Socio-Economic Impact Assessments of ESA Programmes: A Brief Overview

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1 The European Space Agency

The European Space Agency (ESA) is an intergovernmental organisation established in the seventies with today 22 Member States. Its purpose is to promote cooperation between Member States, in space research and technology as well as in space applications.

Among its 22 Member States,¹ 20 of them are EU Member States, the two others being Norway and Switzerland. In addition 7 other EU Member States have Cooperation agreements with ESA, and Slovenia recently became an Associate Member. Lastly, Canada has a special Cooperation agreement with ESA and participates in its programmes.

ESA's staff is working mainly on its 8 different sites in Europe. The Agency's budget is about €5.6 billion in 2019,² with €1.6 billion coming from the budget of the European Union, for the Galileo (Navigation) and Copernicus (Earth Observation) programmes and of EUMETSAT for meteorological satellites. The rest of the budget comes directly from the contributions of the Member States.

¹See Fig. 1.

²See Fig. 2.

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Fig. 1 Mapping of the 22 ESA Member States (in dark blue)s, Associate members (Slovenia), and States having Cooperation agreements (in grey)

About a fourth of the budget goes to the Earth Observation programmes, thus representing the largest set of activities in the Agency, followed by Launchers (Space Transportation), Navigation, and finally Human Spaceflight & Exploration).

ESA is one of the few space agencies in the world to combine responsibility in nearly all areas of space activity. Space science is a mandatory programme, i.e., all Member States contribute to it according to GDP. All other programmes are optional, funded “a la carte” by Participating States.

The Agency has designed, tested and operated over 80 satellites over the past 50 years. About 85% of ESA’s budget is spent on contracts with European industry. ESA should ensure that Member States get a fair return on their investment.

ESA supports the development of the European space industry, which today, for the manufacturing part, sustains around 40,000 jobs. Europe is successful in the commercial arena, with a market share of telecom and launch services higher than the fraction of Europe’s public spending worldwide. European scientific communities are world-class and attract international cooperation. European space research

Fig. 2 ESA Budget for 2018, by domain

and innovation centres are recognised worldwide. European space operators (Arianespace, Eumetsat, Eutelsat, SES Global, etc.) are among the most successful ones in the world.

The ESA's governing body is the Council, in which each Member State is represented and has one vote. Every 3 years, the Council meets at the ministerial level ("Ministerial Council") to take the key decisions on the continuation of the programmes and the new ones coming as well as on their respective funding.

In 2019, the Council will meet in late November. ESA is therefore preparing proposals to the 22 Ministers in charge of space, complemented with an assessment of the socio-economic impact of its programmes.

2 The Socio-Economic Impact of Space Activities

Space is more and more part of our daily lives and has become an engine of economic growth and innovation with impacts that go well beyond its industrial sector [1]. ESA's Member States wish to ensure maximum benefits to the economy and society from their investments in space activities. The Agency, as any other modern public administration, has a responsibility to ensure the creation of value for society, in an end-to-end perspective (i.e. from technology research to service development). Governments need evidence that investing in space creates jobs and supports a competitive European economy of the future, while providing strategic tools to implement sovereign policies. ESA has therefore conducted more and more socio-economic impact assessment studies of its programmes over the past years to inform decision-makers.

In preparation of its last Council at Ministerial level in 2016, ESA conducted three studies on large programmes, including Ariane 5 and the International Space Station. This past couple of years, in preparation of the upcoming Council at Ministerial level, such studies were conducted not only *ex post* but also *ex ante*, on programmes of different sizes and in different domains, covering most of ESA's fields of activities.

3 Methodology of Socio-Economic Impact Assessment of ESA Programmes

There is no standard approach to assess the socio-economic impacts of space programmes in general and even more so to assess the impacts of all ESA programmes. Since 2012 ESA has consolidated its own methodological approach in line with recognised standards. The methodology of all the assessments conducted by ESA on its programmes was harmonised to the extent possible but it was also tailored to the mandate and strategic objectives of the programmes and respective

stakeholders' interests. The specificities of the programmes imply differences in the scope and parameters of the impact assessments, be it the timeframe for the analysis, the availability of underlying data and data sources or an emphasis on certain types of impacts. For that reason, the results of the various assessments are independent for each study and a direct comparison between the results is only possible to a very limited extent.

The framework for assessing the impact of ESA programmes includes the definition of the impacts and indicators tailored to the programme, the definition of the assessment methodology of each indicator tailored to the programme (qualitative and quantitative), and an analysis of the sources of data and of the relevant stakeholders (incl. Scientific community, Member States, ESA, industry, research organisations and society). The impacts were assessed according to five categories: economic, scientific, technological, strategic and societal impacts.

As an example the **scientific impact** of an ESA programme would include:

- The volume and quality of the refereed papers based on ESA-led programmes and missions;
- The interest from the scientific community, through the number of users accessing ESA scientific data and the volume of data downloaded;
- The knowledge transfer and cross-fertilisation (when knowledge from scientific papers is used in other domains) as well as industrial cross-fertilisation (for example, refereed papers which originate from a collaboration between public and private partners);
- The international cooperation of scientists on ESA-led programmes and missions, with the measure of international co-authoring for scientific papers.

The **strategic impact** of an ESA programme would include:

- The level of international cooperation;
- The level of industry competitiveness, with for instance the number of patents;
- The level of European non-dependence.

The **societal impact** of an ESA programme would include:

- The level of public outreach through social media and visibility in the media;
- The contribution to education and careers in STEM, with for instance the number of PhD theses based on ESA-led missions;
- The contribution to sustainability, for instance with the space weather programmes contributing to the overall sustainability of space activities.

The **economic impact** of an ESA programme would include:

- The gross value added or the impact on the GDP;
- The number of jobs sustained and created;
- The support to innovation and technology transfers, including spin-offs and technological spill-overs.

To illustrate this approach, the assessment of the economic impact of ESA's R&D programme in Earth Observation, i.e. Future EO, concluded that:

- Every euro invested by ESA Member States in the programme creates €3.8 in their economy over 2013–2030, from which:
 - €1.9 corresponds to an increase in their GDP
 - €1.9 corresponds to longer term innovation spill-overs;
- More than 60% of the investment is recovered in tax revenues in the medium term;
- For each new job in the space sector, 1.3 additional jobs are created in the wider economy.

4 Conclusions

This paper gives an overview of the different types of impacts that ESA's space programmes have in different domains, measured with relevant and specific sets of indicators. The impacts of the future space missions to be proposed to the European Ministers at Space19+, the Council at Ministerial level that will take place in November 2019, will be evaluated to support their decisions. The main results will be available on ESA's Space Economy website (space-economy.esa.int).

ESA's programmes have demonstrated benefits as significant and diverse as other major scientific projects and the Agency will continue cooperating with other institutions to exchange on indicators and impact evaluation.

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Reference

1. <https://space-economy.esa.int/initiatives/#first>

Full Presentation

https://indico.cern.ch/event/727555/contributions/3461265/attachments/1868232/3072979/Presentation_FCC_Mathieu.pdf

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