Evaluation report and recommendations on the national measures for space implemented in Switzerland for the years 2004-2009: Foreword by the SER/SSO

I. Context

The evaluation study was commissioned by the State Secretariat for Education and Research (SER) to assess the impact of the national measures for space, and identify the advantages they generate for the Swiss ESA (European Space Agency)-contractors and for the direct beneficiaries of the national measures. Crucially, the study was also aimed at evaluating the barriers, if any, to the optimal positioning of Swiss entities as partners and competitors in ESA programmes, and the steps that could be taken to overcome them? The findings derived from the responses to the survey covering the years 2004-2009 and conducted by Interface Politikstudien are presented below. Consequently, while the effect of the national investment in support of Swiss-based ESA-related infrastructures was assessed, the impact of the Mesures de positionnement technologique and Mesures de consolidation technique are not evaluated in the report, since their implementation is only recent.

II. Relevance of the study

The following categories of entities were invited to take part in the survey:

- Institutions which are beneficiaries of the national measures for space,
- Companies involved in ESA projects (ESA-contractors), and
- Companies conducting activities which are potentially space-related but which have no link to ESA.

It must be noted that although the distribution of respondents generally reflected the distribution of actors present, by sector, in the Swiss space landscape, the number of respondents was rather low (about 1/3 of those invited). For this reason, the statistical significance may be questioned.

The survey was conducted mainly with national actors active in the space sector, having an interest and/or benefiting from the implementation of national measures. The focus of the survey was on the impact the respondents felt that these measures had on their own activities, including those they conduct as ESA-contractors, for the space business in and for a modern State such as Switzerland. This focus has drawn attention away from additional, equally important considerations. For ESA-contractors, “space sector” is often equated with “space business”, making it difficult if not impossible for them to assess the societal and political benefits created by national measures. Furthermore, there exists a significant number of actor, both public and private, who benefit at different levels (economic, political and societal) from investments made in space and whose views are important in order to provide the complete picture. Clients and users of institutions benefiting from the national measures in space are not necessarily ESA-contractors, despite their relevance and the added-value services they are able to provide being a direct result of the national investments. Such stakeholders were not included in the survey.

III. Recommendations

Based on the respondents’ answers, the evaluation team formulated the following recommendations pertaining to the national investments in space in Switzerland:

1. Continuation of Swiss investments in space activities. The respondents support the general orientation of the Swiss space policy and approve of the country’s participation in ESA, highlighting the positive scientific, technological and economic impacts.
2. Systematic focus of the national measures on the needs of the space sector. The national measures are a means to increase the competence of national actors in the space sector, which can in turn increase Swiss participation in ESA programmes. Therefore, the objectives

of the national measures should be aligned with the needs of the Swiss space community, permitting an optimal leverage for Swiss participation in international space programmes.

3. Increase of the investments in national measures. Compared to Switzerland's overall investments in space and especially considering the important role played by the national measures in enabling Swiss companies and institutions to collaborate internationally, the resources invested in these measures are very low. An increase in resources is needed to fund preparatory activities in view of international collaborations, and to contribute to knowledge transfer both within and beyond the space sector nationally.
4. Sharpening the strategy contained in the Swiss space policy. The respondents expressed the wish for more mid-to-long-term strategic guidance in relation to the development and goals of the Swiss space investments. The roles of the entities involved in the implementation of the corresponding measures should also be defined accordingly.
5. Collection, analysis and strategic use of Swiss ESA participation information. Regular monitoring of the trend in the Swiss ESA participation, of the relevance to national space research and industry and of the resulting return will provide an indispensable tool for steering the strategic objectives to Switzerland's needs and priorities in the field.
6. Information and advice to potential ESA contractors as a way to enhance Swiss ESA participation. For some respondents and first and foremost for the non-ESA contractors, lack of a strong network or of information is a barrier to participation. Additional resources at the national level should be allocated to informing and advising potential and existing candidates on possibilities concerning ESA. Such actions can only strengthen Swiss participation in European space programmes.

The wider considerations of strategic benefits for sectoral policies have thus not been evaluated. In addition, the views on the relevance of space for entities of the federal administration are collected by a dedicated body for interministerial coordination.

INTERFACE

Evaluation of Switzerland's investments in space activities

Report commissioned by the State Secretariat for Education and Research SER

Lucerne, May 26 2011

Prof. Dr. Andreas Balthasar (project management)
balthasar@interface-politikstudien.ch

Mirjam Inauen (project assistance)
inauen@interface-politikstudien.ch

David Walker (project assistance)
walker@interface-politikstudien.ch

TABLE OF CONTENTS

INTRODUCTION		3
1.1	Actors within the Swiss space sector	3
1.2	Distribution of funds	4
1.3	Evaluation questions	7
1.4	Methodological procedure	8
2	RESULTS FROM THE EVALUATION	11
2.1	Assessment of the SSO and ESA	11
2.2	National measures	14
2.3	Participation in ESA	17
2.4	Impacts of ESA participation	25
2.5	Political context of the Swiss space sector	30
2.6	The Swiss space investments in an international context	33
3	SYNTHESIS	36
4	RECOMMENDATIONS	40
COMPANY INFORMATION		43

I INTRODUCTION

Switzerland has been a member state of the European Space Agency (ESA) since the Agency's foundation in 1975. According to the Federal Council's message related to the fostering of education, research and innovation for the years 2008 – 2011[1], the participation in ESA shall serve the political and strategic goal to preserve Switzerland's status and influence in the European space sector, especially given the ongoing convergence between ESA and the European Union. Also, interested companies and research institutions shall be enabled to secure contracts with ESA for industrial production as well as for research. Thus, the participation in ESA is seen as an investment in the country's research and development potential that aims to develop the technological expertise in the Swiss space sector. Finally, participating in ESA shall allow Switzerland to contribute to and benefit from the development of space technologies which are highly relevant for Swiss society, such as infrastructures for telecommunication, navigation, earth observation and meteorology.

The major part of Switzerland's space budget is invested through ESA. Additionally, measures at national level were adopted in 2004. Mainly dedicated to the support of research institutions linked to ESA, these national measures shall allow further leveraging the benefits of Switzerland's participation in ESA. By promoting the development of technological knowledge and improving the Swiss research location in general, Swiss applications for tenders at a European level can be optimised. This shall minimise existing inequalities between Swiss applicants and their foreign competitors, especially given that these competitors are supported by significant national means.

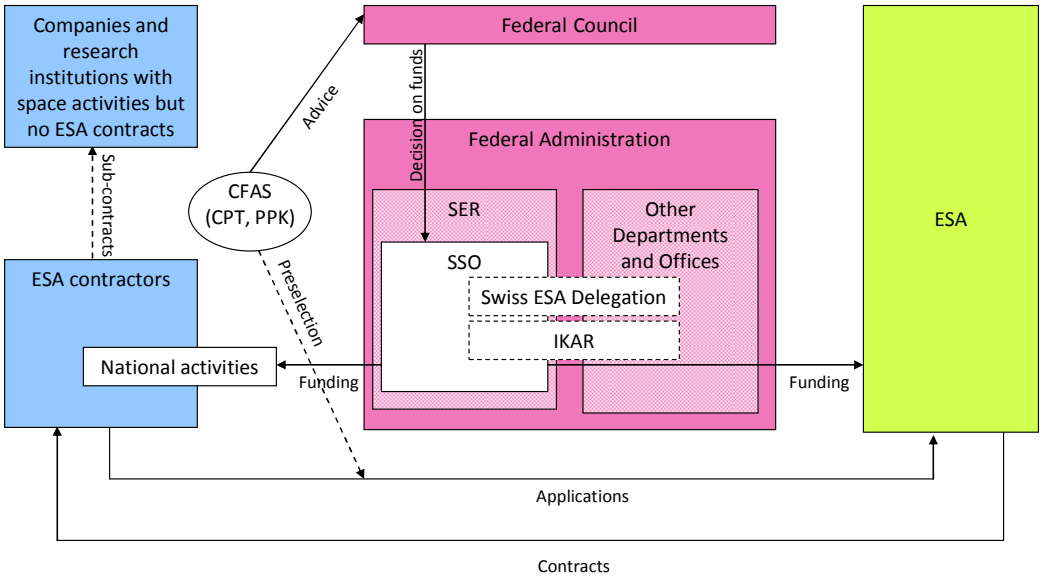
I.1 ACTORS WITHIN THE SWISS SPACE SECTOR

As shown in illustration I 1.1 a significant number of bodies work together in a complex arrangement for the planning and implementation of Swiss space policy. The Federal Council is responsible for defining the strategy and the investments for Switzerland's space sector. Its decisions are based on the recommendations by the Federal Space Affairs Commission (CFAS), which is composed of representatives from space research institutes and industry. The CFAS has two permanent sub-committees, the *Comité de politique technologique* (CPT) and the *PRODEX-Programme-committee* (PPK). These committees examine the applications of Swiss companies and research institutions that wish to participate in certain ESA programmes. An efficient cooperation between departments and federal offices involved in space matters is guaranteed by the Interdepartmental Committee for Space Affairs (IKAR). The Swiss Space Office (SSO) is the administrative unit responsible for planning and implementing the Swiss space policy as well as for managing the corresponding budget. The SSO is a division of the State Secretariat for Education and Research (SER), part of the Federal Department of Home Affairs. The SSO also chairs the IKAR and administrates the IKAR's and the CFAS' secretariats. Furthermore, the SSO heads the Swiss Delegation at ESA,

[1] Federal Council (2007): Botschaft über die Förderung von Bildung, Forschung und Innovation in den Jahren 2008–2011 vom 24. Januar 2007, Bern

which represents Switzerland's interests at ESA and is composed of space experts from different federal offices. Switzerland is thus represented in more than 15 ESA committees, where delegations define the ESA strategy and prepare, implement and monitor ESA programmes.

I 1.1: Actors within the Swiss space sector



Source: Compiled by the evaluation team

Since 2004, the Federal Council has decided to partially support certain institutions with activities linked to ESA in order to reinforce existing competences and foster innovation. Via the national measures for the period 2008–2011, the SSO currently allocates funds to four research institutions: the International Space Science Institute (ISSI), the Integral Science Data Center (ISDC), the Swiss National Point of Contact for Satellite Images (NPOC) and the Space Center EPFL.

Research institutions and companies with space-related activities can submit proposals to participate in ESA programmes. The process includes submitting an application in a competitive tendering process organised by ESA. Depending on the type of programme, the applications are examined and recommended by one of the CFAS' subcommittees beforehand. Successful applicants then enter into project-specific contracts directly with ESA. The SSO is not involved in the allocation of ESA contracts to Swiss contractors but monitors the procurement process.

1.2 DISTRIBUTION OF FUNDS

For the years 2008 to 2011, the period covered by the Federal Council's current message, the Swiss contribution to ESA activities amounts to around 150 million Swiss francs per year. As illustrated in I 1.2, only around 5 million Swiss francs are invested nationally. Thus, the participation in ESA is the most important instrument in the implementation of Swiss space policy, accounting for around 97 percent of the total investment in space activities.

I 1.2: Distribution of space investments 2008–2011, in millions of Swiss francs

	2008	2009	2010	2011	Total	In %
ESA	156	150	145	150	**601**	97%
National measures	5	4	5	5	**19**	3%
Total	161	154	150	155	**620**	100%

Source: Numbers provided by the SSO, representing payments, while the overall growth is fixed within the Federal Council's message related to the fostering of education, research and innovation for the years 2008 - 2011.

1.2.1 PARTICIPATION IN ESA

The funds directed to ESA can be divided into two categories: Mandatory and optional programmes.

Mandatory programmes

The contributions to ESA's mandatory programmes are calculated on a scale based on the member states' gross domestic product. Programmes carried out under the General Budget and the Science Programme budget are 'mandatory'; they include ESA's basic activities (studies on future projects, technology research, shared technical investments, information systems and training programmes). For the period 2008 – 2011, Switzerland's contributions to ESA's mandatory programmes correspond to around 24 percent of the country's total ESA investments.

I 1.3: Distribution of Switzerland's funds directed to ESA in 2008–2011, in millions of Swiss francs

	2008	2009	2010	2011	Total	In %
Mandatory programmes	38	37	34	33	**142**	24%
Optional programmes	118	113	111	117	**459**	76%
Total	156	150	145	150	**601**	100%

Source: Numbers provided by the SSO, representing payments, while the overall growth is fixed within the Federal Council's message related to the fostering of education, research and innovation for the years 2008 - 2011.

Optional programmes

All member states are free to decide on their level of involvement in new optional programmes. Once participating states have negotiated the respective involvements, the corresponding programme declaration becomes legally binding. Based on the recommendations by the CFAS, the Federal Council decides in which ESA programmes Swiss funds are invested. As shown in I 1.3, the major part of Switzerland's investments in ESA, namely around 76 percent, is directed to the optional programmes. The optional programmes can be assigned to different thematic areas of ESA's activities.

1.2.2 NATIONAL MEASURES

Based on a recommendation by the CFAS, in 2004 the Federal Council decided to financially support four research institutions, an investment that should complement Switzerland's contributions to ESA.[2] In 2008, two additional measures at national level, the measures for technical consolidation and technological positioning, came into effect. Illustration I 1.4 shows the distribution of funds destined to the three different national measures.

I 1.4: Distribution of funds directed to national measures in 2008–2011, in Swiss francs

	2008	2009	2010	2011	Total	In %
Support of Research infrastructures	3'020'000	3'000'000	3'050'000	3'100'000	12'170'000	66%
Technical consolidation	1'868'000	830'000	929'000	685'000	4'312'000	23%
Technological positioning	-	117'800	1'017'800	958'900	2'094'500	11%
Total	4'888'000	3'947'800	4'996'800	4'743'900	18'576'500	100%

Source: Numbers provided by the SSO (Numbers for 2011 are not definitive.)

Support of research infrastructures

The investments dedicated to the national measures, as decided by Parliament in its message related to the fostering of education, research and innovation for the given period, correspond to the effective payments made. The biggest part of these investments, namely 66 percent, is aimed at supporting four research institutions. The following four space research institutions currently receive funds from the SSO:

- *The Integral Science Data Center* (ISDC)[3] in Versoix is attached to the Astronomical Observatory of the University of Geneva. The ISDC processes satellite data in order to prepare it for research. It sees itself as an interface between complex instruments producing data and the community of astrophysicists. The ISDC currently employs 50 people.
- *The International Space Science Institute* (ISSI)[4], located in Bern, invites scientists from a wide range of disciplines to discuss existing results from space research. Its aim is to build upon those results and continually develop specific scientific fields by allowing multidisciplinary discussions. The ISSI sees itself as a catalyst for space research, since experts work together to indicate where the focus should lie in the definition of space missions, i.e. before ESA and other space agencies decide which missions to pursue. Currently, twelve people are working for the ISSI.

2 SSO (2004): Demande de subside „Mesure d'accompagnement espace (ESA)", Bern

3 www.isdc.unige.ch, January 31 2011

4 www.issibern.ch, January 31 2011

- *The Space Center EPFL*[5] is located at the *École polytechnique fédérale de Lausanne* (EPFL) in Lausanne. It coordinates the space activities within the EPFL and promotes cooperation between the EPFL and the Swiss space industry. Also, the Space Center has an important role as an educator in space research (e.g. development of a mini-satellite "Swiss Cube" and Concurrent Design Facility). It employs eight people.
- Half of *The Swiss National Point of Contact for Satellite Images* (NPOC)[6] is located at the Remote Sensing Laboratories (RSL) at the Department of Geography of the University of Zurich and the other half at the Federal Office of Topography (swisstopo) in Bern. The NPOC describes itself as the national information, distribution and archive centre for satellite images. It not only offers satellite images but advises mainly scientists as well as other clients on the appropriate use of these images. The NPOC currently employs four people.

The funds for the four research institutions are not equally distributed, with two institutions receiving 90 percent of the payments. In the period 2008 to 2011, the ISDC received 62 percent and the ISSI 28 percent of these funds. The financial support to the four research institutions amounts to 65 percent of the space budget allocated to national measures.

Measures for technological positioning

Another 11 percent of the funds for national measures are invested for the promotion of frontier research. A first Call for proposals was organised in 2010, resulting in the selection of nine projects. These are studies on technological concepts for space missions and carried out through partnerships, namely between research institutions and industrial actors[7]. The names of the projects and partners involved are published on the SSO's website.

Measures for technical consolidation

23 percent of the funds for national measures are aimed at supporting further development of instruments and applications and fostering technical competences in public research institutions within established scientific and technological fields of research.[8] The SSO indicated that two projects are currently being financed through these measures.

1.3 EVALUATION QUESTIONS

The present evaluation was commissioned by the Swiss Space Office (SSO) at the State Secretariat for Education and Research (SER) and shall analyse the efficiency of Switzerland's investments in space activities, their relevance for the Swiss business and research location as well as their societal effects. The evaluation takes place in the con-

5 http://space.epfl.ch, January 31 2011

6 www.npoc.ch, January 31 2011

7 Federal Council (2007): Botschaft über die Förderung von Bildung, Forschung und Innovation in den Jahren 2008–2011 vom 24. Januar 2007, Bern

8 *Ibid.*

text of the elaboration of the Federal Council's message related to the fostering of education, research and innovation for the yeas 2013 – 2016, destined to the Federal Parliament. The present report aims to answer the following questions:

Assessment of the SSO and ESA

1. How do ESA contractors assess the support from the SSO? What relevance does the SSO have for those companies and research institutions in the space sector which are not ESA contractors? How do ESA contractors assess the collaboration with ESA?

National measures

2. What relevance do the research institutions, supported within the national measures, have for the Swiss space community? What relevance do the funds from the SSO have for the supported research institutions?

Participation in ESA

3. What types of companies or research institutions have been contracted by ESA over the last seven years? What are the characteristics of their ESA participation? What is the success rate of Swiss companies and research institutions when tendering for ESA contracts?
4. What relevance do ESA contracts have for ESA contractors compared to other contracts?
5. What are the interests that Swiss companies and research institutions have pursued when applying for ESA programmes? What are the reasons why some Swiss companies and research institutions do *not* participate in ESA programmes?

Impacts of ESA participation

6. What are the scientific and economic impacts of the participation in ESA programmes on ESA contractors? What are the societal impacts of the participation in ESA?

Political context of the Swiss space sector

7. Are the measures implemented by the SSO appropriate to reach the goals of the Swiss space sector? How do the ESA contractors assess the development of the political context of the Swiss space landscape?

The Swiss space investments in an international context

8. How are Switzerland's investments in ESA and in national measures assessed in an international context?

1.4 METHODOLOGICAL PROCEDURE

The following four methodological approaches were chosen to elaborate the answers to the evaluation questions above.

Expert interviews

A first interview with the director and other representatives from the SSO facilitated the collection of important information on Swiss space policy and the space sector. The evaluation team then conducted four interviews with the heads of the research institutions that receive funds through the national measures. These interviews were aimed at exploring the field of space activities in Switzerland and preparing the online survey. Another interview was conducted with Mr. Peter Briner, member of the Council of States and head of the CFAS, in order to discuss mainly political issues.

Online Survey

The SSO provided a list of 84 different industrial companies and 34 science and technology institutes from Switzerland that were contracted by ESA between the years 1998 and 2009.[9] Thereof, we extracted 114 valid addresses of companies and research institutions and invited them to participate in an online survey. 38 respondents filled in the online questionnaire. However, two of them stated that they had not been contracted by ESA within the last seven years and were therefore directed to the end of the questionnaire.[10] Thus, the online survey resulted in 36 valid responses which correspond to a response rate of 32 percent. With regard to their institutional background as well as the ESA programmes they have participated in, the 36 respondents to the online survey correspond well to the distribution of 114 companies and research institutions that were invited to participate (see illustration I 2.5 and I 2.6). Consequently, it can be said that Swiss ESA participants are well represented in the responses of the survey.[11]

The questionnaire addressed the companies' or institutions' general profiles, the content of the ESA projects they had contracts for, the interests they have been pursuing through their participation in ESA as well as their estimation of the corresponding scientific, economic and societal effects. It also included an assessment of the collaboration with the SSO and ESA as well as an evaluation of the political context of the Swiss space landscape.

It must be stressed that the evaluation exercise was conducted with national actors active in the space sector. Other sectors that might benefit from the knowledge and applications derived from the space industry and flowing into the wider society and economy were not included. Potential benefits generated, such as scientific progress, access to earth observation data, increased intellectual property rights, strengthened international relations, are supposed to positively impact Swiss society at various levels and to varying degrees, and are thus not always quantifiable.

9 Swiss Space Office (2009): Swiss ESA Contractors, Bern. The data does not consider contractors whose ESA contract commitments do not reach 50'000 Euro.

10 The online survey was limited to companies and research institutions that have been contracted by ESA within the last seven years.

11 According to data provided by the SSO, 34 percent of Swiss ESA contractors are manufacturing companies, 37 percent are private research-oriented engineering companies, management consultancies or service-oriented companies, 8 percent are public research and development institutions and 21% represent universities or other institutions of higher education. These categories do however not fully correspond to the categories that we used in our online survey and that are presented in I 2.5.

Telephone interviews with companies and research institutions in the space sector without ESA contracts

The SSO provided a list of companies and research institutions with activities potentially related to the space sector but no ESA contracts. We conducted ten telephone interviews with these potential ESA participants in order to find out the reasons why they have not yet participated in an ESA-Programme. The directors of seven manufacturing industries, two non-university research or development companies as well as one university institute were interviewed.

Expert workshop

The SSO invited the following directors of the national space offices or agencies of five ESA member states to participate in an expert workshop:

- Dr. Bo Andersen, Norwegian Space Agency, Norway
- Eric Beka, Belgian High Representation for Space Policy, Belgium
- Dr. Olle Norberg, Swedish National Space Board, Sweden
- Harald Posch, FFG Aeronautics and Space Agency, Austria
- Prof. Dr. Johann-Dietrich Wörner, German Aerospace Center, Germany

The workshop facilitated a discussion of the findings of the present evaluation report and the formulation of corresponding recommendations. Previously, the participants were asked to provide some basic information on their countries' investments in the space sector and deliver evaluation reports, if any, on their national space policy and sector.

2 RESULTS FROM THE EVALUATION

In the following chapter we will describe and analyse the results from the context interviews, the online survey as well as the telephone interviews stemming from the evaluation questions presented in chapter 1.3.[12]

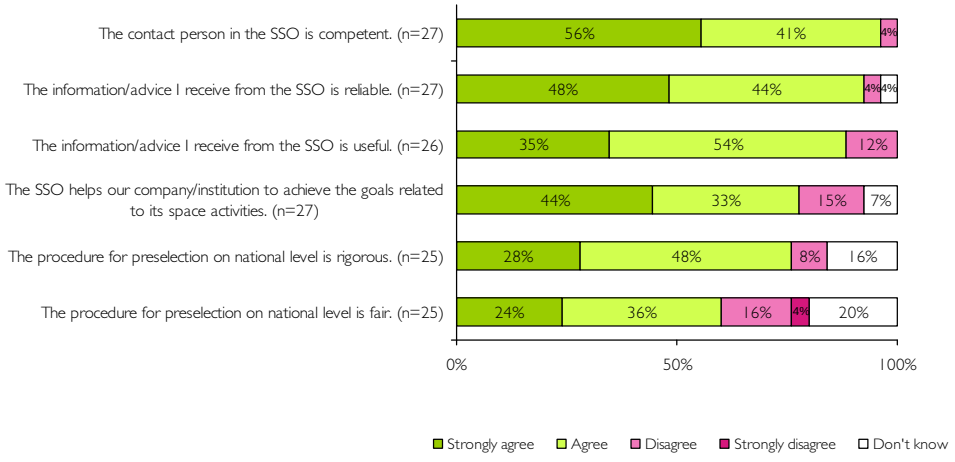
2.1 ASSESSMENT OF THE SSO AND ESA

1. How do ESA contractors assess the support from the SSO? What relevance does the SSO have for companies and research institutions in the space sector without ESA contracts? How do ESA contractors assess the collaboration with ESA?

Assessment of the SSO

Three quarters of the 36 respondents of our online survey have received support from the SSO for participation in an ESA-Programme.[13] Of these, the vast majority, namely 97 percent, is of the opinion that the contact person at the SSO is competent. Also 92 percent of them agree or strongly agree that the information and advice provided by the SSO is reliable and 89 percent find that it is useful, as shown in I 2.1.

I 2.1: Assessment of the SSO[14]



Source: Results from online survey.

[12] Please note that in the following presentation of the results from the online survey, total amounts slightly below or above 100 percent are due to rounded numbers.

[13] Did your company/institution get any form of support (e.g. information, advice) from the SSO at the State Secretariat for Education and Research for the participation in an ESA-Programme? (N=36)

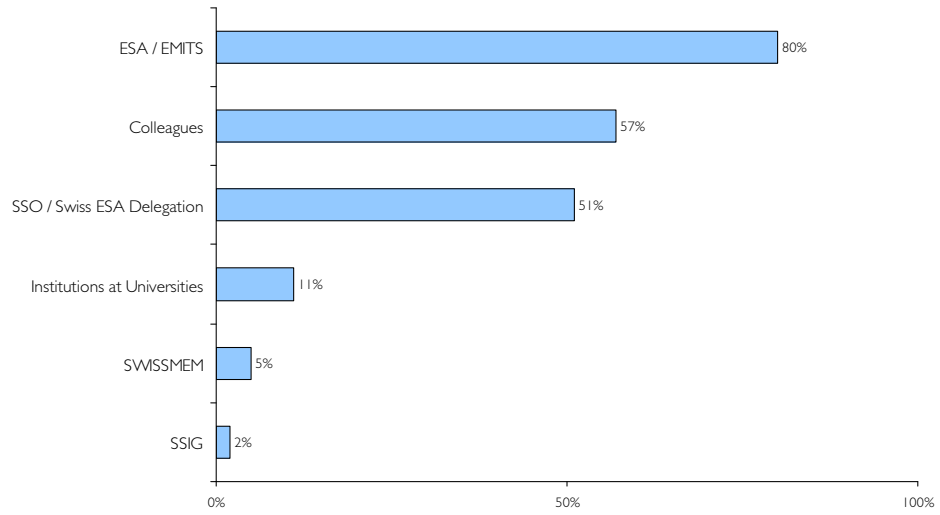
[14] Based on your experience with the SSO, please indicate the extent to which you agree or disagree with the following statements concerning its activities.

Finally, 77 percent of the respondents that have received support from the SSO agree or strongly agree with the statement that the SSO helps their company or institution to achieve the goals related to their space activities.

69 percent of all respondents have been involved in an ESA tendering process that involved a pre-selection at national level.[15] This means that their application for participation in an ESA-Programme has been previously examined by one of the CFAS sub-committees. 76 percent of the companies and institutions that have passed through such a procedure agree or strongly agree that it is rigorous. However, only 60 percent of them think that the procedure for preselection at the national level is fair. These results can be compared with findings of a similar survey concerning the European CO-operation in the Field of Science and Technology (COST).[16] Thus, the satisfaction with the SSO's activities is equally high and in some domains even higher than with COST.

As illustrated in I 2.2, a majority of respondents of the online survey, namely 80 percent, is informed on new tenders via ESA's Electronic Mailing System for handling Invitations to Tender (EMITS) or other ESA channels. However, the SSO (51%) and colleagues from inside or outside their own company or institution (57%) are two other important sources of information. In contrast, the Swiss Space Industries Group (SSIG) (2%), the association of Swiss mechanical and electrical engineering industries (SWISSMEM) (5%) as well as institutions at universities (11%) play only a marginal role.

I 2.2: Sources of information on ESA tenders[17]



Source: Results from online survey

[15] Has your company/institution ever been involved in an ESA tendering process that implied a preselection on national level (such as GSTP, ARTES or PRODEX)? (N=36)

[16] COST is the European CO-operation in the Field of Science and Technology. Interface evaluated its activities in 2010 on behalf of the SER. Interface; Technopolis Group (2010): Wirkungsanalyse Cost, Luzern.

[17] How does your company/institution find out about new ESA tenders (multiple answers possible)? (n=35)

This leads to the assumption that the ESA contractors currently do not have very strong contacts to third parties of the private sector such as SWISSMEM and SSIG. This assumption corresponds to the assertion by some of the directors of the research institutions, that the network between the companies and research institutions active in the space sector is not very strong.

The directors of the research institutions supported through the national measures, were also asked to assess their collaboration with the SSO. All four interviewees stated that the collaboration with the SSO is excellent. The SSO's employees are seen as most competent. However, two of the interviewees expressed the concern that the SSO is understaffed, given the tasks the Office has to fulfil. Also, one director deplores the lack of transparency in the decision on the distribution of funds through the national measures. The criteria for the selection of entities which may be supported are contained in the Ordinance of 4th July 2001 governing the allocation of subsidies for education and science within the framework of international cooperation.[18]

Relevance of SSO for companies and research institutions without ESA contracts

Seven of the ten interviewed directors of companies and research institutions without ESA contracts do not know the SSO. Two interviewees are aware of its existence but have never had any contact with it. Only one has visited an information event organised by the SSO.

The majority of the companies and research institutions without ESA contracts, whose directors we interviewed, are small or very small, most of them having less than 50 employees. Also, their space activities are negligible, four interviewees stating that the share of space activities of their annual turnover in 2010 amounted to zero percent, while the highest score stated was 20 percent. Apart from for the University institute none of them actually does research and only two interviewees stated that the development projects made 100 percent of their companies' turnover in 2010. Four companies were involved in neither research nor development, the others being somewhere between R&D and standardised industrial production.

Given their limited knowledge of the SSO, the interviewees were not able to evaluate its activities. Nevertheless, except for four interviewees, they were able to formulate some expectations to the SSO. Thus, five respondents stated that they wished the SSO would help them network and open doors to potential clients. Two responded that they would appreciate support for securing contracts as sub-contractors with bigger companies that have contracts with the ESA. Another two stated that they would expect to be better informed about participation possibilities with ESA, one of them emphasising that the SSO should focus more on supporting small and medium-sized companies.

[18] Bundesrat (2004): Verordnung über die Gewährung von Beiträgen für die internationale Zusammenarbeit in Bildung und Wissenschaft vom 4. Juli 2001, Bern

Thus, the SSO currently does not have any relevance for these companies and research institutions. However, this does not mean that their directors do not wish for the SSO to take on a more active role in supporting them with respect to their space activities.

Assessment of ESA

A clear majority of respondents, namely 77 percent, agree or strongly agree that the contact person at ESA is competent and 83 percent think that the information they receive from ESA is useful. With respect to ESA's tendering process, 69 percent of the respondents consider it rigorous, but only 40 percent think it is fair, while 37 percent do not think so and 23 percent stated that they simply do not know. Also, 57 percent of the respondents think that the administrative work required for an ESA application is too complex and too time-consuming. A little less, namely 51 percent think that the administrative work required for the execution of an ESA project is too complex and too time-consuming. Thus, almost half of the respondents, namely 49 percent stated that the administrative work has at least once prevented their company or institution from submitting a tender proposal.[19] Compared to the findings of the COST-survey, the estimation of the administrative work required for participation in ESA is much more critical. Thus, it can be concluded that interested companies and research institutions could not only use more support when applying at ESA but also more information on negative decisions concerning their applications.

2.2 NATIONAL MEASURES

2. What relevance do the research institutions, supported within the national measures, have for the Swiss space community? What relevance do the funds from the SSO have for the supported research institutions?

Relevance of supported research institutions for the Swiss space community

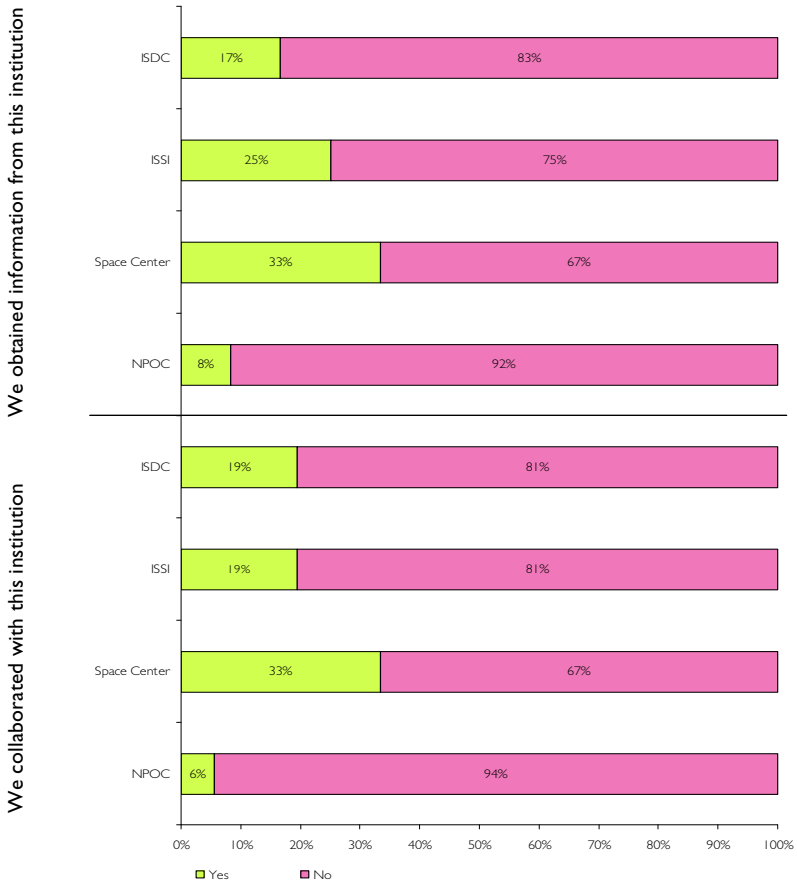
There are neither strong contacts nor collaboration projects between the supported research institutions themselves. Except for the Space Center EPFL, they clearly serve the scientific space community and therefore have no systematic contacts to the industry either. Correspondingly, 83 percent of the respondents of our online survey know the Space Center EPFL, but only 61 percent know the ISSI, 42 percent the ISDC and 31 percent the NPOC.[20] None of the responding companies or research institutions has mandated any of the four supported research institutions and only very few have been

[19] Based on your experience with ESA programmes, please indicate the extent to which you agree or disagree with the following statements concerning the ESA tendering process: The contact person at ESA is competent. (n=35) The information/advice I receive from ESA is useful. (n=35) The ESA tendering process is rigorous. (n=35) The ESA tendering process is fair. (n=35) The administrative work required for an ESA APPLICATION is too complex and too time-consuming in comparison with other space agencies/actors. (n=35) The administrative work required during the EXECUTION OF A PROJECT funded by ESA is too complex and too time-consuming in comparison with other space agencies/actors. (n=35) The administrative work has at least once prevented our company from submitting a tender proposal. (n=35)

[20] Do you know any of the following research institutions? International Space Science Institute (ISSI) at the University of Berne, Integral Science Data Center (ISDC) at the University of Geneva, National Point of Contact (NPOC) at the Remote Sensing Laboratories RSL of the University of Zurich, Space Center at Federal Institute of Technology Lausanne (EPFL). (N=36)

contracted by them. As shown in illustration I 2.3, a minority of respondents has obtained information or collaborated with the supported research institutions. They have mostly been in contact with the Space Center EPFL, followed by the ISSI and the ISDC, while only very few have benefitted from the NPOC. In conclusion, the number of respondents that have benefitted from the existence of these research institutions is very low.

I 2.3: Forms of contact to supported research institutions[21]



Source: Results from online survey

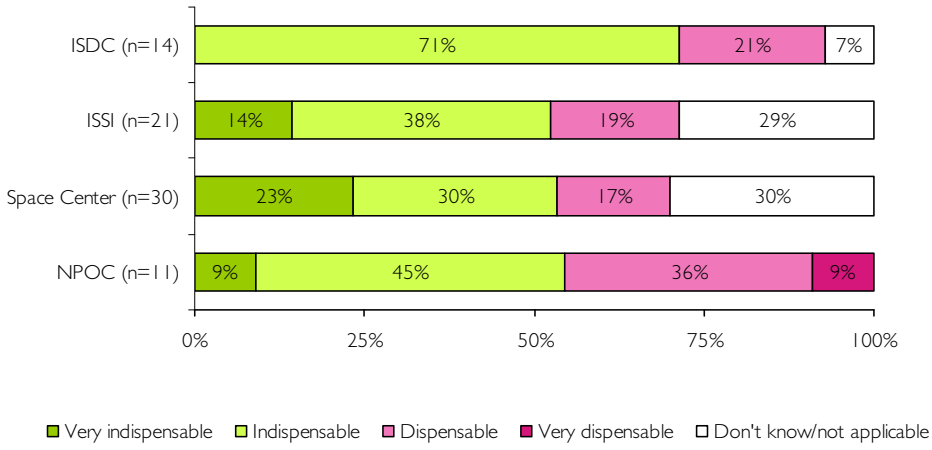
The respondents were also asked to assess the quality of the supported research institutions that they know. However, the small numbers of respondents that are aware of their existence as well as the low intensity of their contacts have to be taken into account when interpreting the results. In addition, even among those who know the ISDC, the ISSI, the Space Center EPFL or the NPOC, a large part was not able to answer the question, stating that they can not judge the quality of the institution's activities. The institutions are still evaluated rather positively with only small differences. While around 75 percent assess the ISDC's and the Space Center's activities as good or

[21] Has your company/institution had any contact with the ISDC over the last 7 years? If yes, what form of contact? We have not had any contact with this institution over the last 7 years.; We obtained information from this institution (e.g. purchase of data, obtaining of information material, visit of a conference or seminar).; We collaborated/are collaborating with this institution.; We mandated/are mandating this institution.; We were/are being contracted by this institution. (N=36)

even very good, a little less, namely around 60 percent, do so for the ISSI and the NPOC.

Again, only those who know the institution were asked to assess its relevance for the Swiss space community. The answers are illustrated in I 2.4. While 71 percent of these respondents think that the ISDC is indispensable or even very indispensable, only a little more then 50 percent think so for the ISSI, the Space Center EPFL or the NPOC. When comparing these results, the differences between the numbers of respondents must however be considered. Also, already from the description of the activities of the ISDC, the ISSI and the NPOC in chapter 1.2.2 it becomes clear that their primary target groups are not among the ESA contractors nor the companies and research institutions interested in ESA participation. Thus, the respondents' estimation of these research institutions' relevance has to be seen in this context.

I 2.4: Relevance of supported research institutions for the Swiss space community[22]



Source: Results from online survey

None of the interviewed directors of companies and institutions without ESA contracts know the ISDC, the ISSI or the NPOC. However, two interviewees were aware of the existence of the Space Center EPFL. One of them completed a course offered by the Space Center and assessed its activities as very good and its existence as highly relevant for the Swiss space community, especially for the education and further education of qualified personnel for space research and industry.

Relevance of SSO funds for supported research institutions

The SSO's payments to the four research institutions are based on formal decisions signed by the SER Secretary of State (above a certain threshold by the Federal Counsellor, with approval of the Federal Department of Finance, as required), which determine their financial support for a period of four years but do not define the tasks to be per-

[22] Based on your experience and knowledge of space research and industry in general, how do you assess the importance of the Space Center / NPOC / ISDC / ISSI for the Swiss space community?

formed or goals to be reached. These are presented to the SSO and assessed beforehand. While the directors of the supported infrastructures have a certain degree of freedom in deciding on the use of these funds in the running of the institutions, the governing framework is set in a mandate. Due to confidentiality reasons, the evaluation team could however not evaluate these documents. As an additional control measure, the research institutions are under the obligation to submit annual reports. Also, the SSO has a certain influence on the development of the ISSI as well as the Space Center, as some SSO representatives are members of the ISSI's board of trustees and of the Space Center's steering committee.

According to the director of the SSO, the funding of the four research institutions is primarily mission and/or project linked and must be seen as a public incentive, which is periodically re-evaluated. The concerned institutions shall therefore undertake efforts to become largely independent from these funds. However, with one exception the interviewed directors do not seem aware that the funding of their research institutions is actually temporally limited. Consequently, they have not yet developed any strategies to obtain other means of funding. According to the interviews, there are differences between the four research institutions with respect to their dependence on the SSO's funds. Thus, a cancellation or reduction of these funds would affect the institutions differently. However, as the evaluation team did not inspect their budget structure, it is not possible to objectively assess the consequences that a reduction or end of the SSO's financial support would have on the four research institutions.

2.3 PARTICIPATION IN ESA

3. What types of companies or research institutions have been contracted by ESA over the last seven years? What are the characteristics of their ESA participation? What is the success rate of Swiss companies and research institutions when tendering for ESA contracts?

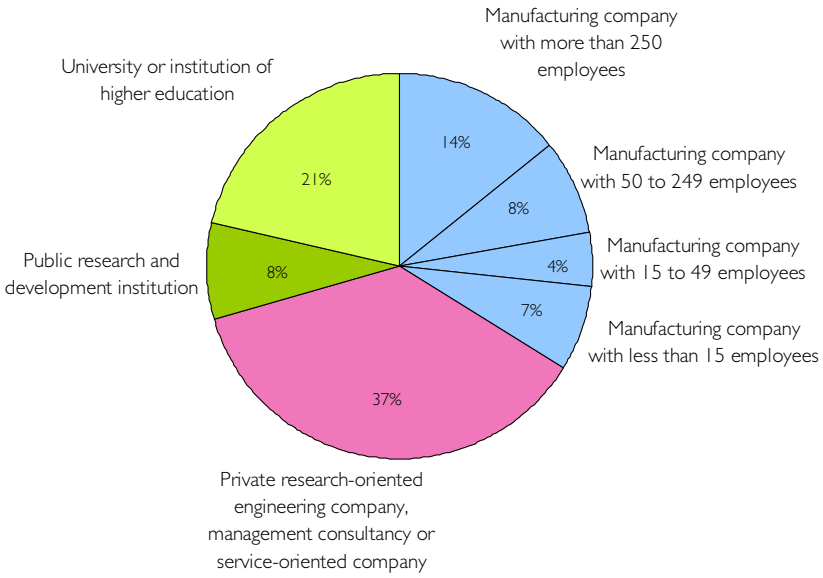
Profile of ESA contractors

For confidentiality reasons, the SSO's data on Swiss ESA contractors is not publicly available. I 2.5 illustrates some basic information on the profile of Swiss ESA participants.[23]

Also, our online survey can provide only a very limited view of the structure of the Swiss space sector. As illustrated in I 2.6, 39 percent of the 36 respondents represent companies from the manufacturing industry, 25 percent are private research oriented engineering companies, management consultancies or service oriented companies. 6 percent represent public research or development institutions and 19 percent are institutes at a University or other institutions of higher education. Finally, another 11 percent of the respondents represent other public or private research and development institutions.

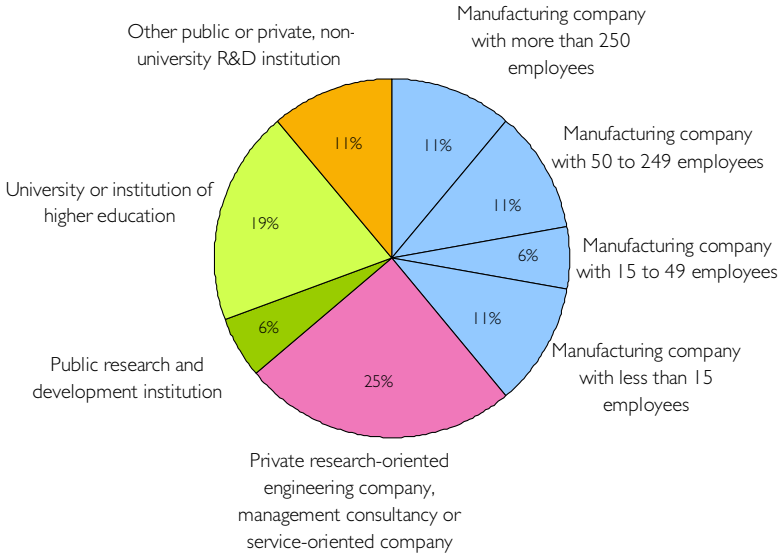
[23] Please note that the categories in I 2.5 do not fully correspond to the categories that we used in our online survey and that are presented in I 2.6.

I 2.5: Profile of Swiss ESA participants



Source: Own illustration based on numbers provided by the SSO

I 2.6: Profile of respondents to online survey[24]



Source: Results from online survey

A majority of respondents, namely 72 percent stated that they have had research-related contracts with ESA. A little less, namely 58 percent responded that their ESA projects also concern specific products but only 25 percent are working on infrastruc-

[24] Type of your institution: Manufacturing company; Private research oriented engineering company, management consultancy or service oriented company; Public research or development institution; Institute at a University or other institution of higher education; Other public or private non-university research and development institution. (N=36)

ture projects.[25] 42 percent have participated in ESA programmes as subcontractors or suppliers, a little less, namely 33 percent as partners, whereas 25 percent have been project leaders in ESA funded projects.[26]

I 2.7: Area of activity of respondents[27]

	Ground-based applications	Space-based solutions	Total
Niche products / services	21%	53%	74%
Broad range of products/services	14%	12%	26%
Total	35%	65%	100%

Source: Results from online survey

As shown in illustration I 2.7, with respect to their space activities, 74 percent of the responding companies and research institutions are niche players. Furthermore, around two thirds produce space-based solutions.

As can be seen in I 2.8, the number of responding companies and research institutions that participated in the different areas of ESA's activities corresponds, with a few exceptions, to the level of Swiss investments in these areas.

[25] How would you categorise the ESA project(s) your company/institution has been participating in over the last 7 years (multiple answers possible)? (N=36)

[26] What role did your company/institution (most frequently) take on within ESA funded projects over the last 7 years? (N=36)

[27] Where would you place your company's/institution's space activities in the following chart? Niche products/services; Broad range of products/services; Ground based applications; Space-based solutions (n=34)

I 2.8: Area of ESA participation[28]

	Switzerland's total past contributions to ESA until Dec. 2009 by area		Respondents to online survey	
	In million Euro	In %	In numbers	In %
Mandatory Activities (Basic Activities, Science Programme & Associated to General Budget)	62	8%	15	16%
Telecommunications	47	6%	11	12%
Earth Observation	192	25%	16	17%
Human Spaceflight	173	22%	6	6%
Microgravity			4	4%
Launchers	119	15%	4	4%
Technology and Science Support	146	19%	25	27%
Robotic Exploration	13	2%	3	3%
Navigation	23	3%	6	6%
Space Situational Awareness	0.1	0%	3	3%
Total	775	100%	93	100%

Source: Numbers provided by the SSO based on an internal ESA document on member states' participation; Results from online survey

According to the directors of the four supported research institutions as well as the Report *Revision der schweizerischen Weltraumpolitik* submitted to the Federal Council[29], a growing market potential lies in ground-based activities. However, as mentioned above, most respondents state that they are active in space-based solutions. Thus, there seems to be a discrepancy between the assessment of experts of the space market's development and the current orientation of the Swiss space sector.

Success rate

The 36 responding companies and research institutions that filled in our online questionnaire have participated in a total of 746 ESA tenders over the last seven years. 411 of their applications were successful. This corresponds to a success rate of 55 percent, which can be assessed as being very high.[30] On average, one company or research institution has worked on around 11.5 ESA projects over the last seven years. However,

[28] In which areas has your company/institution been contracted for ESA programmes over the last seven years (multiple answers possible)? (N=36)

[29] Eidgenössisches Departement des Innern EDI, Staatssekretariat für Bildung und Forschung SBF (2008): Revision der schweizerischen Weltraumpolitik, Bern.

[30] In how many ESA tenders did your company/institution participate over the last 7 years? How many of these applications were successful? (n=33)

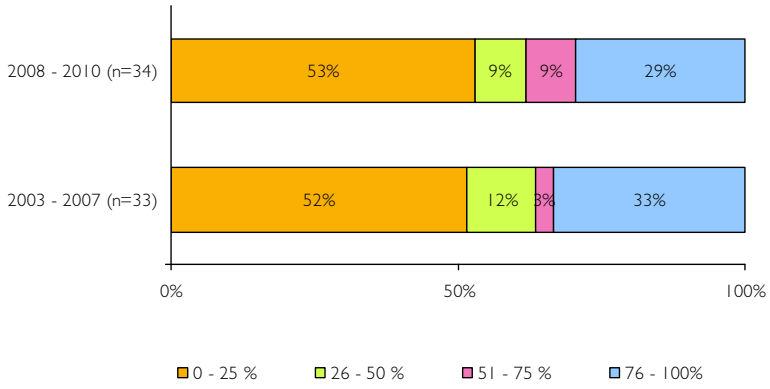
given the varying sizes and competences of the responding entities, it is likely that there was not an equal distribution of the number of contracts generated.

4. What relevance do ESA contracts have for ESA contractors compared to other contracts?

Relevance of ESA contracts

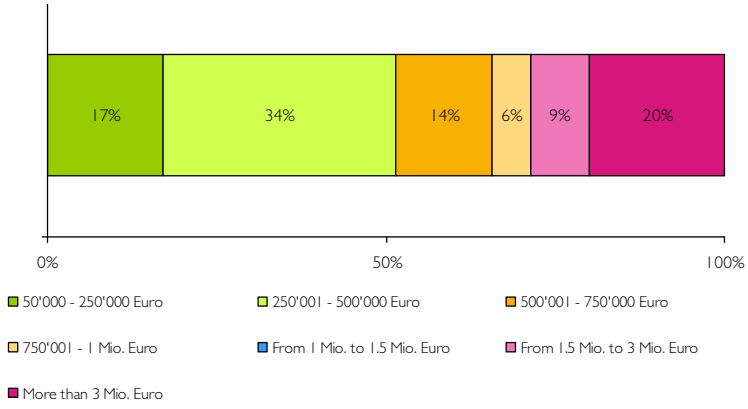
As illustrated in I 2.9, for more than half the companies and research institutions, the share of revenues for space activities represents only 25 percent or less of their total turnover. However, the companies and research institutions for which their space activities make more than 75 percent of their turnover also represent around a third of the respondents, with only negligible changes over the last seven years.

I 2.9: Estimated share of revenue for space activities of company's/institution's total turnover[31]



Source: Results from online survey

I 2.10: Estimated amount received through ESA-related contracts per company/institution in the years 2008–2010[32]



Source: Results from online survey

[31] What was the estimated share of revenues for space activities of your company's/institution's total turnover in the years 2008–2010? (n=35)

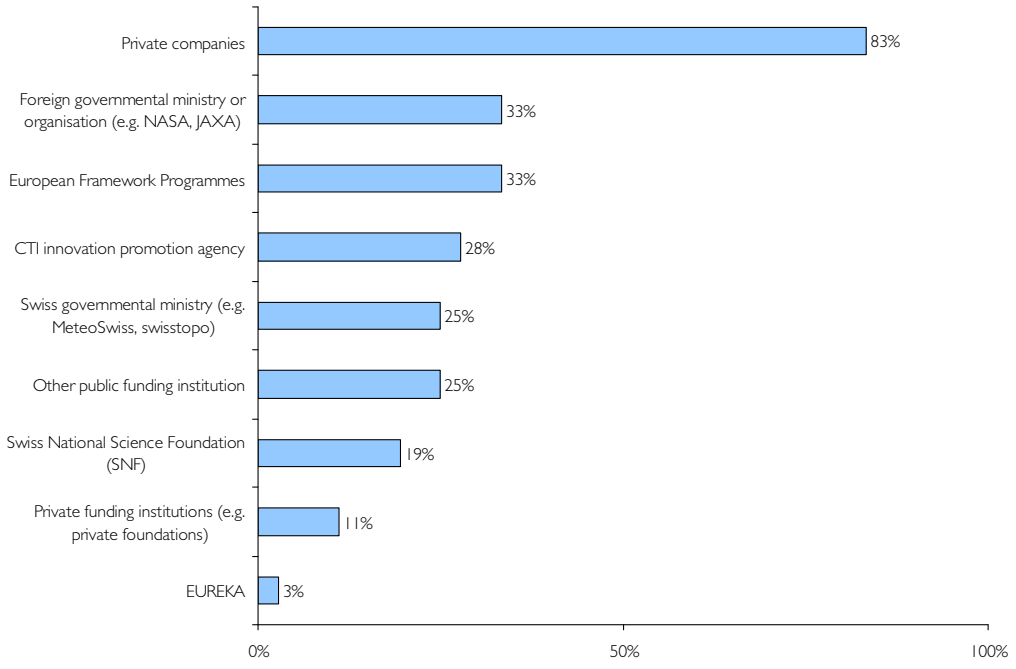
[32] How would you estimate the TOTAL amount in Euros that your company/institution received through ESA-related contracts in the years 2008 - 2010? (n=34)

Illustration I 2.10 shows that around a third of the surveyed companies and research institutions received a total amount between 250'001 and 500'000 Euro for the years 2008 to 2010 through ESA contracts.

44 percent of the respondents believe that the future contract volume with ESA will stay approximately the same compared to the years 2008 to 2010. 11 percent expect it to be smaller, while 36 percent think that the future contract volume with ESA will increase, with 8 percent of the respondents not being able to predict the development of ESA funds for their companies or institutions.[33] Also, 64 percent of the responding companies and institutions have already secured contracts for work to be performed in 2011 and beyond.[34]

The responding companies and research institutions have a broad portfolio of contractors, as can be seen in I 2.11. Most of the surveyed companies and institutions, namely 83 percent, have been contracted by private companies to conduct space projects. Significantly fewer have received funds or contracts for space activities from other institutions such as the NASA, the European Commission or Swiss research funding institutions.

I 2.11: Other funding institutions and companies for space activities[35]



Source: Results from online survey

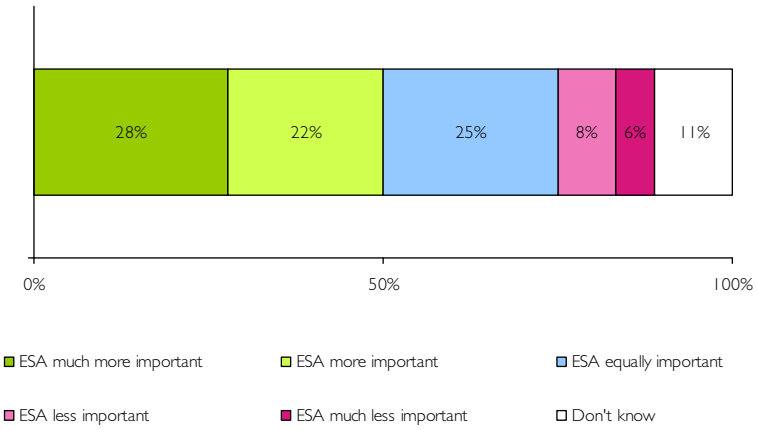
[33] What are your expectations concerning the future contract volume with ESA compared to the years 2008 -2010? (N=36)

[34] Has your company/institution already secured contracts for work to be performed in 2011 and beyond? (N=36)

[35] Has your company/institution been contracted by any of the following institutions to conduct space-related (research) projects over the last 7 years (multiple answers possible)? (N=36)

As shown in I 2.12, half of all respondents however stated that ESA is more important or even much more important than these other contractors. For a quarter of these companies and institutions the funds from ESA are equally important compared to the above funding sources.

I 2.12: Importance of ESA as a contractor compared to other funding institutions[36]



Source: Results from online survey

All interviewed directors from companies and research institutions without ESA contracts have received funds or contracts from other private companies to conduct space projects. Other institutions such as the European Commission, foreign ministries and universities as well as the KTI were mentioned just once as funders of space projects.

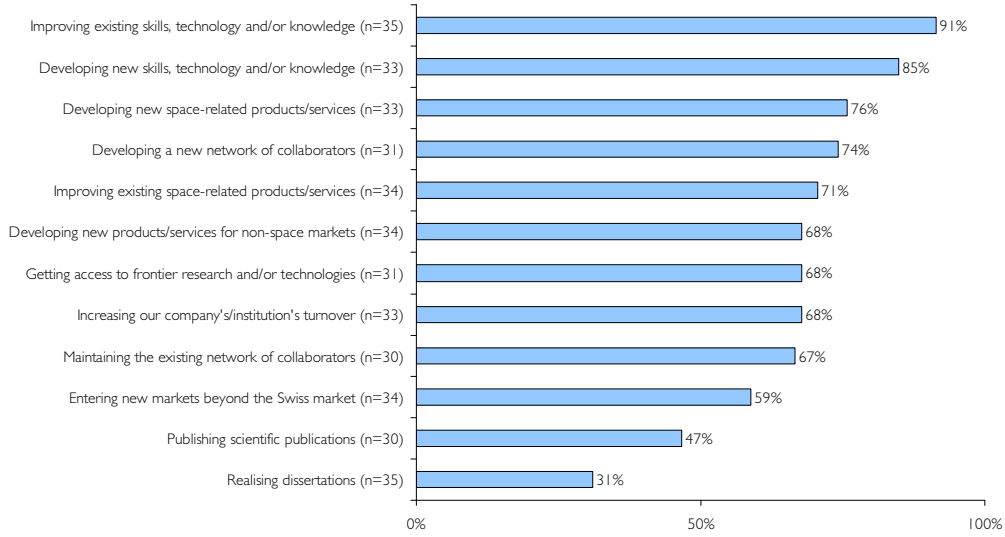
5. What are the interests that Swiss companies and research institutions have pursued when applying for ESA programmes? What are the reasons why some Swiss companies and research institutions do *not* participate in ESA programmes?

Interests in ESA participation

Illustration I 2.13 lists the interests that the companies and research institutions were pursuing when applying for ESA contracts. Thus, 91 percent of them aim at improving existing and 85 percent at developing new skills, technology or knowledge. Around three quarters wish to develop new space related products or services as well as to gain access to a new network of collaborators.

[36] What importance does ESA have as a contractor for your company / institution compared to the above institutions? (N=36)

I 2.13: Interests in ESA participation[37]



Source: Results from online survey

Also important is the improvement of existing space-related products or services, the development of new products and services for non-space markets, the access to frontier research and technologies as well as the increase of the company's or institution's turnover and the maintenance of the existing network. More than half of the respondents expect to gain access to foreign markets when conducting an ESA project. However, purely scientific interests such as publishing scientific publications as well as producing dissertations are mentioned by less than 50 percent of the respondents. Of course, this has to be seen in the context of the respondent's institutional background, only one fifth of them representing universities or institutions of higher education. Nevertheless, when applying at ESA, the respondents combine a multitude of interests, which reflect their priorities in research and development as well as purely economic goals.

Reasons for non participation

The directors of companies and research institutions without ESA contracts mentioned a variety of reasons why they have never worked with ESA. In several cases, the reasons for their non participation lie within the companies or institutions themselves: Thus, five out of ten companies simply have no need for additional funds. Two interviewees stated that their products or services do not correspond to ESA's interests, while one said that the products that could be of benefit to ESA do not cover the company's core business. For another company, the development of space products in general does not correspond to its current strategic priorities. Another reason mentioned is that their productions are much too small for an ESA contract. However, only three interviewees stated that they would never consider an application at ESA. Thus, there are also external reasons: According to four respondents, they do not have enough or no information at all on their potential opportunities at ESA. Another two declared their lack of network and contacts in this area as the reason why they have never ap-

[37] What main interests has your company/institution been following through the participation in ESA programmes over the last 7 years (multiple answers possible)?

plied for ESA participation. Only one of the ten respondents has looked into current opportunities for participation, using ESA's EMITS. Asked about the conditions under which their company or institution would apply at ESA, four mentioned that they would need more information, while two said that they would have to develop a better network in this area. Three respondents expressed their interest in being informed of open opportunities, while one of them is already planning to apply at ESA.

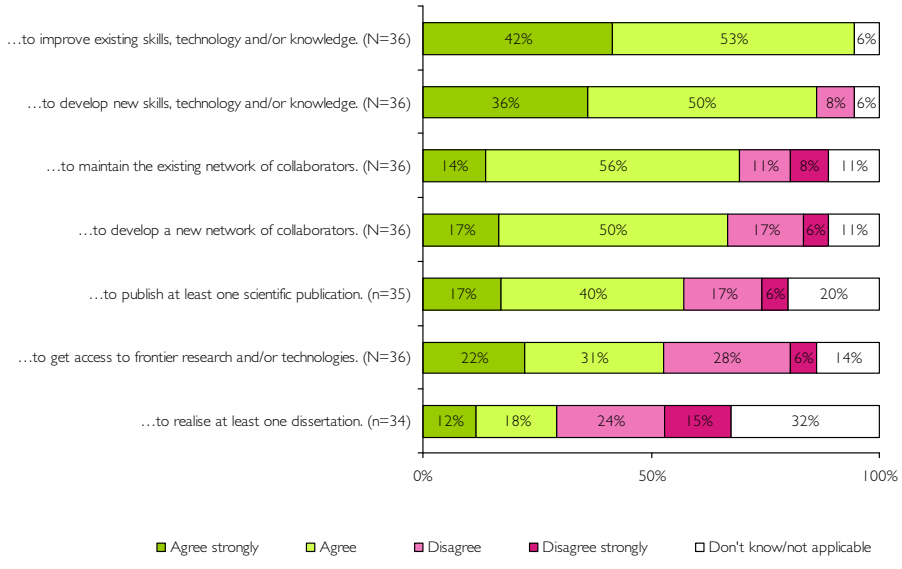
According to the director of the SSO, dedicated information measures to enlarge the space community have not been a priority because of resource constraints. He nevertheless underlined that general information with specific data for professionals is openly available on the SER-Website. The persons responsible for the individual ESA programmes at the SSO keep their existing network informed of current opportunities. The interests and needs of potential ESA contractors are currently not systematically surveyed.

2.4 IMPACTS OF ESA PARTICIPATION

6. What are the scientific and economic impacts of the participation in ESA programmes on ESA contractors? What are the societal impacts of the participation in ESA?

Scientific impacts

I 2.14: Scientific impacts of ESA participation on ESA contractors[38]



Source: Results from online survey

As shown in illustration I 2.14, the participation in an ESA-Programme allowed 95 percent of the respondents' companies and research institutions to improve existing

[38] Economic effects: For each of the following statements, please state whether you agree or disagree: The participation in ESA programmes over the last 7 years allowed our company/institution…(N=36)

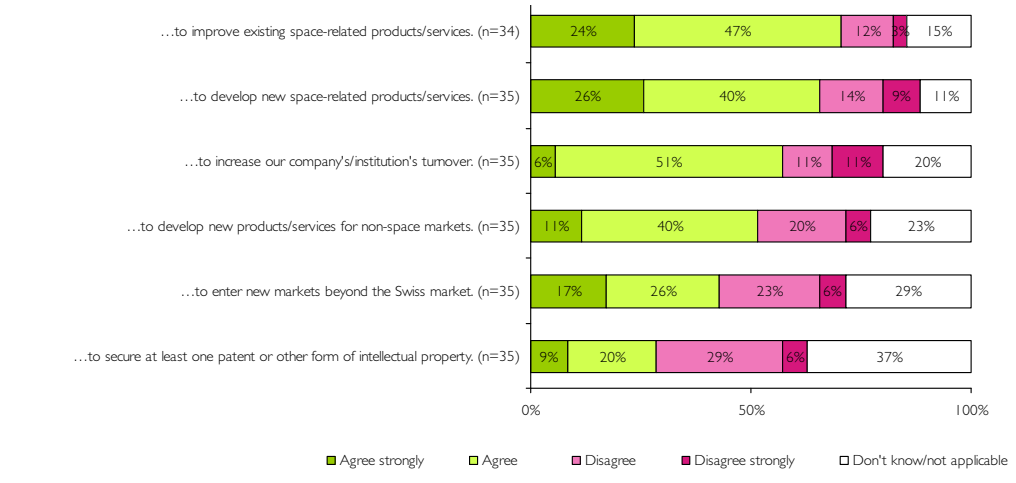
and 86 percent to develop new skills, technology or knowledge. Around 70 percent were able to maintain the existing or develop a new network of collaborators. Even if still a majority of respondents published at least one scientific publication and gained access to frontier research, these effects were a little less important. Finally, still a third of the responding companies and research institutions assisted in completing at least one dissertation owing to their participation in ESA.

Thus, the ESA projects especially contributed to scientific capacity building and had important network effects. Given the fact that a high number of the respondents was working on ESA projects concerning products and not only research, these results can be assessed even more positively.

Economic impacts

Compared to the scientific impacts, the economic impacts seem a little less important, as can be seen in I 2.15 Thus, 71 percent of the respondents stated that the ESA participation of their company or research institution allowed the improvement of existing space-related products or services, while 66 percent of them think that they were able to develop new space-related products or services. Also, the turnover of 57 percent of the companies and research institutions was increased thanks to their participation in ESA. Still a little more than half of them, namely 51 percent, developed new products or services for non-space markets, while 43 percent were able to enter foreign markets. Finally, only 29 percent agree that the participation in an ESA-Programme allowed them to secure at least one patent or other form of intellectual property. Thus, economic impacts can be assessed positively, especially because ESA contracts allowed a majority of respondents to develop new products and services and enter new markets.

I 2.15 Economic impacts of ESA participation on ESA contractors[39]



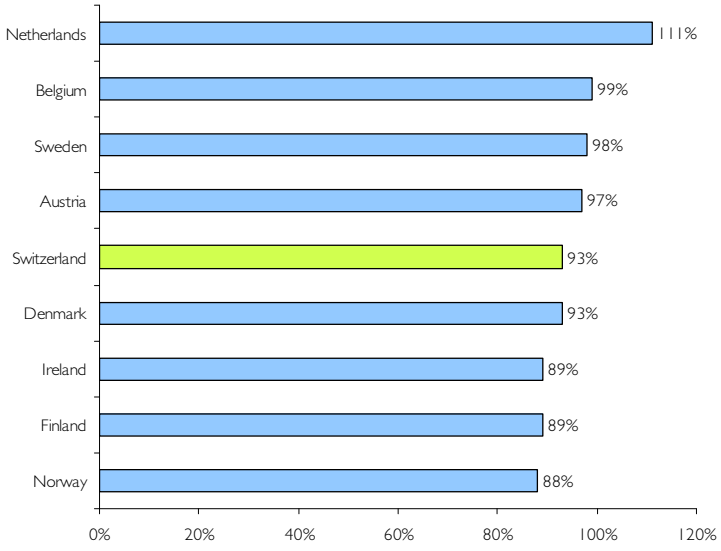
Source: Results from online survey

According to the respondents, the contracts with ESA allowed the maintaining or creation of approximately 400 full time job positions in the year 2010, which corresponds

[39] Economic effects: For each of the following statements, please state whether you agree or disagree: The participation in ESA programmes over the last 7 years allowed our company/institution… (N=36)

to around 11 full time job positions per responding company or research institution.[40] These figures, however, must be considered with a degree of caution. According to the SSO, these job positions are often linked to projects of limited duration, namely academic theses and phases of space missions.

I 2.16 Contributions to ESA: Overall Return Coefficient from 2000 to 2009



Source: Own illustration based on ESA figures provided by the SSO. It's worth to note that the Netherlands and Belgium host ESA facilities on their territories.

In the period from 2000 to 2009, after overheads deduction, the return on the Swiss contribution to ESA amounts to 93 percent. As can be seen in illustration I 2.16 Switzerland's return coefficient is average when compared to other ESA member states of similar size. However, it is slightly below ESA's generally acknowledged threshold of currently 94 percent. According to the SSO, Switzerland strives to reach a return coefficient of 1.

An expert from the workshop stressed that even if the return coefficient might be an important political argument for investments in ESA, the content and quality of the contracts of Swiss companies and research institutions with ESA should also be considered. Also, according to the President of the Swiss Space Industry Group (SSIG, member of Swissmem), each Swiss franc of institutional investment in space finally generates two Swiss francs of turnover in the Swiss space industry. Regarding application programmes, namely in telecommunications, navigation and earth observation, a significant leverage has been identified in market potential for new products and services.

Societal impacts

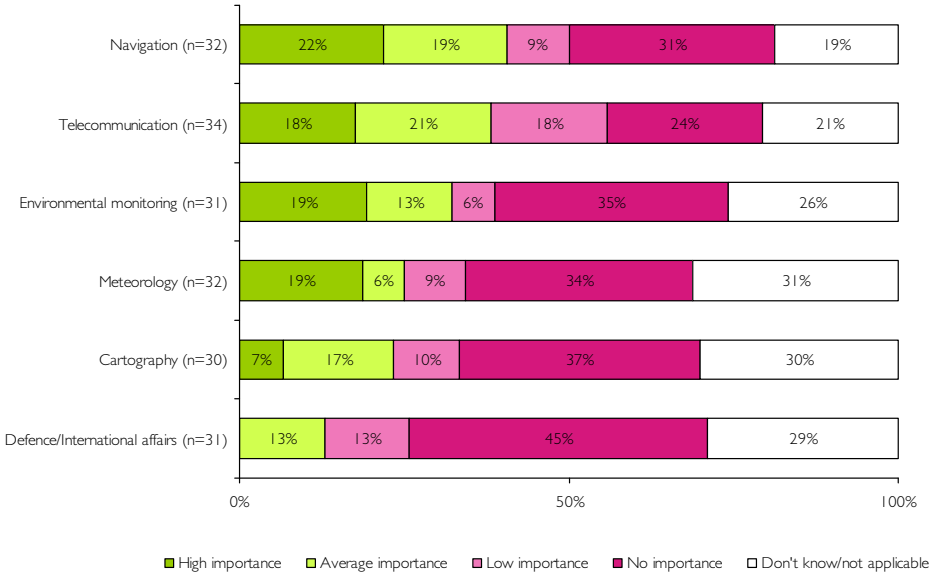
The respondents had difficulties assessing the societal impacts of their company's or research institution's participation in ESA, as can be seen in illustration I 2.17. Also, a considerable number of respondents think that their ESA projects had no importance

[40] How many full time job positions did the contract(s) with the ESA allow your company/institution to maintain and/or create in 2010? (N=36)

on several fields relevant to Swiss society. However, navigation and telecommunication seem to be the fields that are most impacted by Switzerland's participation in ESA, around 40 percent of the respondents saying that their ESA projects had an average or even important impact on them. Between a quarter and a third of the respondents think that the results of their company's or research institution's ESA projects had an average or high importance for meteorology, cartography and environmental monitoring. However, only 13 percent recognise such an importance for the field of defence and international affairs. When asked about other societal fields for which the results of their ESA cooperation might have been important, three respondents stated medicine and health, while two emphasised that the ESA participation fosters basic research and education, which is at least equally important as other societal impacts.

Although not addressed here, the SSO stresses that the wider societal impacts related to scientific progress, for instance, Swiss citizens' access to and use of space applications-derived data, acquired expertise and intellectual property rights, strengthening of international relations and of Switzerland's reputation on the global scene, must be recognised.

I 2.17: Societal impacts of ESA participation on ESA contractors[41]



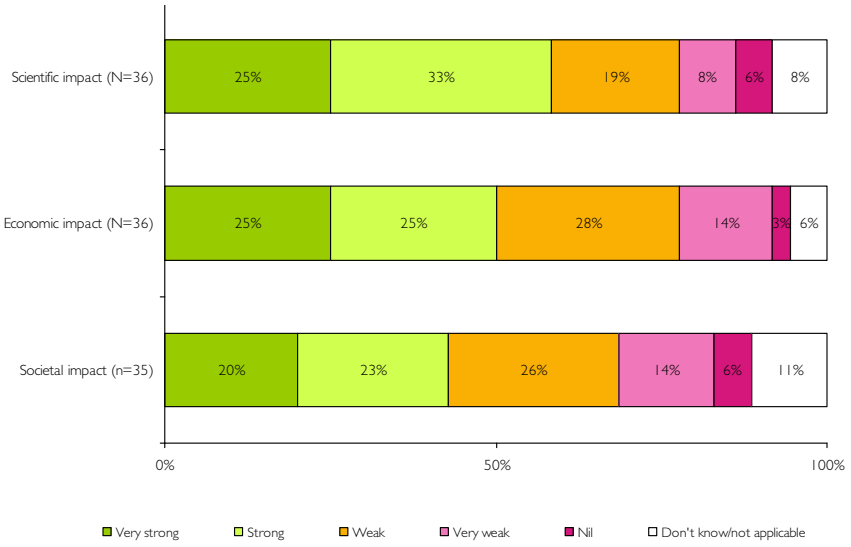
Source: Results from online survey

Comparison of scientific, economic and societal impacts

58 percent of the respondents assess the overall scientific impact of their participation in ESA as strong or even very strong, while only 6 percent think that the scientific impact was nil, as illustrated in I 2.18.

[41] How would you assess the importance of the results from your cooperation with ESA in the following fields relevant for Swiss society? (N=36)

I 2.18: Overall scientific, economic and societal effects[42]



Source: Results from online survey

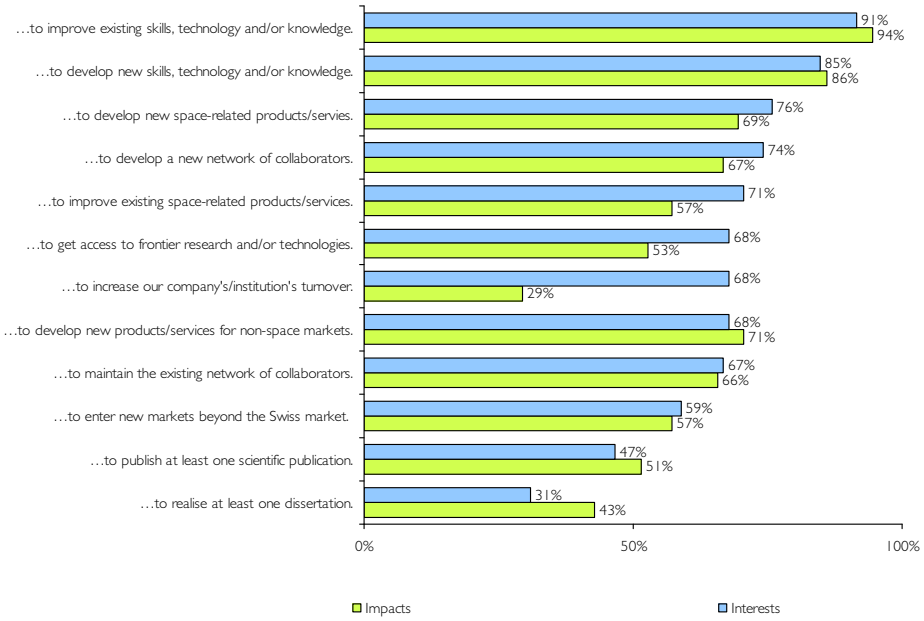
In comparison, the overall economic impact was rated a little lower. However, still 50 percent of the respondents think that the economic impact of the participation in ESA on their company or research institution was strong or even very strong. Thus, both the scientific as well as economic impacts can be rated very positively. In comparison, the societal effects seem to be a little weaker as only 43 percent of the respondents think that the ESA participation of their company or research institution had a strong or very strong societal impact. Of course, it has to be considered that societal effects unfold only in the long term and are therefore more difficult to notice. Also, the respondents to the online survey are not necessarily the ones that are able to assess the long term impacts of their ESA participation on Swiss society.

Comparison of interests and impacts

As illustrated in I 2.19, the effects correspond more or less to the interests the respondents were pursuing when applying at ESA. A considerable gap between expectation and actual effect can be observed only with respect to the increase of the company's or institution's turnover. 68 percent of the respondents indicated the increase of their turnover as an interest when applying to win ESA contracts, but only 29 percent actually agree that their ESA participation had such an effect. Another gap between interest and impact can be observed with respect to gaining access to frontier research as well as improving existing space related products or services. Though, it is not clear whether the respondents had unrealistic expectations, the ESA contracts either did not hold their promises or Swiss applicants were not successful in obtaining the right projects.

[42] Please rate the overall SCIENTIFIC, ECONOMIC and SOCIETAL impact on your company/institution through its participation in ESA programmes.

I 2.19: Interests compared to effects of ESA participation



Source: Results from online survey

2.5 POLITICAL CONTEXT OF THE SWISS SPACE SECTOR

7. Are the measures implemented by the SSO appropriate to reach the goals of the Swiss space sector? How do the ESA contractors assess the development of the political context of the Swiss space sector?

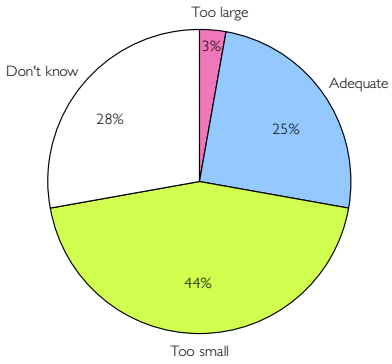
Assessment of existing measures of Swiss space sector

As shown in chapter 1.2, Switzerland currently invests around 155 million Swiss francs per year in space activities, 150 million of which is directed to ESA and 5 million is invested nationally. Thus, the national investments correspond to around 3 percent of the whole space budget.

None of the interviewed directors of the four supported research institutions questions the strategy to invest most of Switzerland's space budget in ESA. Nevertheless, they point at the fact that most ESA member states have national space programmes through which they support their space sector with considerable financial means. The interviewees actually perceive a development towards more nationalism within European space policy, a tendency which they criticise. In their view, the growing competition of large member states with ESA harms the development of a European space sector that is able to compete with important space actors at international level and remain independent from these in space matters. Still, such national investments might make sense for large countries with significant space investments that do not see their interests fully represented within ESA. Small countries like Switzerland will however not be able to follow a similar strategy. Nevertheless, this does not mean that the interviewees are against an increase of funds destined to national measures. On the con-

trary, they would welcome an increase in national investments, if these are aimed at fostering and strengthening the participation of Swiss companies and research institutions in European collaboration projects. Thus, national measures have to be designed in a way that they do not compete but complement space projects at a European level. More precisely, nationally invested means should support preliminary work in order to strengthen the position of Swiss space research institutions and companies when applying for European funds or competing for European contracts.

I 2.20: Assessment of share of space expenditures invested nationally[43]



Source: Results from online survey

The answers of the respondents to the online survey go in a similar direction. Thus, 44 percent of the respondents think that the share of space expenditures that are invested nationally is too small. As can be seen in illustration I 2.20, 25 percent think it is adequate and only 3 percent consider it too large.

Asked to indicate the share of the space budget that they would invest nationally at the expense of Switzerland's investments in ESA, only 44 percent of the respondents were willing to give an answer. According to a quarter of these respondents, Switzerland should reduce its national investments to zero. A majority of respondents however indicated a number between 10 and 35 million Swiss francs that they would invest nationally.

In summary, Switzerland's participation in ESA is not being questioned. Nevertheless, it can be discussed if the distribution of the space budget between ESA and the national measures is appropriate. A majority of the respondents of our online survey as well as the people interviewed believe that the Swiss space sector would benefit from an increase of means intended for national measures. However, the current form of national measures must be questioned as well. Today two thirds of the national investments are aimed to support four research institutions that have a relatively weak relevance for the Swiss ESA contractors.

Assessment of political developments

The Swiss space research and industry sector is very diverse, with a high number of small players working in several different areas. As already mentioned, Swiss space

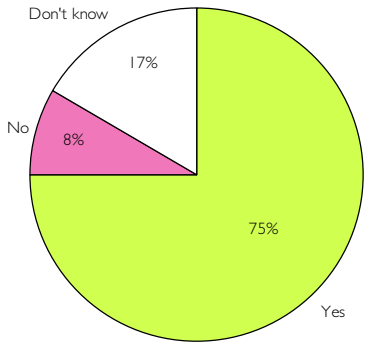
[43] How do you assess the share invested nationally? (N=36)

research institutions and companies normally apply directly to ESA to participate in the Agency's programmes. Consequently, the SSO does not have control over the content and form of their applications and therefore over the thematic orientation of Swiss space research and industry, over and above the choice of programmes that are subscribed to at ESA. Also, as shown above in illustration I 2.7, Switzerland invests in a multitude of ESA programmes, with an equally diverse participation of Swiss space actors in these programmes. One interviewee pointed out that it would be important for Switzerland to focus its capacities and specialise in niches, especially given the growing competition within ESA, as the Agency currently includes new member states.

Thus, all four interviewed directors would welcome the creation of a national space programme. Such a thematically focused programme would not only be destined to strengthen Swiss participation in European space programmes, as mentioned above, but also to define priorities for the Swiss space sector and concentrate its activities on a few key domains. Also, all four interviewees expressed a wish for more strategic guidance for the Swiss space sector, based on a clear vision of its future development. The CFAS has also expressed its wish for the creation of a national space programme.[44]

Also a clear majority of the ESA contractors that filled in our online questionnaire would approve of the creation of a thematically focused national space programme, as can be seen in I 2.21.

I 2.21: Approval of a national space programme[45]



Source: Results from online survey

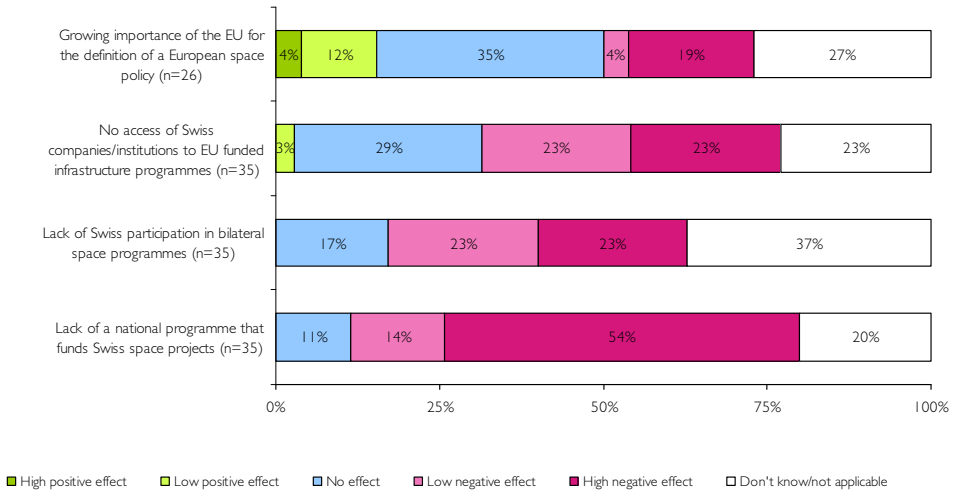
68 percent of the respondents think that the lack of a national programme that funds Swiss space projects has a negative effect on the development of their company's or research institution's space activities. As illustrated in I 2.22, this is perceived as the most serious deficiency of Swiss space policy. In comparison, only 46 percent of the respondents think that the lack of Swiss participation in bilateral space programmes and the fact that they do not have access to EU funded infrastructure programmes harm their space activities. Even less, namely only 17 percent feel that their company's

[44] Eidgenössische Kommission für Weltraumfragen (2010): Raumfahrt in der Schweiz – Motor für Forschung, Innovation und Wirtschaft, Bern.

[45] Would you approve of the creation of a thematically focused national programme that funds Swiss space projects? (N=36)

or research institution's space activities are negatively influenced by the growing importance of the EU for the definition of a European space policy.

I 2.22: Assessment of the effects of the political development[46]



Source: Results from online survey

2.6 THE SWISS SPACE INVESTMENTS IN AN INTERNATIONAL CONTEXT

8. How are Switzerland's investments in ESA and in national measures assessed in an international context?

According to the participants of the expert workshop, Swiss space industry and research is for the most part very successful at international level, with its few but competent companies and research institutions producing excellent results in their individual niches. Thus, despite being a small country, Switzerland has managed to assume an important role within ESA. The country is considered a solid and reliable partner that promotes common goals and is constructive when it comes to finding solutions. Switzerland's participation in ESA is therefore highly respected. Nevertheless, the expert workshop opened up a discussion of the following issues concerning Switzerland's space activities.

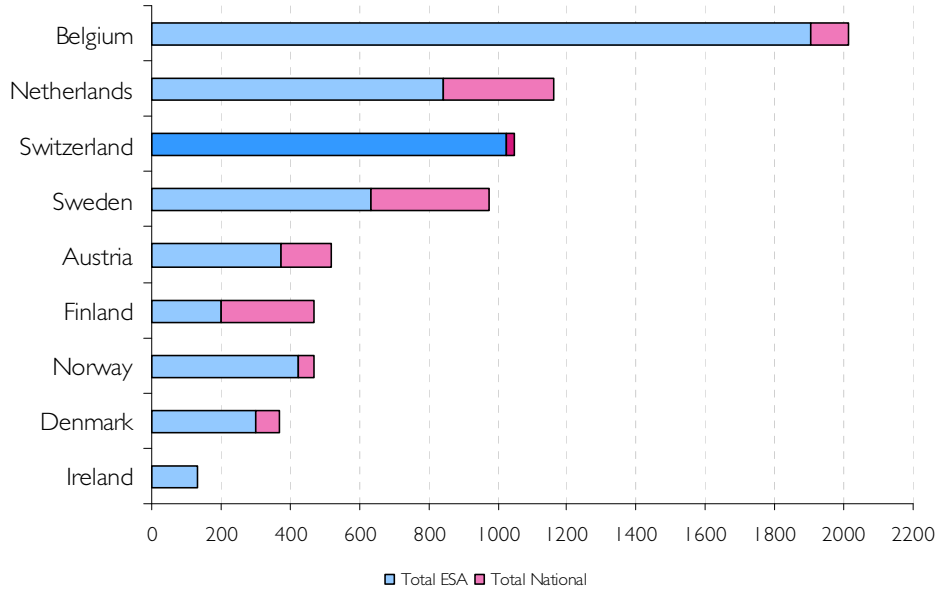
Investments in national measures

The fact that Switzerland concentrates its space investments on ESA and has only limited additional resources for national measures attracted the experts' attention. As can be seen in illustration I 2.23, compared to other countries of similar size, Switzerland's share of investments in national space measures is very small. In the experts' opinion, such national measures can significantly contribute to a country's success in international space matters if they are designed in such a way to build up competences which can be used in international collaboration projects and particularly if the industrial

[46] Do the following political conditions have any effects on the development of your company's/institution's space activities?

base is wide enough to allow for competition within such national measures. Therefore they should not compete but rather leverage the participation of Swiss companies and research institutions in such projects. Additionally, national measures should foster the transfer of knowledge acquired in the space sector to other sectors of the national economy. According to the participants of the expert workshop, the additional increase of the share of national investments should therefore be considered.

I 2.23 Contributions to ESA and national measures 2000-2009 (in millions of US$)



Source: Own illustration based on data provided by the SSO (Euroconsult (2010): Profiles of Government Space Programs)

Strategy of the Swiss space policy

According to the participants of the expert workshop, the organisation of national space activities in the ESA member states significantly differs from one country to another. Thus, the national space offices or agencies differ significantly with respect to the degree of their independence from the national government and administration as well as their more strategic or executive role. Also, the countries that the experts represented at the workshop are in different stages concerning the elaboration of a strategy for their national space activities. Despite this, they all consider it important to discuss and consciously formulate such a national strategy. In the past, Swiss space companies and research institutions have concentrated on a few areas where they have significantly contributed with excellent results. In the experts' view, such a concentration on niches is the only viable strategy for a small country like Switzerland. However, they identify as a weakness the fact that Switzerland has not put a strategy for the Swiss

space sector on paper, even if the document *Revision der schweizerischen Weltraumpolitik*[47] contains some strategic elements.

Collaboration and knowledge transfer within and beyond the space sector

An important issue raised during the workshop concerned the collaboration and knowledge transfer between, on the one hand, research and industry and between the space sector and other sectors on the other. Based on the information of the current evaluation report, the experts were under the impression that in the Swiss space sector, the link between companies and research institutions leaves room for further development. Also, there seems to be only limited effort to promote the collaboration and transfer of knowledge within and beyond the space sector. According to the experts, as the support of knowledge transfer and collaboration could contribute significantly to the valorisation of Swiss space activities for Swiss economy and society, funds should be allocated to fulfil this task.

Investigation on long term effects of space investments

According to its director, the Austrian space agency has to provide input (achievements as well as figures) on Austrian ESA participation every four years when their activities are evaluated externally. Norway and Sweden regularly survey companies and research institutions that have been contracted by ESA or received national funding in order to assess the concrete impact of their countries' investments in space. For the participants of the workshop, it has not become clear if and how Switzerland measures the impact of its space investments. In their opinion, however, information on effects can serve as an important instrument to legitimise these investments. They therefore suggest regular surveying of companies and research institutions that have received funds through ESA projects or national measures. Key questions of such a survey would concern consecutive contracts and spin-offs that can be directly linked to Swiss space investments as well as the transfer of knowledge within and beyond the space sector.

[47] Eidgenössisches Departement des Innern EDI, Staatssekretariat für Bildung und Forschung SBF (2008): Revision der schweizerischen Weltraumpolitik, Bern.

3 SYNTHESIS

The present evaluation report analyses the efficiency of Switzerland's investments in space activities, their relevance for the Swiss business and research location as well as their societal effects. For this purpose, Swiss companies and research institutions that have been contracted by ESA were surveyed with an online questionnaire. Also, the directors of four research institutions that receive subsidies through the SSO, representatives from the SSO and the CFAS as well as directors of companies and research institutions in the space sector without ESA contracts were interviewed. Finally, the results of the evaluation were discussed with the representatives of the space offices or agencies of five European countries.

Five main questions oriented the analysis of the results:

- How do companies and research institutions that have been contracted by ESA assess the collaboration with the SSO as well as with ESA?
- What relevance do the funds invested in national measures have for the Swiss space sector?
- How can the participation of Swiss companies and research institutions in ESA be characterised?
- What are the scientific, economic and societal impacts of Switzerland's participation in ESA?
- How can the political developments relevant for the Swiss space sector be assessed?

Even if the response rate of the online survey was 32 percent, with regard to their areas of activity the 36 respondents to the online survey correspond well to the distribution of 114 companies and research institutions that were invited to participate.

Assessment of the SSO and ESA

The collaboration with the SSO as well as with ESA is rated very positively by the respondents of the online survey. 60 percent of them think that the procedure for national pre-selection is fair. In comparison, only 40 percent consider the ESA tendering process as fair. Also, the administrative work required by ESA seems rather complex and time-consuming; a fact that has resulted in preventing around half of all respondents from applying for ESA contracts at least once.

For the ten interviewed directors of companies and research institutions in the space sector without ESA contracts, the SSO currently does not have any relevance. Nevertheless, they would appreciate receiving support from the SSO to network with potential clients, for example in order to close contracts as sub-suppliers for bigger companies that work for ESA. Also, some of them expressed their interest in applying for participation at ESA.

National measures

Switzerland's investments in national space measures are aimed at fostering Swiss participation in European collaboration projects. Thus, nationally invested means should support preliminary work in order to strengthen the position of Swiss space research institutions and companies when applying for European funds. The evaluation could however not prove that the support of the four research institutions effectively contributes to this goal. Only a few of the responding companies and research institutions have benefitted from the existence of the financially supported institutions, for example by receiving information or working on a joint project. Even from those who are aware of the existence of these institutions, a considerable part is not able to evaluate the quality of their activities or the relevance of their existence. A significant part of the respondents is not convinced that these institutions are relevant for the Swiss space community. Also, the interviewed directors of companies and research institutions without ESA contracts are not aware of the supported research institutions. It must be considered though that only since 2008 the support of these research institutions has been put in the context of the above mentioned goals for national measures.

Two other measures at national level, the measures for technological positioning and technical consolidation, have been launched only recently. This is why their contribution to the goals of the national space measures has not been evaluated in the present report.

Participation in ESA

According to a list provided by the SSO, 118 Swiss companies and research institutions have been contracted by ESA over the last seven years. These ESA contractors are mainly private research or manufacturing companies, while academic institutions represent the smaller part. The SSO also composed a list of companies and research institutions in the space sector that could potentially participate in ESA. It can be concluded that the Swiss space sector is formed by a relatively small number of companies and research institutions, some of them with a high involvement in space matters. This however does not exclude the fact that a certain number of companies and research institutions in the Swiss space sector might benefit indirectly from Switzerland's investments in ESA.

The responding companies and research institutions have received funds for space projects from a wide range of other contractors than ESA. Nevertheless, for three quarters of them, ESA is equally or more important than other funding sources.

The respondents are pursuing a multitude of interests, which reflect priorities in space research and development as well as purely economic goals. The reasons why some companies and research institutions in the space sector have never had contracts with ESA are equally diverse. Thus, in some cases, their space activities do not correspond to ESA's priorities, while in others a lack of information and contacts has prevented them from applying at ESA. The answers to certain questions indicate a lack of information among the ESA contractors as well.

Impacts of ESA participation

The respondents to the online survey rated the scientific as well as the economic impacts of their ESA participation relatively high, the scientific impacts being even a little more important than the economic impacts. Also, the contracts with ESA allowed the maintaining or creation of around 11 full time job positions per responding company or research institution.[48] However, only a minority of respondents could observe societal impacts from their ESA projects.

The rating of the scientific and economic impacts corresponds with a few exceptions to the priorities of the interests the responding companies and research institutions were pursuing when applying at ESA. It can therefore be concluded that ESA has been able to meet the expectations of its Swiss contractors.

Political context of Swiss space sector

Currently, only 3 percent of Switzerland's space budget is invested in national measures. A considerable part of the respondents of the online survey thinks that the share of national investments is too small. The interviewed directors of the four research institutions also agree that national investments should be increased in order to allow strengthening the position of Swiss applicants at ESA or other European space funding institutions. The majority of respondents to the online survey as well as the interviewees would approve of the creation of a national space programme. Such a thematically focused programme would not only be destined to strengthen Swiss participation in European space programmes, but also to define priorities for the Swiss space sector and concentrate its activities on a few key domains. Thus, the four interviewees also expressed a wish for more strategic guidance for the Swiss space sector that should be based on a clear vision of its future development. However, the interviewees are reluctant to recommend increasing national investments at the expense of the investments destined to ESA and therefore call for additional means.

The Swiss space investments in an international context

Within ESA, Switzerland is a highly appreciated member. Swiss companies and research institutions active in space are internationally competitive as they produce important results in their niches. Still, the participants of the expert workshop noticed the small share of additional Swiss investment in national space measures, a fact which, in their opinion, concerned policy makers should reconsider. The experts also discussed the lack of a consciously formulated strategy which would include a long term vision for the development of the Swiss space sector. In some of the countries represented by the experts, such strategies have been set in writing only recently, but they all consider this an important task. Also, a strategy for the Swiss space sector should include a reflection on how collaboration and knowledge transfer within and beyond the Swiss space sector can be promoted. Finally, the experts attach importance to a regular investigation of the impacts of a country's investments in space. They noticed that Switzerland might have neglected the task to survey companies and research institutions which

[48] This figure, however, must be considered with a degree of caution. According to the SSO, these job positions are often linked to projects of limited duration, namely academic theses and phases of space missions.

have benefitted from Swiss space investments for the investigation of the scientific, economic and societal effects of these investments.

4 RECOMMENDATIONS

The findings from the present evaluation allow formulating the following recommendations that have been elaborated in collaboration with the participants of the expert workshop.

Recommendation 1: Continue investing in space activities

The satisfaction of the respondents to our online survey as well as the directors of the four supported research institutions with the SSO is high. Also, the representatives of the Swiss space sector seem to support the general orientation of Switzerland's space policy while the country's participation in ESA was not questioned at all. Such support corresponds to the positive scientific, technological and economic impacts experienced by the respondents of the online survey. Moreover, Switzerland is a highly respected member within ESA, the output of its space industry and research being internationally significant. Given these positive results of the present evaluation the continuation of Swiss investment in space activities is recommended.

Recommendation 2: Systematically focus national measures on the needs of the Swiss space sector

The goals defined for the national measures are to strengthen Swiss participation in ESA programmes by increasing the competence of Swiss companies and research institutions active in the space sector. Also, the national measures shall enable Switzerland to benefit from the results generated. The evaluation team however could not prove that the four research institutions that are currently supported within the national measures contribute to achieve this goal. Although they might perform important work for space research, it is clear that their target groups do not fully correspond to the group of Swiss ESA contractors or potential ESA contractors. In addition, the two institutions that receive the largest portion of the means invested in national measures actually seem to be the least oriented towards the present needs of the Swiss space sector. It has to be recalled however that the context under which they were initially set up has evolved in the meantime. Also, two additional measures at national level have been adopted in 2008, amounting to one third of the national investments. They are intended to increase the competence of Swiss companies and research institutions for participation in ESA. As they were not the subject of the present evaluation their contribution to the national measures' goal can not be readily assessed. Still, we recommend the reorientation of national measures to the direct needs of the Swiss space community with respect to participation in European space programmes, thus also permitting an optimal leverage for Swiss participation in international space programmes. This is why a systematic investigation, separating direct needs of the ESA contractors from general political and societal dimensions should precede the implementation of such national measures.

Recommendation 3: Increase the investments in national measures

Compared internationally, the share of means dedicated to national measures compared to Switzerland's overall investments in space activities is very small. Such national measures, however, can play an important role in promoting the participation of

Swiss space companies and research institutions in ESA or other international collaboration programmes. They therefore should be aimed at financing preparatory activities that foster the development of knowledge relevant for international collaboration. Additionally, national measures should contribute to the transfer of knowledge within the space sector as well as to other scientific and economic fields. In order to reach these goals, we recommend increasing the share of nationally invested means.

Recommendation 4: Sharpen the strategy for a Swiss space policy

Even if some strategic elements have been written down, the lack of a clearly defined strategy attracted the attention of the participants of the expert workshop. Furthermore, the wish for more strategic guidance for the Swiss space sector, based on a clear vision of its future development, was also expressed by some of the interviewees. Consequently, we recommend sharpening the formulated vision of the policy for the Swiss space sector, geared at its development over the next ten to fifteen years as well as the long term goals of Swiss space investments. The expectations regarding return on investments, the benefits for Swiss research and development as well as for Swiss economy and society, beyond the published vision should be polished. The strategy should define the measures required to achieve these goals as well as the roles of the SSO and other involved bodies for their implementation. Finally, the strategic aims, based on discussions and recommendations from experts in the field, should be published in order to allow its use as the instrument fuelling Switzerland's investments in space. This is why, the Federal Space Affairs Commission's role (CFAS), which combines the required expert knowledge and experience, must also be reoriented for an enhanced strategic approach.

Recommendation 5: Collect, analyse and strategically use information on Swiss ESA participation

Although the SSO possesses data on the contracts of Swiss companies and research with ESA, for confidentiality reasons, the evaluation team did not have access to them. We are therefore unable to judge how elaborate and useful the existing data is. However, we recommend that such data is not only collected but also systematically analysed and utilised. This should facilitate observing the trend of the development of Swiss ESA participation and assess the resulting return and relevance for Swiss space research and industry. Additionally, the impacts of Switzerland's space activities on Swiss economy, science and society should be investigated on a regular basis. Thus, the present evaluation can be seen as a starting point towards a more regular monitoring of the effects of the Swiss space investments. Finally, such continuous monitoring is not only necessary to support Swiss companies and research institutions with space activities in an increasingly competitive environment but also an indispensable tool for honing and steering the strategic objectives to Switzerland's needs and priorities. Also, data on the impacts of Switzerland's investments in space should be processed in such a way as to allow public accounting for its strategy.

Recommendation 6: Enhance Swiss ESA participation by providing information and advice to potential ESA contractors

Around two percent of Switzerland's budget directed to European Framework Programmes are invested in Euresearch, an organisation that fosters Swiss participation in

European research projects by informing and advising interested researchers. Also, according to the participants of the expert workshop, Austria, Germany and Norway invest significantly in a variety of activities to inform and support potential ESA participants. Limitations of the Swiss space sector as revealed by the present evaluation include a lack of information, contacts in the field and a strong network. Finally, almost half of the ESA contractors that responded to our online survey stated that the administrative work required by ESA has at least on one occasion prevented them from submitting a tender proposal. These factors which weaken Swiss participation in European space programmes can be overcome by providing much more weight to informing and advising potential candidates. We therefore recommend reserving a certain share of the budget to this end.

COMPANY INFORMATION

INTERFACE
Policy Studies Research Consulting
Seidenhofstrasse 12
CH-6003 Lucerne
Tel. +41 (0)41 226 04 26
www.interface-politikstudien.ch

PROJECT REFERENCE

Lucerne, May 26 2011
Project number: 10-48