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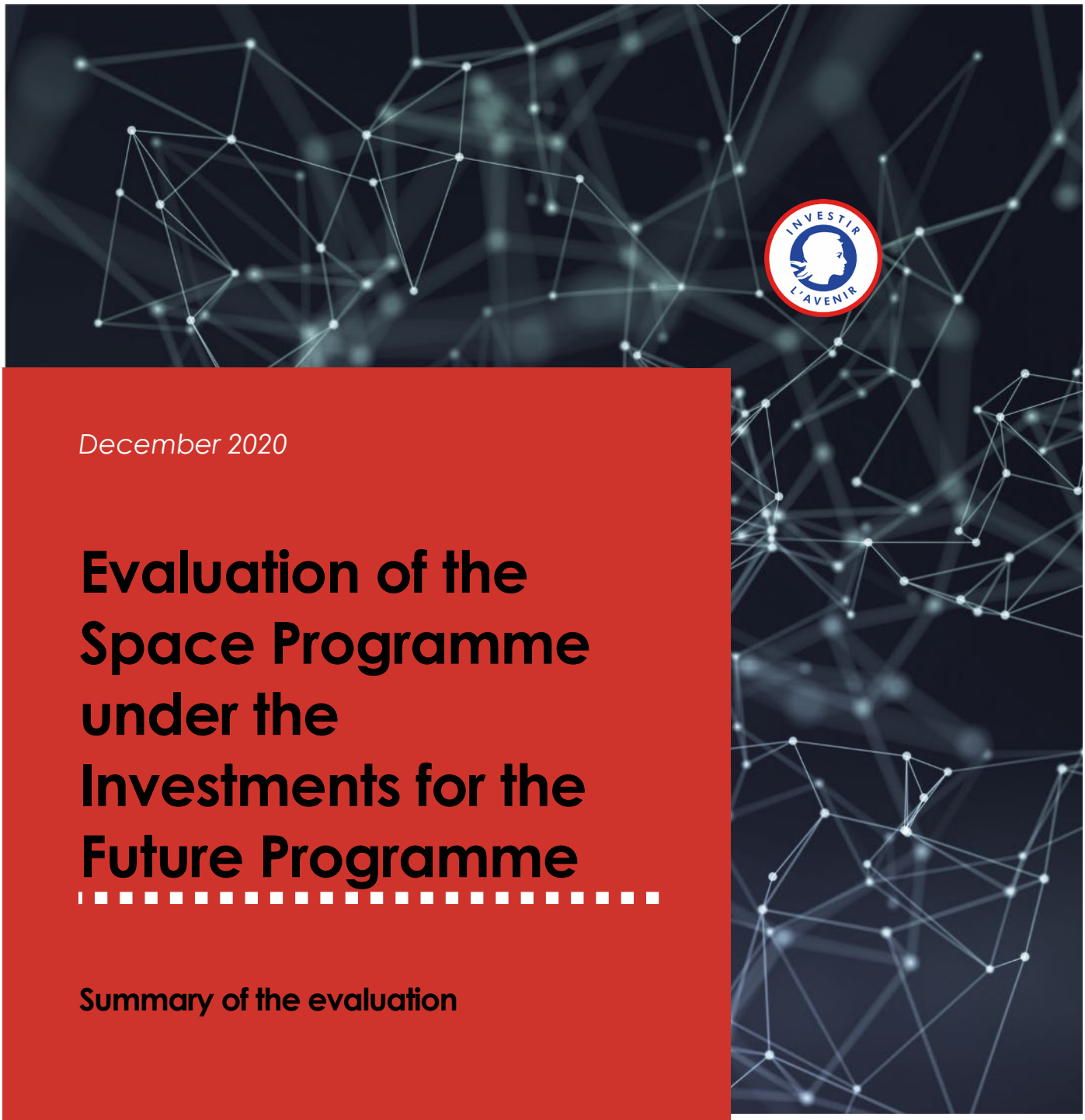

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Evaluation of the Space Programme under the Investments for the Future Programme

Summary of the evaluation

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Developing France's aerospace industry was identified as a priority for the country in the 2009 'Investing for the Future' report, which preceded the establishment of the Investments for the Future Programme (*Programme d'Investissements d'Avenir –PIA- in French*). The Programme's support towards the development of the space industry in France was implemented through four operators: the National Research Agency (ANR in French), the National Investment Bank (Bpifrance), the Deposits and Consignment Fund (CDC in French) and the National Centre for Space Studies (CNES in French).

A total of €755 million from the Investments for the Future Programme was earmarked by the French Prime Minister for space-sector projects (Space Programme). CNES is the main operator, with almost 75% of the allocated funding. The projects receiving support, some of which are still in progress, deal with a number of themes.

Table 1 Breakdown of projects and funding of the Space Programme under the Investments for the Future Programme

Area	Theme	Projects	Part of funding	Operators
1	Preparation of Ariane 6	2 and 1 recapitalisation	33%	CNES
2	Development of satellites with high application potential	5	52%	ANR, CDC, CNES
3	Electrically propelled satellites	4	9%	CNES
4	Development of equipment for Low Earth Orbiting satellites (LEOs) in constellations	4 (of which 1 discontinued)	5%	Bpifrance
5	Valorisation of information from the space sector	17	1%	Bpifrance

An evaluation of Space Programme under the Investments for the Future Programme (Space Programme hereafter) was conducted by Technopolis Group between May and November 2019, under the supervision of a Steering Committee chaired by the SGPI and composed of representatives of the Ministry of Higher Education, Research and Innovation (MESRI in French), the Ministry of Ecological and Solidarity Transition (MTES in French) and the Ministry of Economy and Finance (MEF in French) as well as four operators. The evaluation aimed to assess the consistency between the selected projects and the objectives of the Investments for the Future Programme, and determine the impacts of the funding on the space sector and its added value in relation to regular CNES budget allocations.

In total, 115 people were interviewed in the course of the evaluation. Three surveys were also conducted, from which 69 responses were collected.

Relevance

Activities were carried out during a period of major change but also of increasing space activities. The emergence of new technologies, but also of new players, posed major risks in ensuring that France remained competitive in the sector. At the time the first version of the Investments for the Future Programme was launched, CNES did not have the capacity to

commit to new projects to meet these challenges, even though these risks had, for the most part, been identified. The availability of the funding from the Investments for the Future Programme during this period of major change therefore enabled the French industry sector to respond to vital issues, particularly in the fields of telecommunication satellites and launchers, and prepare for the short-to-medium term. The programme had a strong acceleration effect on the development of new innovation in important segments.

Nevertheless, the evaluators note the absence of any formalised intervention logic for the Space Programme, which could have been proposed by government services and linked to the CNES Medium Term Plan (MTP). An intervention logic with short- and long-term objectives would have enabled the Space Programme to not only be reactive but also proactive, and propose a long-term vision for the French space sector consistent with the activities and tools at the CNES' disposal to identify and develop fundamental research projects over longer horizons.

The Space Programme therefore only partly meets the objective of financing quality investments in sectors of the future for the preservation of France's medium- and long-term growth potential. While the Investments for the Future Programme has undoubtedly made it possible to maintain this potential in the medium term, particularly in the areas of 'telecommunication satellites' and 'electrically propelled satellites', it does not demonstrate this capacity over the long term.

Coherence

The analysis shows that there is a strong additionality of the Investments for the Future Programme with respect to standard CNES budget allocations. The Investments for the Future Programme provided additional funding and did not compensate for the decrease in State allocations for the CNES 191 and 193 programmes. The Investments for the Future Programme allowed the CNES to fund projects that it would otherwise not have been able to fund without impacting other committed priority areas. Compared to other budget allocations, the added value of the Investments for the Future Programme has been demonstrated.

With the exception of those supported by Bpifrance, the projects funded are in line with the CNES Medium Term Plan, which defines the CNES' roadmap to implement French space policy. The mobilisation of the Investments for the Future Programme made it possible to broaden the coverage of the CNES Medium Term Plan's priorities. The absence of a long-term commitment to the Space Programme makes the future capacity of actors to carry out technological developments uncertain.

The Space Programme has a complementary role to that of CNES towards the European Space Agency (ESA). By financing technological-development activities across lower TRLs (Technology Readiness Level), the Investments for the Future Programme creates considerable added value by enabling new solutions to be provided to ESA. Technological breakthroughs allow the French industry to achieve a competitive position, even if political decisions and the geographic 'fair return' rule may limit these benefits. Lastly, the Investments for the Future Programme's willingness to contribute to the development of small and medium enterprises depends on other funding programmes, most notably those of ESA. Indeed, the pre-eminence of major French contractors and the geographic fair return rule limit their possibilities of participation, whereas the Space Programme focused precisely on increasing the involvement of French SMEs.

The Space Programme is complementary to other budget allocations. Its added value is demonstrated throughout the entire scope of its intervention.

Effectiveness

Due to the industrial structure of the space sector, the selection of projects in 2010 was mainly based on CNES procedures and differs from the current procedures of the Space Programme. However, the expertise of CNES and the support of the industrial and scientific communities for the elaboration of the CNES Medium Term Plan made it possible to effectively select priority projects submitted to the Investments for the Future Programme. Moreover, targeted consultations only led to the emergence of a limited number of new projects. The involvement of the General Secretariat for Investment (SGPI in French) ensured that the proposed projects met the Investments for the Future Programme's criteria with spillovers for the French space sector. In terms of technological development, all selected projects were in line with expectations.

For the part of the programme operated by Bpifrance, projects were selected through two dedicated thematic calls for projects, in 2016 and 2017. The process was tried and tested and enabled the selection of projects which met the objectives of the calls for projects. Only one project was discontinued.

The Space Programme enabled a significant increase in the maturity of supported technologies, very close to commercialisation. Despite a strong ambition, it is noteworthy that small gaps existed between targeted and achieved TRLs.

Almost all of the completed projects have led to the development of new technologies or services, and many technologies are qualified or already in operation. At the programme level, the prospects for market introduction are good, and only a handful of companies reported a commercial failure. For industrial prime contractors and certain equipment manufacturers, this translates into equipment sales resulting in an increase in turnover, benefiting the entire supply chain. A large majority of beneficiaries consider that the Space Programme has contributed significantly to the creation and maintenance of jobs, with an estimated 4,000 jobs (of which a significant part is linked to the "Satellite of the Future" project).

Regarding launchers, the Space Programme made it possible to launch the Ariane 6 programme at the European level, even if the returns are more limited than initially hoped for. In the field of telecommunications satellites, it led to the maintenance of French export positions despite market uncertainties. For earth observation, the Space Programme made it possible to maintain or develop skills across the entire sector in France. Finally, the support for electric propulsion enabled the French industry to position itself with regard to this new segment.

At the societal and environmental levels, few indicators exist to assess the results of the Space Programme. Nevertheless, the rationale of certain projects is clearly linked to societal and environmental issues, particularly for the "satellite with high application stakes" projects (understanding the carbon or water cycle, reducing the cost of very high-speed Internet access).

The expertise and procedures of CNES should be highlighted as important factors in achieving these results.

The Space Programme is particularly successful from a technological point of view. The projects that it supported have achieved the ambitious objectives that were set. At the industrial and commercial level, due to the long lead time of the industry, it is still too early to observe overall

results. Nevertheless, no problems have been identified at this stage that cast doubt on the ability to achieve the expected results in the future.

Efficiency

The majority of the projects financed by the Space Programme are the result of public procurement. The industrial co-financing level is contractually declarative (roughly €1 billion). However, the analysis has not been able to identify the effective leverage effect.

For some CNES projects, royalties have been set according to commercial results. The prospects of reaching the first milestones in the short term for three projects should generate financial returns for the French State as early as 2021. However, the estimated amount of the returns (€5 million) is low in relation to the Space Programme investment. In addition, repayable advances (€15 million) have been granted for six projects operated by Bpifrance.

The scientific and societal returns are not yet known.

Few patents and publications have emerged from the Space Programme's projects, although this situation is not specific to the Space Programme and stems from practices and characteristics of the space industry.

The evaluation did not carry out a precise calculation of the management and administrative costs of the programme (such a calculation would have included the costs resulting from the involvement of several ministries and agencies, from which it would have been necessary to subtract the value of the time dedicated by CNES to the programme, which did not bear any management costs as an operator). However, it is certain that the Space Programme has generated additional gains compared to those that would have been possible with projects supported by CNES through its annual allocation. Several factors justify this assertion: a willingness to integrate SMEs into the projects (even if the results fall short of the programme's ambitions), a real consideration by CNES of expected economic effects and impacts of the funded projects, and the development or strengthening of expertise in the field of space within ministries and agencies.

The Space Programme has therefore demonstrated its efficiency.

Impacts and sustainability

The results in terms of increased competitiveness of the space sector are generally positive and vary according to the area under consideration. Significant gains in competitiveness have been made in the "telecommunications satellites" and "electric propulsion" components. In the "earth observation satellites", "launchers" and "constellation" sectors, the Space Programme enabled French actors to develop or strengthen their positioning. The development of the downstream sector is also a positive sign. These gains in competitiveness are already materialising with the awarding of industrial contracts and should continue to manifest themselves even after the end of the funding period.

The willingness to involve SMEs is significant, and the Space Programme has contributed to a better integration and development of SMEs in the space sector. However, the integration of SMEs has come up against a number of pitfalls, such as a low number of SMEs, the costs of certifying equipment and ESA's geographic fair return rule. The implementation of this criterion has, however, made it possible to significantly change the practices of major industrial and institutional players, which account for more than 90% of the Space Programme funding.

The implementation of the Space Programme was carried out in parallel with the establishment of joint steering structures between the State and industry. COSPACE thus launched the Booster initiatives prior to the launch of the dedicated calls for projects by Bpifrance, which were instrumental in structuring these Boosters. The establishment of structures which benefited from the Space Programme contributed to changing the interaction within the French space industry.

Elsewhere, the application of good practices drawn from the Space Programme appears to be a sustainable practice that will continue in the future.

In terms of impacts, the effects of the Space Programme are multiple and positive: increased competitiveness of the space sector across different segments, changes in the structuring of interaction, support for the implementation of joint steering structures between industry and the State, and changes in CNES practices.