives a useful overview by development level and quality of funding. The SSO funding instruments were added.

Figure 13 : Overview of space-focused financial instruments in Europe and Switzerland



b. Interviewee perceptions

Global space environment in a decade and corresponding challenges for Switzerland

The workshop participants agreed that in ten years space is due to affect our lives even more. In that regards, the experts thought the following trends, statements and questions to be relevant in a decade:

[79] Ibidem, page 44

1. Space penetrates our daily lives even more (autonomous vehicles, etc.).
2. The strategic importance of space remains.
3. Democratisation is greater than today, for smaller states and smaller companies.
4. Commercial space-based applications and services increase: who will bear the risk for funding the infrastructure?
5. Regarding infrastructure, the backbone is state-financed, other parts possibly by commercial actors.
6. Sustainable space is key (debris, legal aspects).
7. Human exploration stays important, which may vary depending on political leaders.
8. Space is the new normal, with more jobs and possibly a different role for the SSC.
9. Time span from idea to realisation will become shorter in general, which is contradicting present trends at ESA/Europe.
10. Speed: impatience in society and parliament is growing, and at the same time ESA programmes tend to become longer. The fact that in space it takes time to see results remains true.

The main challenge elicited for Switzerland was to maintain and possibly improve global market access (ESA, EU, USA, China, Russia, India). To do so, the experts thought that Switzerland would need to:

1. become the world champion along the value chain, be “incontournable”;
2. turn into an (even more) attractive partner because of its excellence in academia and industry (human potential) as well as its agility;
3. establish new leadership areas, for instance by developing services and applications, daring vertical integration in specific areas and going global commercially;
4. be part of the world, in terms of memberships, partnerships and access rights;
5. contribute to stable/stabilized international partnerships;
6. continue to support access to space (launcher activities);
7. support the key role of space in its innovation, research and education policies;
8. provide adequate framework conditions, in terms of stability, security, competitiveness;
9. foster the development of earth use cases (e.g. in smart cities, together with non-space actors);
10. develop strong education curricula to attract talents.

Ideas to change the Swiss space ecosystem: some dreams!

The interviewees yielded abundant ideas to change the Swiss space ecosystem (regardless of constraints), touching upon funding, collaboration, facilitation and policy issues. These include in decreasing citation order:

1. Mobilize additional funding: from public sources, especially for R&D or for certain domains, and allow to invest beyond ESA, but also from private investors, including initiatives fostering investment in space from private and institutional sectors alike.
2. Provide networking opportunities and collaboration support, with a strong focus on facilitating the academia and industry linkages, but also the idea to have clear contact points.
3. Propose facilitating tools, such as intelligence (gathering and sharing of space trends), coaching and continuing education for newcomers, public awareness and focus area definition.
4. Develop and nurture innovative initiatives to build concrete and ambitious cross-sectoral projects with current and non-space actors, especially for downstream activities;
5. Enhance policy impact, with a clear strategy formulation (potentially with highly visible outputs, such as a Swiss satellite or a Swiss astronaut), focus areas, promotion of specific domains (e.g. remote sensing), increased public awareness.

6. Support business development and facilitate scaling-up of companies, especially by smoothing access to the international market, by removing restrictions for Swiss companies in international institutional markets or by supporting market development in defence industry;
7. Reinforce and clarify institutional responsibilities and cooperation within the Federal Administration (simplify and/or clarify interdepartmental cooperation, consolidate the various space related initiatives);
8. Strengthen Switzerland's position within ESA.
9. Boost entrepreneurial culture and lower risk-aversion.

c. Evaluator perspectives

Most of the issues and challenges elicited in this chapter are in the realm of other stakeholders than the SSC, namely Swiss, European and international policy actors and are further influenced by science and technology developments and the evolution of the global environment. Still, the future SSC will have to make a difference in such an environment, of which numerous factors are out of its sphere of influence. The main aim of the SSC is to strengthen the Swiss space ecosystem, and thus the EIB findings are relevant to allow the SSE to thrive.

For Switzerland to become a world champion in specific market segments or focus areas depend mainly on:

- available funding (to overcome high upfront costs and create a strategic upstream–downstream interlink),
- friendly regulations and cooperation frameworks,
- availability of an international market demand, which may call for an anchor tenant that will guarantee a certain pick-up of a provided service (such as public entities).

As said, the ideas or suggestions, which came up either during the workshop or the interviews, are subject to an array of influences and only factors on which the SSE can have an impact were considered.

In this regard, a cornerstone for Switzerland is its space policy. The policy is the responsibility of the EAER, which means, strictly spoken. out of scope of the present evaluation. Yet, this policy is also at the very center of the mission of the SSC, and a soft digression deemed relevant.

The policy dates back to 2008 and understandably is no more a fully relevant document to frame the national perspective on future space developments and the corresponding national ecosystem. Further, the most recent Swiss space implementation plan 2018-2020 analyses rather developments at the time of writing (2017) than it creates a common understanding and narrative about future developments or clarifies roles and responsibilities of various stakeholders, including among the Federal Administration.

Both from the workshop and the interviews, two key challenges stood out:

1. How to maintain or even increase competitiveness of the Swiss space ecosystem?
2. How to enhance market access within the EU, but also in the USA (NASA, SpaceX), Russia and Asia (China, India, Japan)?

The SSC can contribute to meet some aspects of both challenges, yet the bulk of the influence is in the hand of others.

Worth mentioning is that for the first time the workshop gathered stakeholders from research and industry in such a setting. Ample positive feedback was received in that regard. Moreover, this facilitated a most valuable dialog, allowing certain perspectives to be shared and discussed directly, complementing nicely the present evaluation report.

Key findings	
25.	The space sector and related applications will grow in terms of volume, actors and end users. Downstream will play a larger role and needs to be better considered, including in the upstream sector.
26.	Standard business models by segment, including an evaluation of probable implementation timespans, risks and profitability are available and can be used as a guidance for all actors.
27.	Market access is key, be it institutional or commercial. Most important are the EU and ESA, yet consulted stakeholders wish for larger access, including the USA, Russia and Asia. Increasing market access is in the hands of all SSE actors, the public and private sector alike, and not only of the SSC.
28.	There is no common Swiss narrative on how the global, and more importantly the Swiss space ecosystem could look like in a decade. Hence, an important building block is missing to imagine a performant future Swiss Space Center, serving at best the country's interests. This is collective endeavour under political leadership.
29.	Switzerland is a small country with limited resources, yet highly competitive with substantial investments in the space sector. In order to face the global competition, evaluation participants feel that existing resources could be used more effectively, and clear focus areas defined.
30.	Evaluation stakeholders ask for clarity regarding roles and tasks of SSO and SSC as well as within the Federal Administration.

5.2 Imagining the future Swiss Space Center

a. Data and document review

The immediate future of the SSC is framed by its new strategic plan 2019-2022 based on the SSIP 2018-2020, drafted and approved in 2018. This new plan stands for continuity as substantial parts are similar to the previous one. Yet the document brings in new technology topics such as "photonics" and "technologies for user-funded applications". Another change occurred in the emerging technology themes, which are now "ubiquitous connectivity and increased cyber security needs", "big data on planet Earth" and "accelerated industrialisation in the space sector". Thus, the SSC is including more digital and EORS themes in its present strategic plan.

b. Interviewee perceptions

Potential SSC activities with high added value

Networking and coordination, availability of intelligence as well and support to project development were seen as the activities with the highest potential added value. Half of the respondents (especially from industry and public organizations) formulated collaborative ideas such as an industry-academia forum, more effective coordination based on the identification of skills, activities or opportunities, or even lobbying. Intelligence for an early identification of technological or financial opportunities was a demand from a fourth of the respondents from academia and industry. Another recurring theme was that of support for project development (5 mentions), particularly in relation to ESA programmes, either through coaching, coordination, or financing, or even the sharing of certain infrastructures.

Prototyping the future SSC

The main aim of the workshop was to draw on the collective intelligence of 17 experts to imagine avenues for reflection for the future SSC.

First, the workshop participants, divided in four groups, were invited to build a provocative prototype. The prototypes proved all to be some kind of metaphor of a spider and its web, be it in terms of organisational design

or facilitator role of the SSC. In a next step, the groups filled out a canvas with the main features, that they imagined for the future SSC. The results are featured in appendix A.1 [80] and a summary presented below.

Mission	The missions developed came with a variety of leadership levels, from "filling a structural hole" to "being a catalyst for change". The SSC was meant either to actively support stakeholders, facilitate or provide services. In terms of features, the SSC should be independent, proactive and agile.
Goals	In five years, the SSC will possibly have a different name. It is expected to coordinate common projects of academia and industry as an independent entity. It will have an updated and dynamic mapping of the SSE and established links outside the space industry. It will have established clear activity areas and measure success against KPIs. In 2030, the SSC may not be needed anymore, or it will be more effective than an agency. Topics such as KPIs, cross-sectoral facilitations, ecosystem mapping and inclusion of non-space actors will be still on its bucket list.
Scope	The SSC will care for relevant Swiss actors, with a national and international outreach, considering a fair balance between upstream and downstream. It will be a space lab, a platform, an advisory and coordination entity and engage in education as well. It will be neither a consulting firm nor a representative of the State. The SSC will be neutral towards all actors.
Target audience	Its target audience is meant to be wide-ranging: industry and service providers, academia/RTOs, private and institutional end users, including political entities (Federal Administration, cantons, cities). It should include space science and global actors seeking access to Switzerland and work on stronger partnerships with the UAS.
Services	As an essential service, nurturing the ecosystem and mapping its features (technologies, services, capabilities, knowledge) was mentioned by all groups but one. Group 1 saw an extremely proactive SSC: "attract nodes into the network, hunt for (needed) competences and network, teach with tailored teaching and courses, support with know-how on processes and programmes". Three other groups saw it more in a facilitation and support function.
Funding	Four groups thought that the SSC will rely on services for all or part of its financial resources (e.g. business development in another country). Public funding was seen as still an important resource for three groups. Only one mentioned membership as a regular income base.
Partners, complementary services	Besides the natural partners (ESA, SSO/SERI), were mentioned independent financial partners, equivalent organisations (space agencies, academia/labs) and industry associations (trade organisations, lobbying groups) or armasuisse. One group urged to "think beyond the guild of the messy space people".

c. Evaluator perspectives

In sum, there is a strong demand for clarity, focus, inclusiveness, agility, collaboration, ecosystem nurturing and intelligence, resource pooling, continuing education as well as specific services to better leverage Switzerland's capabilities. An increased budget is not a primary demand, even if federal funding can be critical to meet the above-mentioned demands.

Designed to contribute to the implementation of the SSIP, the changes in the strategic plan 2019-2022 show a move towards a greater inclusion of downstream services and actors, and thus aims as well at a greater contribution to Digital Switzerland. Yet, the Steering Committee chose to keep the same plan structure and misses the opportunity to better leverage the tool's potential for monitoring, accountability and learning.

The main demands from the workshop participants revolve around market access and increased capacity to leverage upcoming opportunities through increased cross-sectoral and international collaboration as well as better intelligence on space trends. The scope of the SSC should be broadened to include downstream and applications stakeholders, non-space actors as well as private and institutional end users, such as entities of the public administration, such as the Department of Defence or cities. On the side, it is interesting that interviewees

[80] See A.14 Five possible SSC profiles incepted at the workshop, page 85

asked for clearer goals for the SSC, and when the workshop participants were asked to frame these goals, they drafted mainly activities or status rather than proper goals.

Key findings

31. The strategic plan and related tools for 2019-2022 are in the same format with similar content as the previous ones. The opportunity could have been used to review the performance of these instruments before proceeding as well as to reassess environment of the SSC and needs of the ecosystem.
32. The adequate positioning of the future SSC in terms of independence, role (facilitate or lead) and scope is key.
33. The SSC (strategic plan), the interviewees and the workshop participants agree that in the future applications should be included and devoted a substantial share of SSC's activities.
34. The future SSC is seen to play an important role regarding access to funding, including to private investments.
35. Mapping the SSE, including in terms of technologies, products and services, capacities, knowledge and ongoing projects, is seen as one of the upcoming tasks for the SSC.
36. Proposing intelligence on space trends and opportunities is called for by interviewees and workshop participants alike.
37. The operational model of the future SSC needs refining or even a total review, depending on its positioning, activities and available funding.

6. IMPLICATIONS AND RECOMMENDATIONS

In this chapter, the findings are grouped according to the relevant evaluation questions and the corresponding implications and recommendations drafted. The addressees of the recommendations are mentioned in brackets.

6.1 Has the Swiss Space Center reached the target state?

6.1.1 Relevance and role

a. Related evaluation questions

- Is the mission of the SSC appropriate to implement the partial aspect of space policy to be analysed?
- What is the nature, extend and quality of the contribution of the SSC to the Swiss space policy?

b. Relevant findings (repeated here from previous chapters)

1. The role of a governmental body (i.e. the SSO), including the drafting a space policy matching the capabilities of the Swiss space ecosystem, is valued.
2. Respondents aspire to an enabling operational engine, such as the SSC, to foster collaboration and help leverage relevant opportunities.

30. Evaluation stakeholders ask for clarity regarding roles and tasks of SSO and SSC as well as within the Federal Administration.

c. Implications

The functionalities covered by the present SSO and SSC are most valued and seen as indispensable (findings 1 and 2). To this day, some confusion remains regarding the respective roles and responsibilities despite a corresponding clarification letter of the SSO[81] (finding 30). This is due to certain pragmatic decisions such as the delegation of specific tasks to the SSC (e.g. SSC's support to the Swiss delegation to the ESA Technology Harmonisation Advisory Group) or individual events being featured under the SSO banner (e.g. Swiss Space Industry Days). Further, related tasks are performed by entities such as ESA BIC or AP-Swiss, which adds another level of complexity. Finally, the growing presence of space-related applications in our daily lives leads to the involvement of further public entities (e.g. Swisstopo, the Federal Road Office, the Department of Defence, cities) and results in rising coordination needs among the Swiss public administration.

Clarity about roles and responsibilities as well as coordination mechanisms among the various public or publicly funded entities involved in space-related activities is essential. This need is enhanced by the fact that there is no space agency in the making, as such an agency would simplify the process to a certain extent. Starting such a discussion as soon as possible will be conducive to decide on the number and kind of facilitation bodies needed.

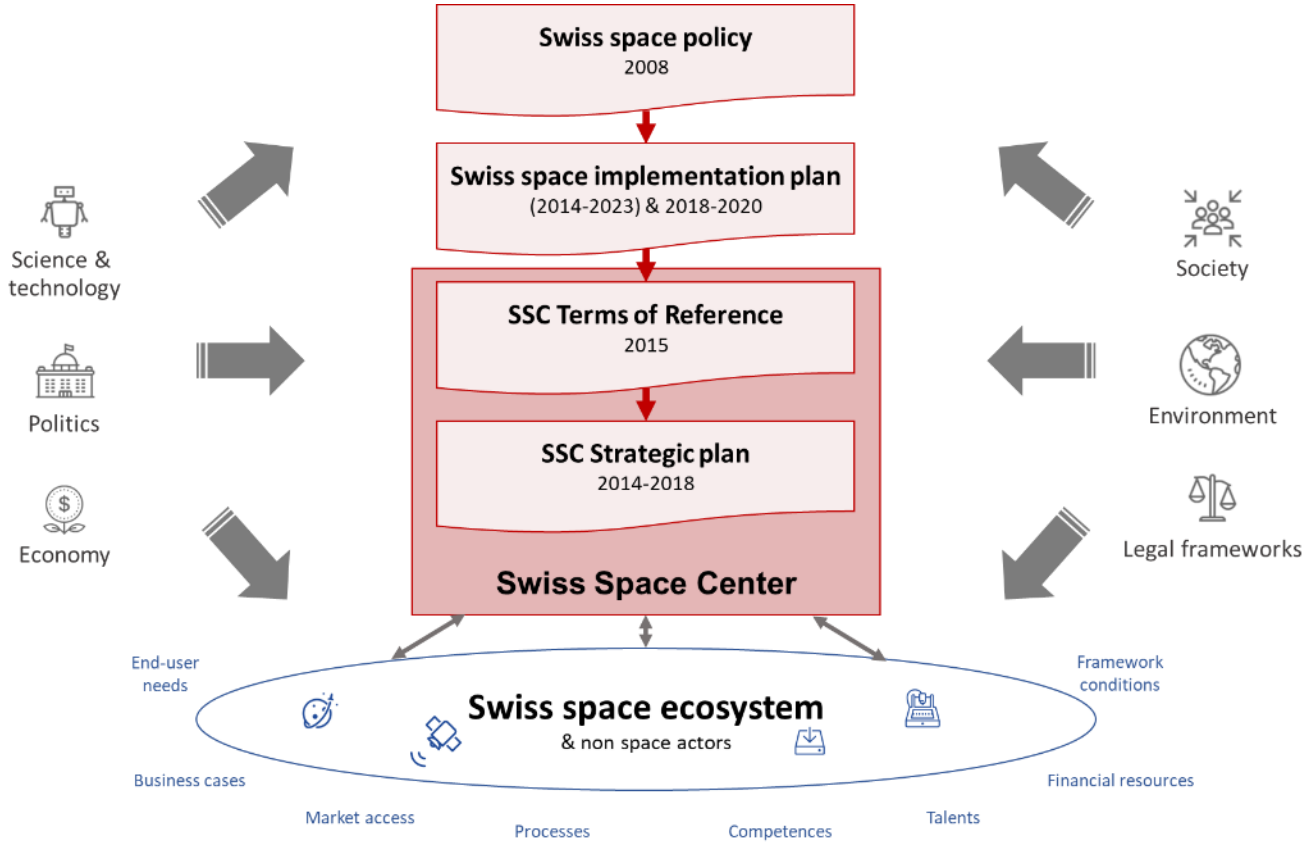
Recommendations	
R.1	Initiate a discussion about roles with the various entities involved today in space-related activities as well as the corresponding coordination processes. Then publish the decisions on an easily accessible internet page and update it as reality changes (SSO, SSC and SSE).

[81] Appendix 86 SSO and SSC: Letter defining roles and responsibilities sent by the SSO to all stakeholders

6.1.2 Alignment of SSP, SSIP, SSC TOR and strategic plan with the needs of the SSE

The mission of the SSC is to contribute to the implementation of the Swiss space policy. Its TOR states that it provides a range of services to the Swiss space ecosystem to help its actors access space-projects and related applications. The question is how the SSP links up with the SSE potentialities and needs.

Figure 14: Simplified presentation of policies, SSE and context



a. Related evaluation questions

- Is the mission of the SSC appropriate to implement the relevant aspects of the Swiss space policy?
- What is the nature, extend and quality of the contribution of the SSC to the Swiss space policy?

b. Relevant findings

4. A range of issues affecting the Swiss space ecosystem depend on factors, which cannot be influenced by the SSC. These include the Swiss participation in ESA, the relations with the EU, the emergence of NewSpace or the commercialisation of space.

16. The Swiss framework conditions are most conducive. Yet the Swiss space industry face specific challenges related to the local market size and difficulties to enter the international space market.

20. The main purpose of the SSC to contribute to the implementation of the SSP is mentioned first in its TOR under mission. Yet, the corresponding goals and approaches could be better formulated, and the management of funding instruments mentioned. Further, the targeted bottom-up approach could be better taken into consideration.

c. Implications

A narrow national space strategy in such a complex and rapidly evolving environment is not adequate. Still there is some leeway to set a general purpose, directions of impact, overall goals, broad roles and responsibilities as well as guiding principles. Such a process would allow to create a common understanding and narrative on space-related challenges, to mobilize resources and collective intelligence in a set of directions and to manage expectations among the various stakeholders.

Coherence and continuity from the SSP down to the strategic plan, or even the workplan, is conducive to an effective SSC. On the other hand, the needs and particularities of the SSE need to be considered, in line with the bottom-up policy pursued by the Federal Administration. Yet, stakeholders (members and non-members) expressed that their needs are not sufficiently taken into consideration. In addition, the SSC is certainly at times torn between policy and stakeholders' expectations. Thus, a thorough and candid dialog between policy and Swiss space stakeholders on how to best leverage existing potentialities for the benefit of the SSE and Switzerland. Such a process would help address issues such as the outlines of the EU/ESA cooperation (finding 4) and market access (16). As a result, the TOR of the SSC could be updated accordingly (20).

Recommendations	
R.2	Use the opportunity of the needed update of the 2008 Swiss space policy to initiate a comprehensive consultation process (SSO, with SSE).
R.3	Adjust SSC's TOR as soon as its future set-up and role are clarified (SSC BoD).

6.1.3 SSC positioning and location

a. Related evaluation questions

- How is the role of the SSC perceived? Does it facilitate access to and implementation of space projects for research institutions, industries and all stakeholders in Switzerland?

b. Relevant findings

18. Today the positioning of the SSC come across as blurred, due to its location and its PhD staff as well as to the branding used by the next door EPFL Space Center.

c. Implications

The positioning and therewith the perception of the SSC as the national center facilitating space activities is essentially blurred by three factors: its location on the EPFL premises, its hosting of PhD staff as well as confusing branding and roles between the SSC and the adjacent EPFL Space Center (eSpace). The two latter could be addressed in the very short term. Once the future role of the SSC determined, its future location and legal status should be established, so to best serve the targeted role. A more central location would reinforce the perception of a national and possibly of a more independent space center.

Recommendations	
R.4	Refrain featuring PhD students on the SSC website, and ideally find another institute to affiliate these students (SSC).
R.5	Start or pursue the dialog with the EPFL Space Center (eSpace), so that branding and roles becomes distinct from that of the SSC (SSC BoD, EPFL).
R.6	Avoid using EPFL email contact addresses on SSC's website[82] and using them altogether (SSC).
R.7	Reassess location and legal status of the SSC until its functionalities and other features have been laid out (SSC BoD with Team and SSE).

6.1.4 SSC activities

a. Related evaluation questions

- Do the services of the SSC correspond to its mission?
- Do the results obtained correspond to expectations?
- Are industry, academia and other SSE stakeholders using the services of the SSC? Could the SSC strengthen its expertise? Has it strengthened the network among the SSE?

b. Relevant findings

3. Cross-sectoral collaboration, especially between academics and industry, is critical for the competitiveness of the Swiss space sector.
9. The present membership concept could meet stakeholder needs and expectations better: on the one hand revenues from membership fees are not substantial, yet regular; on the other hand, members feel that they are not getting enough value out of their membership.
10. The Working Groups are not yet performing to their full potential, as their role and impact expectations are equivocal and complementing convening platforms not used yet.
12. The MdPs are especially valued, by academia and industry alike. Moreover, an ongoing internal monitoring as well as an external evaluation have demonstrated their positive impact. Yet, there is a call for a sharper strategy, greater communication on the process upfront and regarding the ongoing coordination with other funding instruments.
13. Active, institutionalized and participatory networking managed as a process is key to drive high impact collaborations.
14. The SSC is expected to play a stronger role in supporting the inception of space-related projects, in particular cross-sectorial projects and potentially emblematic projects.
15. Interviewees feel that the added value of the various activities is not fully in line with the needs and expectations of the Swiss space ecosystem.
17. The various instruments used by the SSC (MdPs, training, coaching, networking) are important to address the needs of space actors.

c. Implications

The SSC is particularly valued for bringing SSE stakeholders together, be it through networking activities or via the two funding instruments MdP and CfI (finding 3). Therefore, a call for intensifying and possibly structuring even more this role as facilitation engine came up (9, 10 13, 15). This could entail evolving from a networking facilitator to an ecosystem facilitator[83] as well as the facilitation of joint, potentially emblematic projects. Among

[82] "Please send your complete application (CV, motivation letter and required position) to gregoire.bourban@epfl.ch until Monday 17 June, 1pm. " https://www.spacecenter.ch/activities/spacecareer/ntp/

[83] (2018) SSI, Why Cultivating Your Innovation Ecosystem Is Worth the Work:

other things, its facilitation role is expected to be conducive to move space projects from the initial ideas to the final product or service, up the TRL thermometer (14).

The most positive impact of the MdPs could be further leveraged by communicating better about the award criteria bilaterally as well as publicly about the successes they generated (12).

The four tasks as described in the TOR (networking, access to space projects, training and public awareness) make sense (17). Yet, their impact could be increased, for instance by ascertaining that these activities truly meet stakeholders' expectations and needs as well as contribute significantly to the SSP implementation. Further, these activities and their impact could be made more visible through adequate individual and aggregated KPIs. Finally, some activities or functionalities could possibly be performed more adequately by a different actor.

Recommendations	
R.8	Reinforce SSC's networking activity to evolve into a structured and long-term oriented facilitation role (SSC, with SSE).
R.9	Identify common cross-sectoral projects to mobilize and strengthen the existing community and beyond (SSC, with SSE).
R.10	Reassess certain activities, including Working Groups, by involving stakeholders as well as developing and analysing adequate KPIs (SSC, with SSE).

6.1.5 SSC tools and performance

a. Related evaluation questions

- Do the results obtained correspond to expectations?
- Are they sufficient in relation to the resources committed?
- Have key scientific, technological and industrial skills as well as competitiveness of Swiss actors in the space sector been strengthen?

b. Relevant findings

11. The SSC successfully conducts a large range of activities, yet it misses the opportunity to collect, analyse and publish as adequate qualitative and quantitative data on key activities, which impacts its accountability and learning processes.

19. Employing a high proportion of staff under terms of employment meant for junior staff is not conducive to a performant organisation, as high job rotation demands frequent onboarding and impacts performance as well as motivation. On the other hand, the SSC plays a valuable training role as a first employer after graduation for the SSE.

21. Formal processes defined in the TOR are diligently implemented. Still, the processes are not used to serve at best SSC's mission and its members, as the potential leverage of such tools is much greater, including to ensure the required accountability.

22. The present strategic plan, work plan and monitoring processes are not conducive to adequately measure neither SSC's current contribution to the implementation of the Swiss space policy nor the full impact of its activities.

The MIT D-Lab defines an ecosystem as "place-based communities of interacting actors engaged in producing innovation and supporting processes of innovation, along with the infrastructure and enabling environment which allows them to create, adopt, and spread solutions to local challenges". Further, among the benefits the Stanford Social Innovation Review SSI mentions new resources, favourable operating conditions for innovation and new capacities within the system. Strategies on how to achieve these benefits are well described. https://ssir.org/articles/entry/why_cultivating_your_innovation_ecosystem_is_worth_the_work

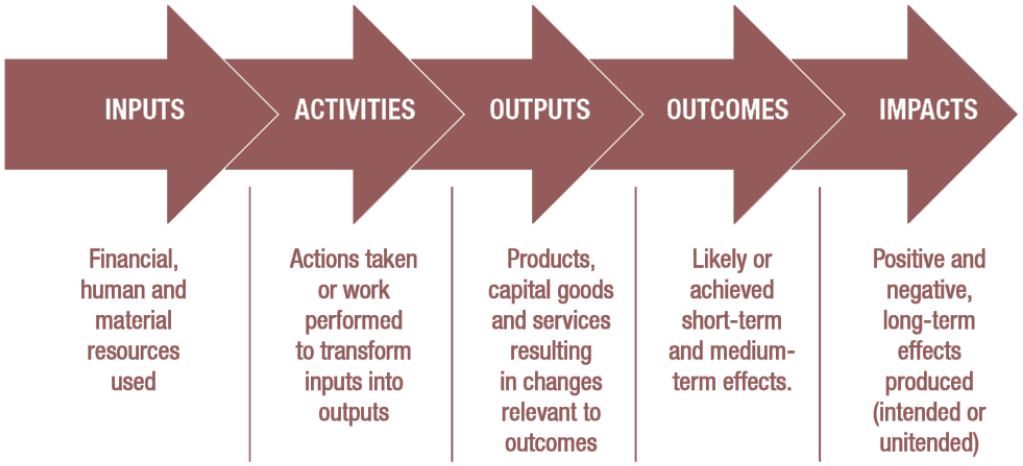
31. The strategic plan and related tools for 2019-2022 are in the same format with similar content as the previous ones. The opportunity could have been used to review the performance of these instruments before proceeding as well as to reassess environment of the SSC and needs of the ecosystem.

c. Implications

The mission of the future SSC to contribute to the implementation of the SSP should be confirmed. Therefore, a logical and traceable link between the SSP and the SSC mission is needed (findings 21 and 31). The same link should appear between the SSC mission, its strategy and the work plan reporting. The lack of these links renders the assessment of the achievement of the targeted impact difficult. In addition, the absence of a coherent organisational framework deprives the SSC from a range of opportunities, such as implementing corrective measures in due time, timely learning as well as ensuring the meeting of accountability requirements (finding 21). Moreover, having such a monitoring and learning system in place would also provide communication material to be shared with the SSE. By communicating more about its own achievements, including aggregated data, would not only inform stakeholders accordingly, but also increase trust and therewith stakeholder engagement.

As SSC's main mission is to contribute to the implementation of the Swiss space policy, development concepts as incepted within the OECD Development Assistance Committee (DAC) are well adapted to help the SSC to produce and measure the intended impacts. This conceptual framework is reflected in the Result Chain, described as "the causal sequence for a (development) intervention that stipulates the necessary sequence to achieve desired objectives beginning with inputs, moving through activities and outputs, and culminating in outcomes, impacts, and feedback"[84].

Figure 15 : OECD Result chain



This result chain with the relevant KPI could be consolidated in a balanced scorecard to monitor progress, learn, take the needed corrective measures and evidence accountability requirements (22).

Numerous activities such as meetings with members or other stakeholders went unregistered as the SSC does not populate a CRM accordingly. Therefore, these activities were not reported and as a consequence went unnoticed by numerous stakeholders. Feeding a CRM with appropriate data would not only allow adequate reporting but also contribute to an increased internal coordination as well as to ensure an appropriate institutional memory. Further, means to better share expertise of the SSC team and their learnings from international conferences should be evaluated.

As the SSC is presently legally and administratively fully integrated in the EPFL, the standard conditions of employment of the ETH apply, triggering substantial job rotation among junior staff because of short-term

[84] (2014). OCDE. Development results, An Overview of Results Measurement and Management https://www.oecd.org/dac/peer-reviews/Development-Results-Note.pdf

contracts (19). On the other hand, the SSC is a most valuable first employer for young graduates, before they join other space actors and this precious role should remain.

Recommendations	
R.11	Reinforce coherence of the SSC various internal governance documents with the SSP and the SSIP to ensure that the SSC achieves the target state (SSC).
R.12	Evaluate the adequacy of using the result chain framework to monitor progress and enhance impact (SSC).
R.13	Enhance communication on successes, such as the MdPs, to better leverage the multiple activities of the SSC (SSC).
R.14	Assess the opportunity to acquire and maintain a CRM to document SSC's external relations (SSC).
R.15	Initiate or pursue a dialog with EPFL HR department to design employment conditions suiting better SSC's staff and management while keeping the needed agility (SSC, with staff and EPFL; to be coordinated with R7).

6.2 How to better leverage Swiss space capacities in the future?

a. Related evaluation questions

- Is the mission of the SSC appropriate to implement the partial aspect of space policy to be analysed?
- Are industry, academia and other SSE stakeholders using the services of the SSC? Could the SSC strengthen its expertise? Has it strengthened the network among the SSE?
- How is the role of the SSC perceived? Does it facilitate access to and implementation of space projects for research institutions, industries and all stakeholders in Switzerland?
- What changes might make the ecosystem more effective?

b. Relevant findings

23. The downstream segment, EORS, represents a substantial share of the activities of all three foreign centers. Therewith, these centers contribute significantly to the digitalisation process of their country and create more opportunities for business applications and thus economic value.

25. The space sector and related applications will grow in terms of volume, actors and end users. Downstream will play a larger role and needs to be better considered, including in the upstream sector.

26. Standard business models by segment, including an evaluation of probable implementation timespans, risks and profitability are available and can be used as a guidance for all actors.

27. Market access is key, be it institutional or commercial. Most important are the EU and ESA, yet consulted stakeholders wish for larger access, including the USA, Russia and Asia. Increasing market access is in the hands of all SSE actors, the public and private sector alike, and not only of the SSC.

28. There is no common Swiss narrative on how the global, and more importantly the Swiss space ecosystem could look like in a decade. Hence, an important building block is missing to imagine a performant future Swiss Space Center, serving at best the country's interests.

29. Switzerland is a small country with limited resources, yet highly competitive with substantial investments in the space sector. In order to face the global competition, evaluation participants feel that existing resources could be used more effectively, and clear focus areas defined.

c. Implications

Switzerland does not have yet a common narrative about the present and future development of the space sector from a national perspective (findings 28 and 29). Such common analysis could be developed within the process of the new Swiss space policy. Some learnings could come from a similar process taking place at the

time of writing under the leadership of the Federal Department of Foreign Affairs for the upcoming dispatch for the International Cooperation[85].

The upstream dependent application sector is the most lucrative segment in the space sector and is due to expand. This means that more non space actors will become involved with the SSE, either from specific economic sectors (e.g. agriculture, transportation, industry) or with particular transversal competencies (e.g. artificial intelligence, data management and storage). Switzerland has identified this trend early on and described it in various policies. Still, the perception prevails that the scope and size of this segment will continue to expand, and that the implementation tends to lag behind (23 and 25).

Maintaining and expanding market access is an important industry endeavour and mostly in its own hands (27). For research, access to the EU research programmes is just as critical. To adjust stakeholder expectations with the Swiss diplomatic room for manoeuvre, a consultation or a workshop including a broad range of actors would be valuable.

One key of the recommendations of the cited report of the European Investment Bank EIB is to "establish a "finance for space" forum with representatives from the finance community, academia, policymakers and industry to bridge the information gap and develop innovative financing solutions for the space sector"[86] (findings 26). Given the leadership position of the Swiss finance sector, such an initiative should not only meet extensive interest but also draw on the unique skillsets available in the country.

Recommendations	
R.16	Develop a common narrative about the future developments of the space sector from a Swiss perspective (SSO, with SSE and the support of the SSC).
R.17	Initiate a consultation or table ronde to refine the market access needs and possibilities for the SSE (SSC, with SSE).
R.18	Launch a "finance for space forum" to enhance mutual knowledge between finance and space actors to increase investment in the SSE (SSC, with SSE and relevant finance actors).

6.3 How could the needed functionalities be implemented?

A critical set of activities and services conducive to a performant Swiss space ecosystem were gathered from the evaluation (relevant findings). To foster the implementation of these activities and services is one of the primaries goals of the SSO. Yet, this process does not necessarily entail designing a different SSC, but rather looking at the functionalities needed and grouping them first in modules and then in entities, so to best achieve the intended purpose. As in any model, a set of conditions and assumptions were isolated at the beginning.

a. Related evaluation questions

- What changes might make the ecosystem more effective?

b. Relevant findings

5. The mission of the SSC is seen as relevant.
6. An opportunity arises to renew its mission in light of the present opportunities and challenges to possibly include further tasks, such as the pooling and sharing of resources (intelligence, infrastructure, knowledge-transfer and access to funding) and better spell out its potential role in application-related projects.

[85] See FDFA website, "More effective international cooperation: FDFA and EAER launch public consultation", https://www.eda.admin.ch/deza/en/home/news/news.html/content/eda/en/meta/news/2019/5/2/74889 , accessed June 2019
[86] (2019) European Investment Bank. The Future of the European space sector, page 14

7. Refined goals beyond contributing to the SSP can add clarity and help manage stakeholders' expectations.
8. Today's governance and affiliation of the SSC creates confusion. Most stakeholders still perceive the SSC under the sole responsibility of EPFL. For the same reasons, the SSC leadership is prone to receive contradictory injunctions from various governance stakeholders.
24. A state space entity with all activities (political and operational tasks, ESA relations and budget management) under the same reporting line and budget is more efficient. On the other hand, an autonomous entity can draw on additional funding streams, such as institutional mandates and consulting fees. Yet, the question arises whether other organisations such as universities or private organisations would not be more adequate for the latter activities.
32. The adequate positioning of the future SSC in terms of independence, role (facilitate or lead) and scope is key.
33. The SSC (strategic plan), the interviewees and the workshop participants agree that in the future applications should be included and devoted a substantial share of SSC's activities.
34. The future SSC is seen to play an important role regarding access to funding, including to private investments.
35. Mapping the SSE, including in terms of technologies, products and services, capacities, knowledge and ongoing projects, is seen as one of the upcoming tasks for the SSC.
36. Proposing intelligence on space trends and opportunities is called for by interviewees and workshop participants alike.
37. The operational model of the future SSC needs refining or even a total review, depending on its positioning, activities and available funding.

c. Assumptions

First a set of principles were laid out, which were called assumptions, as they are debatable or subject to revision.

A.1 Switzerland does not want to set up a space agency or anything that could compare to one.

A.2 Switzerland defined a space policy with three pillars as well as the corresponding SSIP with a set of technical focus areas. The new system should serve these two policies.

A.3 The State is not necessarily the more effective provider of activities and services for a performing SSE. It acts only within its sovereign areas or in case of market failure.

A.4 The State's philosophy is outsourcing, rather than insourcing.

A.5 The Federal Administration favours a bottom-up approach.

A.6 Some modules could be subject to a call for proposals, just as ESA BIC was.

A.7 Function comes first, governance and organisational set-up second.

A.8 If functions are assembled in a coherent way into modules, so to foster synergies, the corresponding entities will thrive.

d. Conditions

A range of conditions must be met for the new facilitation system to succeed.

C.1 The system needs to be set up in a way to enable a coherent, agile and effective facilitation scheme to serve the Swiss space policy.

C.2 The new system shall favour development paths from TRL 1 to TRL 9 to yield a maximum of operational products and services.

C.3 The new modules shall be autonomous, performing, sustainable, distinct, complementary, free of conflict of interests, agile, operational as well as meeting stakeholders' needs and coherent with the Swiss space policy.

C.4 The State shall not substitute itself to the private sector in any way.

C.5 The present services provided by the SSC to the SSO, such as supporting the Swiss representation within ESA (e.g. with the Technology Harmonisation Advisory Group), must be allocated to a module.

C.6 Technology transfer must be able to take place.

e. Modules

Eight logical modules were designed, and the following characteristics populated for each of them: stakeholder needs, objectives, services and activities, possible providers, links to other functionalities and comments.

M.1. Provide services implemented to the SSO

Stakeholder needs	The SSO needs to delegate the implementation of certain activities, on an ongoing or one-off basis (e.g. representation within ESA or 2016 ministerial ESA meeting in Lucerne).
Objectives	- **Implement activities for the SSO, that the latter cannot implement itself, be it for reason of scope (non-strategic) or resources**
Services and activities	F.1 Manage call for proposals MdPs and CfIs, including monitoring and follow-up F.2 Participate in ESA THAG Swiss delegation, including liaising with relevant Swiss companies F.3 Represent Switzerland at various conferences F.4 Facilitate dialog, coherence and synergies between various Swiss actors for a performant and relevant space sector (ESA BIC, SSIG, economiesuisse, EORS entities, Digital Switzerland) F.5 Support to SSO on specific one-off tasks (e.g. event organisation (e.g. industry days or ESA CM16 in Lucerne) or document drafting)
Possible providers	- An entity, in which SSO plays a major role regarding governance and funding (Public-Private Partnership PPP) - The SSO itself
Links to other modules	M.7 Execute mandates linked to space (F.1 Manage call for proposals MdPs and CfIs, including monitoring and follow-up and F.5 Support to SSO on specific one-off tasks (e.g. event organisation (e.g. industry days or ESA CM16 in Lucerne) or document drafting) M.6 Foster the realisation of scientific, technical and economic opportunities for F.4 Facilitate dialog, coherence and synergies between various Swiss actors for a performant and relevant space sector (ESA BIC, SSIG, economiesuisse, EORS entities, Digital Switzerland)
Comments	The “F.1 Manage call for proposals MdPs and CfIs, including monitoring and follow-up” functionality could also be handled by another or even independent entity, yet not in the entity providing coaching to access these instruments.

M.2. Facilitate access to funding

Stakeholder needs	Swiss industry and research stakeholders need funding, public and private[87].
Objectives	- **Increase private funding in space by creating a conducive platform for space and finance stakeholders to enhance knowledge and understanding of each other to develop new models and increase private investments in the space sector** - **Enhance access to public and private funding and its impact**
Services and activities	F.6 Convene key players to facilitate dialogue between demand for and supply of finance F.7 Raise awareness about existing financing instruments, institutional and private ones, via case studies, workshops and other hands-on means F.8 Identify specific needs and develop new (co-)funding models F.9 Bring the needed expertise to intermediaries and investors to be able to properly assess the real technical risks and market potential of the sector
Possible providers	- An independent entity, either funded by the SSO, private investors and/or a membership scheme
Links to other modules	M.6 Foster the realisation of scientific, technical and economic opportunities

M.3. Propose scientific and technical intelligence

Stakeholder needs	Industry and research stakeholders need relevant space intelligence, such as scientific, technical, and manufacturing trends as well as technology transfer processes and opportunities. All stakeholders asked for a mapping of the Swiss space sector in terms of actors, technologies, products and services, capacities, knowledge and ongoing research projects. Access to similar information on a global level was asked for as well.
Objectives	- **Increase the sector's performance, especially in Swiss leadership areas**
Services and activities	F.10 Provide standard intelligence on scientific, technical, and manufacturing trends as well as technology transfer processes and opportunities F.11 Offer online searchable database of actors, technologies, products and services, capacities, knowledge and ongoing research projects of the Swiss space system F.12 Make available on-demand intelligence services
Possible providers	- A commercial entity - A PPP providing such services against payment
Links to other modules	M.5 Deliver tertiary and continuing education (because of the interlinkage of intelligence, technology and knowledge transfer as well as training)

[87] One of the five recommendations of the European Investment Bank[87] is to establish a "finance for space" forum with representatives from the finance community, academia, policymakers and industry to bridge the information gap and develop innovative financing solutions for the space sector. This could be implemented as well at Swiss level.
Finally, there is call for institutional funding to stay and be more principled ((2019). European Investment Bank, The Future of the European space sector page 115.).

M.4. Offer market research

Stakeholder needs	Industry is in dire need of market information regarding the space economy, the more that the latter is evolving quickly with the emergence of NewSpace and could make applied research more relevant.
Objectives	- **Foster competitiveness of the Swiss space industry** - **Mutualize resources**
Services and activities	F.13 Provide market research regarding various business areas (actors, products, market shares) F.14 Monitor the emergence of new business models and new commercial opportunities
Possible providers	- A Swiss or international private entity - The SSIG
Links to other modules	M.3 Propose scientific and technical intelligence

M.5. Deliver tertiary and continuing education

Stakeholder needs	Industry and academia need continuing education and praised the SSC for that service. Interested young graduates look for a high level first professional experience, such as through the National Trainee Programme at ESA. Undergraduates are eager to learn more about space, for instance at summer camps or through and a MOOC (open to all). Except for a minor at EPFL, there is no dedicated space course to the evaluators' knowledge. Stakeholders need an official focal point regarding for space-related education[88].
Objectives	- **Develop relevant skills of students and professionals as well as facilitate onboarding of non-space actors**
Services and activities	F.15 Offer continuing education on technical, scientific, manufacturing and specific space-related topics F.16 Management of the National Trainee Programme at ESA F.17 Run summer camps for students F.18 Provide a list of relevant courses offered by other providers
Possible providers	- An independent entity, possibly a PPP - A university
Links to other modules	M.3 Propose scientific and technical intelligence

[88] A note in the MoM of the BoD mentioned that the SSC wanted to make an inventory of space-related courses. It would make sense to link these to other courses on space-related topics.

M.6. Foster the realisation of scientific, technical and economic opportunities

Stakeholder needs	Networking as an activity was the most appreciated activity of the SSC by industry and academia. This could be transformed into a goal-oriented process to nurture and develop the SSE. In addition, ongoing exchanges with the SSE could help spotting opportunities and bringing together possible project partners.
Objectives	- **Reinforce interaction within the SSE with the aim to increase the number of productive collaborations and cross-fertilisation** - **Nurture the bottom-up process through evolving leadership areas**
Services and activities	F.19 Growing the SSE in terms of competences and possibly size F.20 Foster productive collaboration among SSE actors F.21 Nurture bottom-up process through dialog, expert groups and surveys with space actors and users
Possible providers	- A PPP, possibly with a membership scheme - An independent entity
Links to other modules	0 Facilitate access to funding M.3 Propose scientific and technical intelligence

M.7. Execute mandates linked to space

Stakeholder needs	Non-space actors and start-ups need coaching to be successful in calls for proposals and access funding. Some existing actors may need support in specific areas for a limited time.
Objectives	- **Facilitate access to space projects for new actors** - **Provide specific expertise to existing actors** - **Manage specific or global projects for the SSE**
Services and activities	F.22 Help access institutional funding (ESA, NASA, SNF, Innosuisse, SSO…) F.23 Manage specific projects, such as ESA Lab F.24 Provide expert knowledge and coaching as needed
Possible providers	- Private entity - PPP
Links to other modules	0 Facilitate access to funding M.3 Propose scientific and technical intelligence

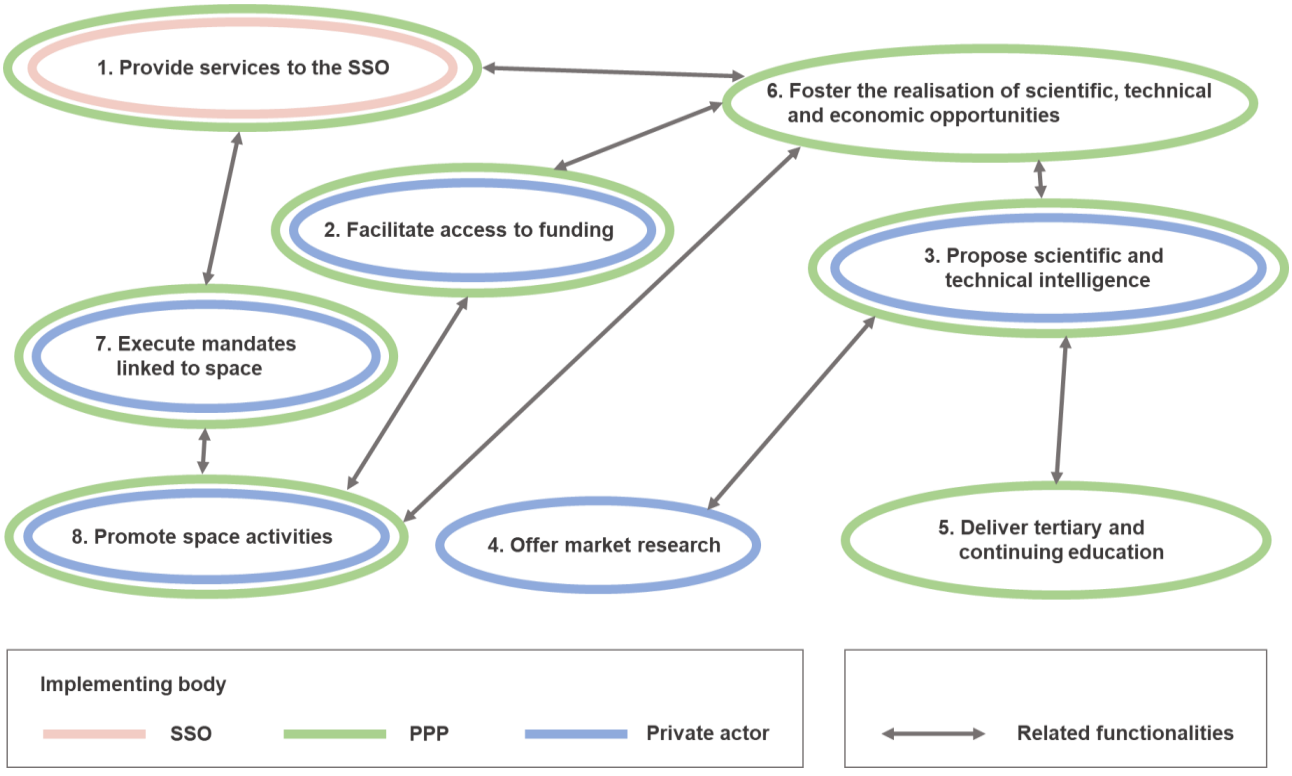
M.8. Promote of space activities

Stakeholder needs	Industry and research stakeholders expressed a strong demand for increased promotion of space activities and their impact on people's daily lives.
Objectives	- **Promote space among the general public, potential business and institutional end users as well as private investors**
Services and activities	F.25 Run specific promotion campaigns geared to specific target audiences, preferably with educational and participative perspectives F.26 Position space as a contributor to the public good and the Sustainable Development Goals
Possible providers	- A communication agency - A PPP
Links to other modules	0 Facilitate access to funding M.6 Foster the realisation of scientific, technical and economic opportunities M.7 Execute mandates linked to space

f. Designing entities

Modules are presented with their primary relations (arrows) and the characteristics of their possible implementing body (SSO, PPP or a private actor).

Figure 16: Mapping of modules



An entity could comprise one or several modules. The constraints will force the determination of several entities to perform all the needed functionalities.

The decision is to leave open at this stage which modules a future Swiss Space Center could include. On key reason is that a thorough and participatory process is needed, including both the SSO and the SSC, supported ideally by an external SSE sounding board.

The evaluators advise to factor in the following dimensions in the final decision:

Recommendations

R.19	Start an inclusive and collaborative process to design the future facilitation scheme for the SSE (SSO, with SSC and SSE).
R.20	Define impact priorities for the space facilitation scheme considering needs, policies, targeted results, feasability and resources (SSO, with SSC and SSE).
R.21	Evaluate a broader scope for the future SSC to include relevant non-space actors and public entities as well as market development support beyond ESA and access to private funding (SSC BoD with team, with SSO and SSE).
R.22	Consider that a decentralised system with several entities will come with more agility, yet add more complexity to an already complex environment and increase coordination needs (SSO, SSC, SSE).
R.23	Gather a significant number of functionalities under one roof to enhance synergies and possibly create a physical location for space actors to meet (SSO, SSC, SSE).
R.24	Consider moving the largest entity, probably the future SSC, to a more central location and chose carefully its organizational form to reinforce the perception of a national space center (SSC BoD with team).
R.25	Select with care BoD members as a diverse, multidisciplinary and representative board will be critical to the fulfillment of the targeted mission (SSC BoD).
R.26	Agree on a set of norms and engagements with SSE stakeholders regarding commitment and contribution to the future SSC and its activities (SSO and SSC with SSE).

7. CONCLUDING REMARKS

The present evaluation aimed to provide a structured and systematic approach to assess whether the current SSC has reached its target state as well as to develop directions of impact for a future SSC and facilitation scheme to help the SSE to develop to its full potential.

Recommendations from the evaluation could be operationalized along the same two stages:

a. Enhancing the effectiveness and efficiency of the current SSC

The mission and the associated tasks of the SSC were assessed as fully relevant. Networking activities were particularly valued. This process could be enhanced in transforming the SSC from a respected networking event organizer to an ecosystem facilitator (recommendation R.8, page 55). Such a role could include the identification of cross-sectoral projects (R.9, 55) as well as the reassessment of certain activities, such as the Working Groups. To ascertain that new activities correspond to actual needs and produce the targeted impact, these should be developed in consultation with the SSE and associated with KPIs (R.10, 55). In the same way, a possible support to the SSE in accessing new markets (R.17, 58) as well as the launch of an investment forum for space should be explored (R.18, 58).

The SSC implements multiple relevant and impactful activities. Yet, it could better leverage these successes by investing more resources to inform the space community and the public at large accordingly (R.13, 57). To ensure that its activities serve the implementation of the SSIP, the SSC could evaluate the use of the result chain framework, which would further enhance monitoring, learning and accountability (R.12, 57). In the same spirit, the deployment and cultivation of a CRM would help record activities and facilitate their dissemination (R.14, 57).

Several recommendations to enhance the positioning of the SSC as Swiss space facilitation body as well as its performance could be implemented immediately. Among them are refraining from using EPFL email addresses (R.6, 54), renouncing featuring PhD students on the website (R.4, 54) and pursuing the dialog with the neighbouring EPFL Space Center (eSpace) to outline distinct roles and branding for the two entities (R.5, 54). On the same line, a discussion to adapt the employment conditions of junior staff could be scheduled straightaway (R.15, 57).

On the other hand, the evaluators recommend that new directions of impact be defined first (R.7, 54), and then, on this basis, that internal governance principles and documents, such as the TOR and the strategic plan, be reviewed. To prepare the next phase, the SSO could start a discussion with various SSE players to outline respective expectations and available resources regarding the design of the future space facilitation scheme. SSE actors should take advantage of such an opportunity and participate actively in the process (R.26, 65).

b. Exploring the outlines of a future SSC

The current transformation of the space sector was one of the factors, which triggered this evaluation. The present facilitation scheme, especially the SSC, was perceived as having to evolve to meet the new needs and allow the SSE to unfold its full potential. This opportunity window could also be used to update the 2008 Swiss space policy using the typical Swiss consultation process (R.2, 53) and develop a common narrative about the future SSE (R.16, 58). This collaborative platform could further be used to design the future space facilitation scheme (R.19, 65) and define its impact priorities by considering needs, policies, targeted results, feasibility and resources (R.20, 65). Important to bear in mind in this regard is that a decentralized facilitation scheme comes with more agility but also with more coordination needs (R.22, 65). Broadening the scope of the SSC by involving relevant public administrations and non-space actors as well as including market development support and access to private funding should also be considered (R.21, 65). Once the new facilitation scheme in place, all relevant information should be published on an easily accessible webpage (R.1, 51).

The exact outlines of the future space facilitation scheme and even more of the future SSC were on purpose left open. The main reason is that this should be part of an inclusive process involving the SSC as well as representatives of relevant stakeholders. The evaluators would like to emphasize that gathering a significant number of functionalities under one roof would enhance synergies and possibly create a physical location for

space actors to meet (R.23, 65). Contributing to the implementation of the Swiss Space Policy is likely to stay at the center of the mission of the future SSC. Therefore, reinforcing the coherence between its internal governance documents with that policy would help the SSC reach its target state (R.11, 57; R.3, 53). Further, moving the SSC to a more central location and equip it with the adequate organizational form will be conducive to the fulfilment of its role of a national space center (R.24,65). Finally, a diverse, multidisciplinary and representative board of directors would serve the same purpose as well as enhance its performance.

A detailed presentation is available in the appendix A.16 Overview of recommendations with addressees, page 93.

As a final word, the evaluators call for their recommendations to be challenged, especially in light of new developments.

8. AKNOWLEDGEMENTS

The evaluators want to first thank heartfully the thirty-five persons who spared a precious amount of time for the interviews and the workshop. Each time, we felt most welcome, had truly interesting conversations and once even got a glimpse of fresh 3-D photos from Mars. We were further impressed by everybody's commitment to contribute to the development of the Swiss Space Center and the amount of time interlocutors made available (up to three hours). The workshop was as well a very rich and fruitful moment, with participants engaging in creative and productive activities, drawing from a diversity of perspectives.

We visited the SSC several times, were invited at the Annual Assembly in Zurich, met at our office and also outside. The senior management was eager to explain the numerous activities the SSC is conducting and truly patient when answering our multiple questions. We are appreciative to have had such a good working relationship with the evaluatee.

We would like to warmly thank the SSO team, which was of course our main counterpart and supported us throughout the process. We met several times in Bern, for the briefing, the kick-off, several follow-up meetings as well as countless emails and phone conversations. We managed to enrich each other's perspectives, while each party remaining strictly in its role, as sponsor and evaluator respectively.

To close, we need to thank each single person for his/her patience to onboard us into the space universe and the Swiss space ecosystem.

Sandra Wirth

Jérôme Billotte

Violette Ruppanner

9. APPENDIXES

A.1 Interview canvas in reference to evaluation model

Impact model	Evaluation model item	Final questions
A. General	**A. General Framework**: position within the Swiss space ecosystem	A.1. Describe a peak experience or major success where you/your organisation played a key role within the Swiss space ecosystem:
		A.1.a Describe the experience or success
		A.1.b What was it that made it possible & effective (circumstances, conditions, values, people, …)?
		A.1.c What value did you get out of it?
		A.1.d If you had three wishes that would ensure that every interaction of you or your organisation with the Swiss Space ecosystem would be as good as the one that you described, what would they be?
		A.2. What are the relationships and coordination needs between stakeholders in the space sector?
		A.3 How is coordination achieved in practice (in general, not necessarily through the SSC)?
B. Concept (coherence)	**B1. Coherence** between Swiss space policy and SSC mission and objectives	B.4. What are the issues and challenges that the space sector in Switzerland in general will have to face in the coming years? e.g. at the political, technological, scientific or economic level
		B.5. What are the key challenges and issues you are facing? *Note: to be linked with the Swiss space policy during analysis*
		B.6. Are the missions of the SSC appropriate regarding these challenges and your needs?
		B.7 Is something missing in these missions?
B. Concept (relevance)	**B2. Relevance** of missions in the context of Swiss space policy	B.8 Which elements of the Swiss space policy do you consider the most relevant for the Swiss Space Center? A) Foster competitiveness and excellence - Attract – Attract new ideas and actors as the fundament to grow and strengthen the network - Hunt – Actively hunt new ideas, technologies, and knowledge with the potential to create a return in the space ecosystem - Select – Continuously raise the selection standards for the development of new capabilities, both for scientific, institutional and commercial needs - Teach – Ensure adequate training and education, for the short-term, but also for longer-term purposes - Support – Support the growth and strengthening of the ecosystem with targeted measures - Invest – Invest into R&D via the ESA R&D programs and by facilitating and promoting further access to capital, as well as by emphasizing economic/commercial viability of space R&D activities - Innovate – Innovate the process for the development of the ecosystem continuously B) Contribute to Digital Switzerland - Intensified exchange with high-level decision-makers in the private and public sectors raise awareness about the potential of space data and infrastructures for the digital transformation; - Strengthening of the innovation chain by encouraging scientific research and university training as well as investments by the private sector in the development of innovative services leveraging space data and infrastructures; and - Work towards securing the access for Swiss actors to major space related data sources and infrastructures. - Development and use of space applications to improve the quality of life for citizens, tackling societal challenges and the digital transformation.

Impact model	Evaluation model item	Final questions
		C) Strengthen the Swiss space community - Enable stronger networking and clustering - Develop education initiatives
		B.9 In your experience, are the missions of the SSC contributing to implement Swiss space policy? (networking, space projects, training, public awareness)?
		B.10 Which mission seems most relevant to you in this context and why?
		B.11 In your view, how should the Swiss Space Office funding complement existing Swiss research and innovation promotion programmes such as Innosuisse and the Swiss National Science Foundation (SNF)?
C. Implementation	**C. Relevance** of activities in regard of the mission of the SSC	C.12 Which activities were particularly useful in relation to the different missions of the SSC (networking, space projects, training, public awareness)?
		C.13 In a world without constraints, which services offered by a center like the SSC would be the most useful? (For an individual organisation, for members as a whole?)
		C.14 What is your understanding of the division of tasks between the SSO and the SSC? Is this appropriate?
D. Results	**D. Effectiveness** and **efficiency** of activities in relation to the mission and expected results	D.15 What are the activities of the center that you consider to be the most successful? And others, less successful?
		D.16 Do you have an example of an activity of the SSC for which you consider the results to have been outstanding?
		D.16.a What were the key elements that enabled this result?
		D.16.b If the SSC was able to change two things within the next 6 months, what two things would create the most value and benefits?
		D.16.c What criteria do you use to assess whether the SSC contribution has been successful? (specify by activity/mission)
		D.16.d Using that criteria, how is the SSC scoring today? Note: to be linked with the resources devoted to such activities to analyse efficiency
E. Impact	**E. Impact** of the activities	E.17 If you compare to 5 years ago, are Swiss actors more competitive today?
		E.17.a What criteria do you use to assess competitiveness?
		E.17.b Can you give me an example of a company or institution that became stronger over the past 5 years?
		E.17.c Did the SSC play a role? if so, which one?
		E.18 Do the services provided by the SSC correspond to your needs?
		E.19 Can you give me an example when the services were particularly in line with a challenge you were facing?
		E.19.a Do you have specific examples regarding the different missions (networking, space projects, training, public awareness)?
F. Wrap-up		F.20 If you had a magic wand to change one thing in the Swiss space ecosystem, what would that be? *(regardless of practical feasibility or organizational or material constraints?*

A.2 Data collection methods

Data and desk review

The evaluators received the relevant federal policies, minutes of SSO-SSC monthly meetings as well as the following SSC documents: Terms of reference, strategy, workplans, minutes of meeting of Board of Directors and the Steering Committee as well as a set of operational documents. These documents were reviewed in light of the evaluation questions.

Face to face interviews

Between January and April 2019, the evaluators conducted 24 interviews in private with Swiss stakeholders according to the interview canvas[89]: 6 people from the industry, 7 from academia, 2 with an industry and academia role as well as 9 from other categories (RTO, Federal Administration including the SSO and the SSC). Further, the evaluators interviewed the corresponding national space entities in Austria, Denmark and Sweden with an adapted interview canvas.

Workshop

To work on possible scenarios for the SSC, 17 stakeholders of the Swiss space ecosystem (industry, academia, SSO and SSC) were invited to a workshop from 28 February noon to 1 March after lunch. After being presented with preliminary findings of the interviews, the participants developed prototypes as an illustration of a possible future SSC, reflected on upcoming developments of world and Swiss space economy, and concluded by drafting a canvas with the key features of a potential SSC.

Observation

Following the ethnography methodology, observation of social practices and interactions has been used at times, i.e. observing a situation without imposing any deductive structure or framework upon it and to view everything as strange or unique.

Data-collection and analysis tools

Data was structured and analysed using IT tools or by using large drawing canvas in a way to track back final recommendations to corresponding anonymized data.

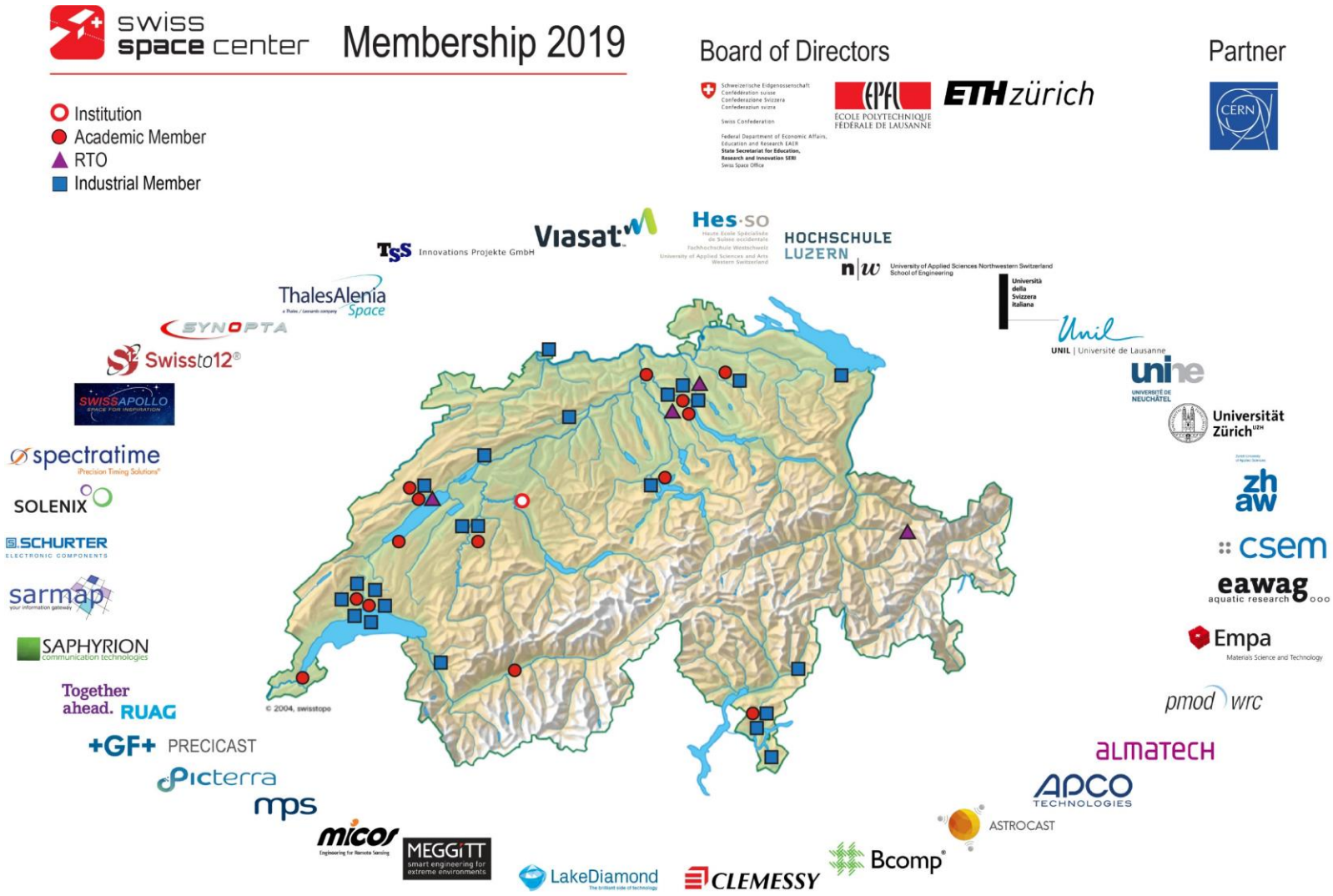
[89] See next page

A.3 Anonymized list of interviewees and workshop participants

The evaluators interviewed 29 persons and facilitated a workshop with 17 participants.

Sector / Organisation	Status	Position	Interview	Workshop
Academia		Head of Department	X	X
Academia	Member	Assistant Professor	X	
Academia	BoD	VP Innovation		X
Academia	Member	Deputy VP Innovation		X
Academia	BoD	VP Research and Corporate Relations		X
Academia	Member	Head of Institute		X
Academia	Member	Head of Institute	X	
Academia	Member	Project manager	X	
Academia		Head of Department	X	X
Academia		Head of Department	X	
Academia		Director	X	X
Industry	Member	Board member	X	
Industry		CEO	X	
Industry	Member	CEO		X
Industry	Member	Vice President	X	X
Industry		CEO	X	X
Industry	Member	CEO / Deputy CEO	X	X
Industry		Head of Unit	X	
Industry	Member	Managing Director	X	X
Start-up		CEO	X	
RTO	Member	Head of Programmes	X	
Armed Forces		Advisor	X	
Swisstopo		Head of Division	X	
ESA BIC	Member	Director	X	
Other		Head of Partnerships and Innovation	X	
Other		Independent expert	X	X
Foreign Center		Director	X	
Foreign Center		Director	X	
Foreign Center		Director of Technology	X	
SSO	Sponsor / BoD	Head	X	X
SSO	Sponsor	Deputy Head	X	X
SSO	Sponsor	Staff		X
SSC	Evaluatee	Director	X	X
SSC	Evaluatee	Deputy Director	X	
SSC	Evaluatee	Staff	X	

A.4 SSC members[90]



[90] SSC Website, Mermbers profile 2018 https://www.spacecenter.ch/wp-content/uploads/2019/03/ssc-members-profiles_2018.pdf

A.5 Working Groups with corresponding strategic area and goal supported

Working Group	Strategic area	Strategic goal supported
Education matters	Education and training	High-level and up-to-date education in space-relevant disciplines, mainly engineering, at all levels from practical courses to academic education.
	Technologies for scientific instruments	Swiss industrial and/or academic actors to maintain and develop their competences for the development of scientific instruments
High-precision mechanisms and structures (→ 2017)	High-precision mechanisms and structures	SSC to strengthen the international leading position of Swiss industrial and/or academic actors in selected key areas and potentially to help extending the areas of excellence
Miniaturization and Mini- or Micro-Systems	Atomic clocks	SSC to strengthen the international leading position of Swiss industrial and/or academic actors in selected key clock technologies and potentially to help extending the competences to identified promising areas.
	Technologies for scientific instruments	Swiss industrial and/or academic actors to maintain and develop their competences for the development of scientific instruments
	Small satellites	SSC to encourage Swiss industrial and/or academic actors to be involved in small satellites and to develop key technological competences and system knowledge in this new and growing field
	Miniaturisation	SSC to support the Swiss industrial and/or academic actors to maintain "pioneer" positions in miniaturisation of functions useful for space applications or to extend their competences to identified promising areas
Earth Observation & Remote Sensing	Technologies for scientific instruments	Swiss industrial and/or academic actors to maintain and develop their competences for the development of scientific instruments

A.6 SSC governance documents[91]

Title	Description	Role of				Frequency	Due date
		SSC Director	Board of Directors	Steering Committee	Annual Assembly		
Terms of Reference	All aspects of governance	takes note and implements	Author	takes note and implements	takes note and implements	as needed	---
Strategic guidelines	Should cover next five to ten years		Author	takes note and implements		as needed	---
Strategic plan	Motivation and justification (e.g. ESA requirements, evolving international context) for work plan. Living document with a two- to five-year projection; based on the BoD's Strategic Guidelines the Swiss space implementation plan (SSIP)	comments (2)[2]	approves (4)	Author (1)	comments (3)	annually	30 November
Work plan	Description of activities planned to be carried out for the coming two years, based on SC Strategic Plan directives from founding members Working Group reports	Author 2: **How** shall it be implemented? (2) implements	approves (4)	Author 1: **What** shall be done? (1) major elements may be contributed by Working Groups	comments (3)	annually	30 November
SC activity report	Detailed report		approves (2)	Author (1)	takes note (3)	annually	30 November
SSC activity report	High level description of activities carried out in the past year (Executive Summary for public distribution) Confidential third-party activity information is to be included in a separate annex for the attention of the BoD only.	Author	approves	analyses / recommends	takes note	annually	30 November
Financial plan	Living document with a two-year projection	Author	approves	analyses / recommends		semi-annually	
Annual budget		Author	approves	analyses / recommends		annually	31 October
Financial report	Detailed report	Author	approves	analyses / recommends		semi-annually	

Figures in parentheses indicate the sequence of activities.

[91] Swiss Space Center, Terms of reference, 03.10.2015, 7 I Rev. 0, page 17-18

A.7 SSC internal reference documents

I. Strategic plan 2014-2018, excerpt

2.2 Facilitate access to international space projects

Due to the inherent international character of space activities and the absence of a national space programme, Swiss actors carry out a large part of their space related activities in the framework of international programmes, such as ESA Programmes and the Framework Programmes for Research of the European Union. Access to such programmes is often linked with considerable administrative hurdles that are difficult to overcome, in particular for new entrants.

Goal

- Active and numerous participation of Swiss actors in international space programmes.

Objectives

- Increase awareness among Swiss actors for opportunities provided by international space programmes.
- Increase awareness among Swiss actors for the administrative support they can potentially get from the SSC.
- Support Swiss actors in finding the right and good consortia.
- Provide an efficient and effective administrative and programmatic support during proposal preparation phase.

Actions

- Swiss Space Center to
  - establish a cross matrix of the technological domains versus the core competences and strategic needs of the members;
  - inform Swiss actors about opportunities and its own support services;
  - provide support services as required; coordinate closely with SSO and Euresearch.

Indicators

- Number of consultations provided
- Number of proposals submitted after SSC consultation
- Number of new entrants to international space projects who have previously consulted the SSC

[92]

II. Work plan 2016-2017, excerpt

5.8. Access to International Space Projects

5.8.1. Long-Term Objectives

- Increase awareness among Swiss actors for opportunities provided by international space programmes.
- Increase awareness among Swiss actors for the administrative support they can potentially get from the SSC.
- Support Swiss actors in finding the right and good consortia.
- Provide an efficient and effective administrative and programmatic support during proposal preparation phase.

5.8.2. Actions 2016-2017

- Maintain templates in answer to ESA ITT and update the webpage entitled "How to do business with ESA"
- Advertisement of our members competences within the presentations and on the website
- Specific actions to support the involvement of new entities in the space business by explaining them the general conditions to tender, the bidder process and the registration on EMITS website

[93]

[92] Strategic Ppan 2014-2018, page 11, 5.8.14, version: 0.6, revision: 2
[93] Workplan 2016-2017, page 11, 7.5.19, version 1, revision 1.

A.8 SSC activities summary (mandat de prestations SSO-SSC)

	Description[94]	2015	2016	2017	2018
NETWORKING / ACCESS TO SPACE	Members engagement	- 9 new members; total members 29 - Annual assembly open to all at EPFL (3.12.2015, 120+ participants) - New RTO member category created - 4 Working Groups with the SSC acting as secretary during meetings: (1) Miniaturization and Mini- or Micro-Systems, (2) High-Precision Mechanisms and Structures, (3) Education, and (4) Earth Observation and Remote Sensing	- 1 new member and 1 new partner; total members 29 - Annual assembly members only at ETH Zürich (7.12.19, 80+ participants) - 4 Working Groups continue	- 4 new members; total members 32 - Annual assembly open to all at EPFL (7.12.2015, 110+ participants) - 4 Working Groups continue, the working group (2) High-Precision Mechanisms and Structures to be held as a roundtable (6.4.17, 20 participants) - Publication of Member's profile 2017 and annual report 2016	- 4 new members; total members 34 - Annual assembly members only at EPFZ (6.2.18, not mentioned in report) - Second Round table on Swiss Space Mechanisms and Components at SSO (18.6.18) - Publication of Member's profile 2018 and annual report 2017 -
	Funding instruments	- 2 series of CfI, 50 out of 140 proposals funded - Analysis of post-funding results of MdPs	- MdP 2016: 12 out of 44 funded - Call for Experiments – Swiss Parabolic Flight Campaign: 5 out of 7 proposals funded - Analysis of post-funding results of MdPs updated	- CfI, 7 out of 19 proposals funded - Coordination of funding of next phase of a 2015 CfI over 2 years; SSC provides technical and scientific expertise and overall administrative project management - Analysis of post-funding results of MdPs updated - Coordinated the participation of Swiss industry in Austria call for funding ASA; 4 Swiss companies were selected.	- MdP 2018: 11 out of 35 funded - Final review of QuSat Phase A project - Follow-up on of 2 entities funded through the Austrian ASA call 2017, as well as of the final phase of the 2016 call for 4 entities. Questionnaire on usefulness and efficiency sent to all participants.
	Industry engagement	- Several non-space companies visited to explain how to do business in space - Organisation of a special evening on business models for space industries at the Global Entrepreneurship Week (16-20.11.15) - "Giant Leap into the Future" – Innovation and business opportunities in space at EPFL	- Space Week in India with Swissnex (visits to Bangalore Space Week and to space institutions; 10 Swiss participants)	- Swiss Space Industry Days at EPFL (15-16.6.17; 150+ participants)	-
	Events for professionals (co-) organised	- British-Swiss bilateral workshop "Laser Technologies for space applications" at the UK ambassador	- Public presentation of MdPs 2014 at EPFL (18.2.16, 100+ participants)	- Call for Experiments 2016 – Swiss Parabolic Flight Campaign: Presentation of results at UniZH (25.4.19, 60+ participants)	- "Space Technologies Studies 2016 – Results" at EPFL (13.2.18, 100+ participants)

[94] Internal activity reports 2015-2018

	Description[94]	2015	2016	2017	2018
		residence (27.10.2015, 16 participants)	- Workshop “COTS Components and up-screening for space applications” at ETH Zürich (18.2.16, 39 entities) - Eurospace workshop on R&T priorities at EPFL (26-27.4.16) - ESA Round Table on Micro and Nano Technologies at European Space Research and Technology Centre (11.16)	- UK-CH workshop on Additive Layer Manufacturing (ALM) technologies for Space Applications (31.1-1.2.17; 30 participants of which 10 Swiss) - Visit from representatives of Polish entities involved in the space domain (7-8.11.19, 13 Polish visitors) - Workshop for the space Earth Observation and Remote Sensing Community in Berne (16.3.17; 63 participants)	- Information event at ETH Zürich about space opportunities in H2020 (20.6.19, 70+ participants)
	ESA-related activities	- Coordination of ESA Frame Contract for EPFL Laboratory Support - Support for ESA accreditation of the Swiss Welding Institute in Yverdon-les-Bains/VD - Support to the Swiss delegation to the ESA Technology Harmonisation Advisory Group (review of technical dossiers, scouting of companies, mapping and reporting) - Participation in Human Spaceflight and Exploration Science Advisory Committee	- Support to the Swiss delegation to the ESA Technology Harmonisation Advisory Group (review of technical dossiers, scouting of companies, mapping and reporting) - Support to the organisation of the ESA Conference at Ministerial Level 2016 in Lucerne	- Support to the Swiss delegation to the ESA Technology Harmonisation Advisory Group (review of technical dossiers, scouting of companies, mapping and reporting) - Workshop at EPFL with representatives from ESA, SSO, EPFL and ETH Zürich on ESA_Lab@ (30.6.17) and follow-up meeting (27.11.17, kick-off/negotiation)	- Support to the Swiss delegation to the ESA Technology Harmonisation Advisory Group (review of technical dossiers, scouting of companies, mapping and reporting) - ICE Cubes Info Event at ETH Zürich (19.4.18) -

	Description[94]	2015	2016	2017	2018
EDUCATION	Education	- Present at space career day at ETH Zürich (17.3.15, 60+ students) and EPFL (6.11.15) - Launched university competition open to all, with only one team applying (received a prize and participated in the European Student Sounding Rocket exchange programme, EuRock in Norway) - Summer camp at Baumann Moscow State University (July 2015, 10 participants) - Camp at Beihang University in Beijing (July 2015, 4 participants) - International summer camp at EPFL with students from Moscow and Beijing (23-30.8. 2015) - Involved in the SATW TecDays in high schools (10 presentations in 5 schools)	- Present at space career day at ETH Zürich (15.3.16, 70+ students) - 7 events at universities to foster careers in the space domain (450+ students; 40 professionals of which 15 members) - Summer camp at Baumann Moscow State University (July 2016, 9 participants) - Camp at Beihang University in Beijing (July 2016, 2 participants) - International summer camp at HSLU (25 participants) - Involved in the SATW TecDays in high schools (15 presentations in 6 schools)	- Present at space career days in 4 towns (350+ students) - 4 events at universities to foster careers in the space domain (350+ students; 30 professionals) - Summer camp at Baumann Moscow State University (July 2017, 9 participants) - International summer camp at HES-SO Valais (19 participants) - Involved in the SATW TecDays in high schools (9 presentations in 3 schools)	- Present at space career day in Geneva and Zürich (7-8.11.18, 350+ students) - International summer camp at ETH Zürich (21 participants) - Supported Geo School Days in Bern (6-7.6.19, 370 participants) - Involved in the SATW TecDays in high schools (12 presentations in 4 schools) - Participated in EPFL Science outreach modules about space exploration (9-10.18 – 3 days, 350 participants) - Prepare a teachers' survey on the use of space topics in school for 2019 - Concept, preparation and launch of ESA Lab project Igluna
	National trainee programme at ESA	- 9 applications, 7 interviews and 3 selected	- 11 applications, 7 interviews and 2 selected	- 22 applications, 9 interviews and 4 selected	- 14 applications, 9 interviews and 4 selected
	Continuing education	- One day workshop on "The Role of Failure Investigation in the Space Systems Safety" at EPFL (9.2.15, 23 participants). - 3-day course on "Model-driven Systems Engineering" at EPFL (2-4.9.15, 8 participants)	- Course on "Reliability for Space" at CSEM (1-3.2.16, 30 participants) - Lecture "Space Segment Software through ECSS and SAVOIR" at ETH Zürich (28-29.2.16, 12 participants)	- "Radiation Environment and its effects in EEE components and hardness assurance for space applications" with ESA at CERN (9-10.5.17; 54 participants) - "Space strategy and business model innovation workshop" at EPFL (17.10.17; 15 participants)	- Travel support for CH citizens attending the Y-ISEF in Tokyo (28-.2.-2.3.18, 4 participants).

	Description[94]	2015	2016	2017	2018
AWARENESS	Public awareness	- Internal segmented mailing list now includes 400+ recipients; page created on Facebook and LinkedIn - Represented at public events of ETH Zürich: Treffpunkt Science City (22.03) and Scientifica (4-6.09.15) - Publication of annual report 2014	- Internal mailing list of 650 subscribers; Facebook and LinkedIn page follows increasing - Organisation of ESA Citizens' debate in Lucerne (10.09.16, 95 citizens) - Publication of annual report 2015	- Internal mailing list of 900 subscribers (click rate 7.3%, open rate 43.3%). Facebook and LinkedIn page follows increasing: 1600 and 1040) - Represented at Scientifica in Zürich - Launch of new website spacecenter.ch	- Organized the translation of the brochure FocusTerra on the solar system - Supported Espace Gruyère with the organisation of the conference of Thomas Pesquet, including the organisation of 14 volunteers and the provision of SSC caps and T-shirts for organizers. An SSC stand informed on ESA; Swiss Space (17.5.18, 2400 participants). - Partner of the "Féérie d'une nuit" at Aubonne/VD (11.8.18, 250+ participants): lending 2 rocket launchers
SUPPORTING ACTIVITIES	Event participation and international visits	- Visits to universities in China/India - Events: Space Symposium in Colorado Springs/USA, Joint Urban Remote Sensing Event in Bilbao/SP, European Space Mechanisms and Tribology Symposium in Oxford/UK, Reinventing Space Conference, International Astronautical Congress in Jerusalem, "Space and Entrepreneurship" in Geneva.	- Visit to Skywin (Wallonia Space Center in Belgium (25-26.1.2016; visit local entities – share best practices on European calls). - Events: Space Symposium in Colorado Springs/USA, Living Planet Symposium in Prag/Czek Republic, Aerospace Mechanisms Symposium in Santa Clara/USA, International Astronautical Congress, in Guadalajara/ Mexico	- Events: Space Symposium in Colorado Springs/USA, R(e)volution in space – exploring your new business in Noordwijk/NL, HAPS for space in Noordwijkerhout /NL, Space Tech Expo in Bremen /D	- Bilateral meetings and 2nd Sino Swiss Science workshop
	Swiss space ecosystem	- Analysis of call for ideas and MdP 2010-2015) to identify the main competences for space applications in Switzerland.	- Survey of Swiss Academic and Industrial Competences updated	- Survey of Swiss Academic and Industrial Competences updated	- Survey of Swiss Academic and Industrial Competences updated

A.9 Criteria to assess successes of the SSC

Participation	- Number of participating organisations in MdP calls - Number of trained people - Number of event participants - Number of people/organisations impacted by networking activities - Number of Annual Assembly participants - Number of SSC members - Proportion of community served (by topics)
Reputation	- Visibility of the SSC - Public awareness - Reputation of and participation in the courses offered - Number of contacts in terms of awareness raising:
Satisfaction	- Member/customer satisfaction/perception - Recognition of expertise in specific area
Collaborations	- Number of productive contacts - Number of new partnerships - Number of collaborative projects
Project development	- Number of projects - Number of coached projects that receive funding - Leverage effect of funding - Number of start-ups - Number and level of participation in ESA projects

A.10 Criteria to assess the impact of the SSC

The SSC impacts the competitiveness of the Swiss space ecosystem, in terms of:

Research and development	- Higher ROI of projects (ESA projects) - MdP recipients getting international grants in the same field - Participation, number of projects won in space - Success in terms of ESA and NASA project participations - University ranking
Market share and revenues	- Space sales excluding ESA - Revenue, volume and number of contracts - Ability to win contracts and to sell high-tech products in a global context - Commercial market share - Number of products and services that bring value to the space community - Number of contracts won internationally - Number of new contracts won in the space sector or new services/products offered - Number of contracts won compared to competitors, - Amount of private investments
Business development	- Number of start-ups - Number of actors and growth of companies - Number of jobs in the space sector, number of newcomers, creation of subsidiaries abroad, - Scale-up of start-ups - Revenue - Number of rising companies in the field - Company and job creations - Companies in the space sector (e.g. ESA contractors), outside ESA being more difficult - Number of employees - Start-ups with space activities - Larger companies, which continue to grow

A.11 SSC staff positions by function

Staff		
Operational staff	**PhD Students**	**National Trainees**
1. Director 2. Deputy Director 3. Professor emeritus 4. Professor MIT 5. Manager Hub ETH Zurich 6. Senior executive assistant 7. Events and Communication expert 8. Science and technology expert 9. Technician and security expert 10. Space technology advisor I 11. Space technology advisor Igluna II 12. Space technology advisor Igluna III 13. Scientific advisor Igluna I 14. Scientific advisor Igluna II 15. Scientific assistant Igluna	16. PhD at CSEM, COTS reliability 17. PhD at CERN & CSEM, thermal management of mems 18. PhD student “Habitat”	19. NTP 4, Systems Engineering, ESTEC, Noordwijk 20. NTP 4, Life Support Systems, EAC, Köln 21. NTP 4, Time and Frequency, ESTEC, Noordwijk 22. NTP 4, Radiation, ESOC, Spain 23. NTP 5, Additive Manufacturing 24. NTP 5, Prodex office 25. NTP 5, Automation and Robotics 26. NTP 5, Future Launcher

As of February 2019

A.12 The SSC in contrast to Austrian, Danish and Swedish entities

b. Interviewee perceptions

Contribution to policy implementation

All entities see their mission as contributing significantly to their respective space policy and the related goals. ASA's most relevant impact is the management of the national ESA participation and the provision of policy, technical and operational advice. DTU Space participates in both the upstream and the downstream segment, yet only the latter one is included in the Danish space policy.

Regarding their impact on the goals set for Switzerland in the actual SSIP[95], the three entities assess competitiveness as the highest, followed by strengthening of the space community, and, for ASA, digitalisation, given its governmental priority in 2019.

The division of tasks with the national administration was seen as well divided by ASA, yet a potential for delegation exists, by keeping only strategy, budget and monitoring at the political level. DTU Space describes the division roughly as between taking care of the politics on the administration side and of science and technology on theirs. In its view, despite a smooth working relationship, the division is suboptimal because of grey zones, resulting in missed positioning opportunities at ESA. SNSA is part of a ministerial office, so this is not an issue.

Issues and challenges in the coming years

The entities see quite diverse yet specific challenges for their respective countries:

- safeguarding national interests in the face of the agenda-setting capacity of larger EU countries (ASA);
- mitigating the adverse consequences of the possible implementation of the headquarters' rule by ESA procurement, as a precondition to participate in certain projects (ASA)[96];
- dealing with the lack of dedicated national funding for space, which in turn limits geographical return for high-risk projects, as the government tends to see such grants as expenses, rather than investments (DTU Space);
- investing in agility to keep up with an evolving landscape (new private actors, new business rules and increasing commercialisation) and seizing emerging opportunities (SNSA);

Reinforcing the downstream sector (ASA), reviewing strategic focus and increasing organisational performance (DTU Space) as well as finding the right balance between "traditional" and "new" space without distorting competition were brought up as internal challenges.

The **geographical return principle**: "The geographical distribution of all the [ESA] contracts is governed by the following general rules:

- Member State's overall return coefficient is the ratio between its percentage share of the total value of all contracts awarded among all Member States and its total percentage contributions;
- for the purpose of calculating return coefficients, weighting factors are applied to the value of contracts based on their technological interest;
- ideally the distribution of contracts placed by [ESA] should result in all countries having an overall return coefficient of 1."[97]

[95] Swiss Space Implementation Plan within Education, Research and Innovation for 2018-2020, page 15

[96] For instance, RUAG Space GmbH in Austria, the largest player in the country, could not bid anymore as an Austrian company, but would have to do so from its headquarters in Switzerland.

[97] ESA an intergovernmental customer, https://www.esa.int/About_Us/Business_with_ESA/Business_Opportunities/ESA_an_intergovernmental_customer

Competitiveness of national space economies

The general assessment of national competitiveness is positive, albeit mixed. In Austria, large actors and those participating in NewSpace have become incredibly competitive, and others haven't (indicators: additional sales for business, concrete results for academia and RTOs)[98]. In Denmark, the sector is seen as having grown (indicators: revenue, staff, contracts), increased competitiveness remaining uncertain. A SNSA survey shows that the sector has grown and become more competitive (indicators: revenue, earnings and relative success rate in ESA programmes).

ASA and SNSA see their positive contribution to their space economy as definite, as they have been funding strategic projects of growing companies, including through ESA. DTU Space believes that its role – through collaborative projects – was small but instrumental.

Coordination within the national space ecosystems

As all entities are from small countries, they think that space people know each other and thus coordination needs are limited. Yet, they see such needs on a global level, especially with ESA, whose political branch "has an arm's length approach" and does not want to take up specific projects or problems (DTU Space)[99]. Coordination touches upon technology development and finance. An agency strategy is key for a performant coordination, while operational coordination is in the realm of universities and industry (SNSA).

Achievements and activities

Peak experiences or successes comprised downstream activities (ASA), a new civil engineering degree "Earth and space physics engineering" and bringing 50 students per year to the national and international job market as well as great space missions and instrumentation (DTU Space), and finally the launch of national satellites, an internationally thriving national industry and the fulfilment of its public missions (SNSA). Among success factors were brought up: budget and scope flexibility, effective communication, niche strategy (ASA); bridging and facilitating role, pragmatic approach (DTU Space); skilled and experienced staff, team of visionaries and doers (builders, operators), long-term strategy to build autonomous capacity and capability, autonomy and lead in key areas and skilled industry (SNSA). Circumstances for more such achievements were related to increased public awareness, strategy formulation and alignment, a single point of contact for the space economy as well as additional funding.

ASA's most useful activities entailed collecting interests, evaluating potentials, establishing letters of support, accompanying projects as well as controlling and reviewing results. DTU Space highlights the running of cadastre stations in an overseas location, using its knowledge to partner and collaborate with industry and government as well as analysing satellite data for direct or indirect service provision. SNSA does not provide particular services outside its financing role.

As less successful, ASA mentioned getting media attention for technical topics and activities (e.g. scientific instruments, material development, big data solutions) as well as result monitoring, ensuring that technology support ends up in relevant missions. For SNSA, programmes and projects tend to fail because of too high ambition or immature technology.

Funding instruments

Funding is critical for all entities. ASA manages a space application programme of EUR 7.5 million per year, as a leveraging instrument for a performant downstream sector with following features: (1) enabling new actors' participation in EU programmes and (2) helping established actors work on new products, services and scientific instruments for specific missions.

DTU Space does not have a dedicated funding instrument. Yet it has just launched an ESA-BIC programme together with external partners to be able to apply for various funding sources.

[98] An evaluation addressing this issue is presently running.

[99] The interviewee thinks that the Swiss delegation is doing much better in this regard.

The SNSA is one of five Swedish agencies for research and innovation. Besides bilateral agreements with other countries (e.g. France and USA), the following programmes support industry with grants:

- An aerospace programme for joint projects between academy (receives grant) and industry (provides matching funds);
- A programme for small industries and start-ups (less than 20 employees and independent) to fund basic and early technology development;
- A technology development programme (CHF 3 million per year) as a permanently open call (has to fit space strategy);
- A programme for science projects at universities based on a yearly call and a peer review selection.

Success measurement

For ASA, success measurement is high on the agenda as it reports yearly within the national programme supporting Austrian RTI actors in European research and innovation areas according to an extensive impact monitoring system[100].

For the two other entities, success is measured through impact, as mission participations, publications, partnership requests from abroad as well as annual reporting to supervisory ministry.

All three interviewees believe that their respective entity is doing well, based on selected evidence.

Perception of Swiss actors and collaboration

Neither interviewed entities but ASA does have a formal relationship with the SSC. Sporadic informal contacts exist, most recently with DTU Space. The latter recons that there is "much potential to collaborate and do research together".

ASA mentioned that it is impressed the fact that Swiss representatives, despite being a small team, were always well prepared for discussions at ESA (clear positioning on most topics, proficient grasp of context, diplomatic, high quality contributions). Compared to its size, the Swiss contribution is considered as visible and having impact.

In a world with no constraints, wishes & magic wands

The wishes ranged from additional or better access to funding, enhancing the capabilities of actors to organizational development:

- a governmental or public venture fund to help industry scale up (ability to provide a larger amount of money more quickly than state funding) (ASA);
- an EU procurement policy and mechanisms that provide a level playing field and that safeguard the interests of small players (ASA);
- a clearer structure ("perhaps a national space agency") and dedicated funding for space (DTU Space);
- more students trained, as they will make a real difference; building satellite instruments and data exploitation for new applications (DTU Space);
- a more diversified space industry with more competitive medium-sized companies, as currently four large companies take the bulk of support (SNSA).

[100] FFG Unterstützung österreichischer FTI-Akteure im Europäischen Forschungs- und Innovationsraum 2014 – 2020, https://www.wirkungsmonitoring.gv.at/2017-vorhaben-wfa-151.html#ziele

Presentation of the main features of the four space bodies

	SSC Switzerland	ASA Austria	DTU Space Denmark	SNSA Sweden
Organisational status	Autonomous entity with a university affiliation	Organisational unit of the ministry	Organisational unit of the state-governed Technical University TU	Autonomous entity with a state-appointed board
Supervisory ministry	Federal Department of Economic Affairs, Education and Research	Ministry for Transport, Innovation and Technology	Ministry of Education and Science	Ministry of Higher Education and Research
Funding	Ministry, Members, Universities, ESA, external mandates	Ministry	40% university 60% external grants and mandates	Ministry
Year of inception and history	The Space Center EPFL created in 2003, was dissolved in 2011 to transfer its activities to the newly created SSC.	Early 1970s as Austrian Space Agency In 2014, integration as a division into the *Forschungsförderungsgesellschaft* FFG, a central agency for the promotion of business-related research	2007: Institute at the Technical University (TU) of Denmark (merger of Danish space institute and Danish Survey and Cadastre with two sections from the TU)	1972
Governance	Director's reporting line: Board of Directors and EPFL VP Innovation	Director's reporting line: FFG management board > BMVIT Space department > Head of the Innovation Division > Head of Section, Secretary General and contact person > Minister.	Director's reporting line: President of TU > Board of the TU with representatives from the Ministry, other public organisations and industry	Director-General reports to a government appointed board
Mission	- Nurture ecosystem for excellence in national focus areas - Facilitate access to and implementation of space projects - Provide education and training - Promote public awareness of space	- Implements national aerospace policy - Represents Austria on international aerospace committees	- Create and expand knowledge about Earth and space physics as well as related space technologies for the benefit of society	- Promote the use of space for public applications - Increase the competitiveness of Swedish space industry and scientific institutions
Scope	- Mainly space upstream, education and awareness	- Aeronautics and space activities	- Satellite instrument (design, build, use) - Earth observation - Deep space	- Research - Remote sensing, earth observation - Specialized industrial competence - Education

	SSC Switzerland	ASA Austria	DTU Space Denmark	SNSA Sweden
Activities and services	- Managing calls for national space programme - Supporting access to space projects - Education - Public awareness - Public and private mandates	- Managing calls for national space programme - Managing ESA participation - Representing industry interests in ESA boards/ WG - Education	- Research - Education - Public and private consulting - Hosting of the Center for Security and the Center for Drones	- Distribute government grants for space research, technology development and remote sensing activities - Initiate research and development in Space and Remote Sensing areas
Performance indicators	No indicators	Reports every year according to *Wirkungsfolgenabschätzung* (indicators legally binding)	Yes and no. Rolling four-year strategy contract at university level; with 18 indicators	Yearly report on fund allocation and task fulfilment. No indicators
Funding instrument	Yes	Yes	No	Yes
Manages ESA budget	No	Yes	No	Yes
Conducts research	No (supervises PhDs)	No	Yes	No
Membership scheme	Yes	No	No	No
Share of ESA income budget 2019[101]	3.8%	1.4%	0.8%	1.8%

[101] https://www.esa.int/spaceinimages/Images/2019/01/ESA_Budget_2019

A.13 Risk assessment of market segments and business models

The business models within the ground segment, satellite service, national security and (at least partly) satellite manufacturing market segments come along with the best market opportunities and lowest risk levels.

Figure 17 : Risk assessment of market segments and business models for five discriminators

	Risk assessment of market segments and business models for five discriminators							
	Launch industry	Satellite manufacturing	Satellite services	Ground equipment	National security	Crewed and robotic space science and exploration	Space tourism (incl. habitation)	Energy, mining, processing and assembly
Product/technology	◑	◔	◑	◑	◑	◑	◕	●
Asset intensity	●	◕	◑	◔	◑	●	●	●
Demand	◑	◔	◔	○	◔	◕	◕	●
Competitive landscape	◑	◑	◔	◕	◔	◑	◕	◑
Regulation	◕	◑	◕	◔	◑	◑	◕	◕
Risk summary	◕	◑	◑	◔	◑	◕	◕	◕

Legend: ○ — Low Risk ◕ — High Risk[102]

[102] (2019). European Investment Bank, The Future of the European space sector, page 9

A.14 Five possible SSC profiles incepted at the workshop

<table>
<tr><th>Mission</th><th colspan="2">Goals</th><th>Target audience</th></tr>
<tr>
<td>1. The SSC fills the structural hole in the international network for Swiss space actors with solution-oriented services for a sustainable community
2. Primary and continuous education, build and organise the coordination, awareness raising (users, potential users – large organisations), market surveys & trends, fundraising & project implementation
3. Maintain the competitiveness of the SSE, identification of trends, facilitate innovation, facilitate access to space
4. Service provider and resource to grow space-related activities in Switzerland
5. To be a catalyst of change supporting institutions, academia and industry to access space and related applications as well as promoting interaction between these stakeholders</td>
<td>5 years
1. Espresso/ it’s not called SSC anymore
2. Coordination of common projects (academia & industry), independent entity
3. Complete ecosystem mapping, establish links outside the space industry
4. SSC has an established set of KPIs to be executed against # of industry days, # of proposal supported and accepted, etc.
5. Establish axes of action with KPIs</td>
<td>10 years
1. It’s not needed anymore
2. Be more efficient than an agency
3. Global mapping of ecosystem, space merge with global technologies
4. Foster synergies/ collaborations between academia one-shots and business industrialized products
5. Grow within KPIs</td>
<td>1. Industry/service providers, academia/RTOs, Users (of services, infrastructure, etc.), institutions (?)
2. End-users (private and institutional)
3. Stakeholders (industry including start-ups, academia, politics/institutional players. More generally, the ecosystem will be broader due to tec/soc. developments.
4. Political actors (incl. cities), Swiss industry, Swiss academia, global actors seeking access to Switzerland
5. Same as today, with stronger user segment (downstream), space science and stronger partnerships with HES</td>
</tr>
<tr><th>Scope</th><th colspan="2">Services</th><th>Partners/complementary services</th></tr>
<tr>
<td>1. For Swiss actors, with international and national outreach
2. Balanced upstream and downstream
3. Space lab & platform, advisory and coordination, education
4. Not a consulting firm, not a representative of the State, tries to be neutral towards all Swiss actors
5. Too early to decide</td>
<td colspan="2">1. Attract nodes into the network, hunt for (needed) competences and network, teach with tailored teaching and courses, support with expertise on processes, programmes,
2. Further education (space business models and market), maintenance of start-up database, info days (industry, markets, …)
3. Networking, mapping of capabilities (technologies, services, knowledge), spinder (=spider)
4. -
5. Cont. education, facilitate Tec transfer (cf Swissnex), connect ecosystem, support to education and training, support transfer of research, exchange of best practices, public awareness</td>
<td>1. Institutions (national & international), ESA, SERI, armasuisse, ETH, …
2. Independent financial partner
3. Equivalent organisations (space agencies, academia/labs); industries (trade organisations, lobbying groups)
4. Think beyond the guild of the messy space people; SSCs of other countries
5. SSO/SERI and ESA</td>
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<tr><th>Joker</th><th colspan="2">Funding</th><th>Open questions</th></tr>
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<td>1. When to stop?
2. –
3. –
4. 3 focus areas to generate knowledge from/for members
5. Independence, proactivity, agility</td>
<td colspan="2">1. The “others”, customers, i.e. the market for SSC’s services, as long as needed.
2. Customers, government
3. Government, membership, services
4. Public base with privately funded mandate (e.g. business development in another country)
5. -</td>
<td>1. Coordination of national activities? (if they do not exist anymore). Needed, wanted? Where? MdP evolution? Owners?
2. Task sharing SSO-SSC
3. Political role, neutrality in terms of positioning, role in defence/security
4. Development of European ecosystem (EU vs. ESA (cannibalisation))
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A.15 SSO and SSC: Letter defining roles and responsibilities

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER

**State Secretariat for Education,
Research and Innovation SERI**
Swiss Space Office

CH-3003 Bern, SERI

by eMail

to the stakeholders of the
Swiss space community

Your reference:
Reference no./File no.:
Our reference: NED
Contact person: Daniel Neuenschwander
Bern, 02.04.2015

Swiss Space Office (SSO) and Swiss Space Center (SSC): Roles and responsibilities

Dear Madam, dear Sir

It came to my attention that the understanding among Swiss space actors concerning the respective roles and responsibilities of the Swiss Space Office (SSO) within the Federal Department of Economic Affairs, Education and Research, and the Swiss Space Center (SSC) within the Swiss Federal Institutes of Technology in Lausanne and Zurich, are not always well understood. With this letter, I want to highlight again the main roles of the pre-mentioned organisations.

The Swiss Space Office

- prepares and implements the Swiss Space Policy,
- represents Switzerland in the governing bodies of the European Space Agency ESA,
- implements the complementary national activities (Activités Nationales Complémentaires ANC),
- coordinates space activities at Federal level,

while the Swiss Space Center supports the SSO in implementing the Swiss Space Policy on specific tasks by

- networking Swiss actors at national and international level,
- facilitating access to space projects for established actors and for newcomers,
- providing education and training,
- promoting public awareness of space.

State Secretariat for Education
Research and Innovation SERI
Daniel Neuenschwander
Einsteinstrasse 2, 3003 Berne
Phone +41 58 464 10 74, Fax +41 58 464 96 14
daniel.neuenschwander@sbfi.admin.ch
www.sbfi.admin.ch

The relationship between SSO and SSC is formalized by an annual agreement in which the tasks to be fulfilled by the SSC, for and on behalf of SSO, are specified. Regarding governance, SSO is represented within the SSC Steering Committee and the Head of SSO is chairing the SSC's Board of Directors.

The services offered by the SSC are open to all Swiss stakeholders The SSC is *a priori* a facilitator and does not enter into competition with any Swiss actor.

The SSC is primarily funded by the Swiss Space Office and the Federal Institutes of Technology in Lausanne and Zurich. In addition, its members contribute to the funding, and participate also in the governance of the SSC. Stakeholders from academia and industry may apply for membership, and will enjoy the following benefits:

- reduced rates for services provided by the SSC,
- voting right for the election of a Steering Committee member,
- participation in the annual assembly.

The SSC is a truly national entity with headquarters located at EPFL focusing on satellite/system aspects, and a hub located at ETH Zurich that focuses on payloads and serves as Point of Contact for central and eastern Switzerland.

For further information about the SSO and SSC, please consult the respective web pages at

- http://www.sbfi.admin.ch/themen/01371/index.html?lang=en for the Swiss Space Office,
- http://space.epfl.ch for the Swiss Space Center.

Yours sincerely,

State Secretariat for Education,
Research and Innovation SERI

D. Neuenschwander

Daniel Neuenschwander
Head of Swiss Space Office

2/2

A.16 Overview of recommendations with addressees

Number	Description	Main addressee(s)	Secondary addressee(s)	Related recommen-dation(s)
R.1	Initiate a discussion about roles with the various entities involved in space-related activities as well as the corresponding coordination processes. Then publish the decisions on an easily accessible internet page and update it as reality changes	SSO	with SSC & SSE	R.2
R.2	Use the opportunity of the needed update of the 2008 Swiss space policy to initiate a comprehensive consultation process	SSO	with SSE	R.1; R.18
R.3	Adjust SSC's TOR as soon as its future set-up and role are clarified	SSC BoD		R.20
R.4	Refrain featuring PhD students on the SSC website, and ideally find another institute to affiliate these students	SSC		R.3
R.5	Start or pursue the dialog with the EPFL Space Center (eSpace), so that branding and roles becomes distinct from that of the SSC	SSC BoD	EPFL	R.3
R.6	Avoid using EPFL email contact addresses on SSC's website and using them altogether	SSC		R.4
R.7	Reassess location and legal status of the SSC once its functionalities and other features have been laid out	SSC BoD & team	with SSE	R.1; R.3
R.8	Reinforce networking activity to evolve into a structured and long-term oriented facilitation role	SSC	with SSE	R.9
R.9	Identify common cross-sectoral projects to mobilize and strengthen the existing community and beyond	SSC	with SSE	R.8
R.10	Reassess certain activities, including Working Groups, by involving stakeholders as well as developing and analysing adequate KPIs	SSC	with SSE	R.8; R.9
R.11	Reinforce coherence of the SSC various internal governance documents with the SSP and the SSIP to ensure that the SSC achieves the targeted state	SSC		R.2
R.12	Evaluate the adequacy of using the result chain framework to monitor progress and enhance impact	SSC		R.11
R.13	Enhance communication on successes, such as the MdPs, to better leverage the multiple activities of the SSC	SSC		R.14
R.14	Assess the opportunity to acquire and maintain a CRM to document SSC's external relations	SSC		R.13
R.15	Initiate or pursue a dialog with EPFL HR department to design employment conditions suiting better SSC's staff and management while keeping the needed agility	SSC	with SSC staff & EPFL	R.7
R.16	Develop a common narrative about the future developments of the space sector from a Swiss perspective	SSO	with SSE & with SSC support	R.2
R.17	Initiate a consultation or table ronde to refine the market access needs and possibilities for the SSE	SSC	with SSE	R.10

Number	Description	Main addressee(s)	Secondary addressee(s)	Related recommen-dation(s)
R.18	Launch a “finance for space forum” to enhance mutual knowledge between finance and space actors to increase investment in the SSE	SSC	with SSE & relevant finance actors	R.9
R.19	Start an inclusive and collaborative process to design the future facilitation scheme for the SSE	SSO	SSC & SSE	R.1; R.2; R.16
R.20	Define impact priorities for the space facilitation scheme considering needs, policies, targeted results, feasibility and resources	SSO	with SSC & SSE	R.3; R.12; R.19
R.21	Evaluate a broader scope for the future SSC to include relevant non-space actors and public entities as well as market development support beyond ESA and access to private funding	SSC BoD with team	with SSO & SSE	
R.22	Consider that a decentralised system with several entities will come with more agility, yet add more complexity to an already complex environment and increase coordination needs	SSO	SSC & SSE	R.1; R23
R.23	Gather a significant number of functionalities under one roof to enhance synergies and possibly create a physical location for space actors to meet	SSO	SSC & SSE	R.22
R.24	Consider moving the largest entity, probably the future SSC, to a more central location and carefully chose its organizational form to reinforce the perception of a national space center	SSC BoD with team		R.22; R.24
R.25	Select with care BoD members as a diverse, multidisciplinary and representative board will be critical to the fulfillment of the targeted mission	SSC BoD		R.3