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A socio-economic impact assessment of the European launcher sector

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A B S T R A C T

In a context where the economic strains are challenging European policies as well as the very fabric of governmental contributions to public life, innovation and efficacy of public policy in research are called upon to support growth in Europe and to sustain employment and entrepreneurial capacities. Governments need evidence that the investments in space, while providing strategic tools to implement sovereign policies, create jobs and build the competitive European economy of the future. This is particularly true when the decisions at stake have a potential bearing on the future of the European space sector for at least the next 30 years, as it has been the case for the ESA Council at ministerial level meeting in December 2014. On that occasion, Ministers took the decision to start the development of a new Ariane 6 launcher and Vega evolutions having a critical bearing on the Member States' strategic industrial capabilities and on the sustainability of the European guaranteed access to space. Given the importance of the subject, and following similar studies undertaken in the past for e.g. the Ariane 1–4 programme, the Agency has requested an independent consulting team to perform a dedicated study to assess ex-post the direct, indirect and induced socio-economic impacts of the Ariane 5 programme (mid-term evaluation) and of the Vega programme (early evaluation) globally, at European level, and within the economies and industries of each ESA Member State. This paper presents the assessment of the socio-economic impacts allowing the evaluation of the return on public investments in launchers through ESA in a wider perspective, going beyond the purely economic terms. The scope of the assessment covered in total approximately 25 ESA programmatic and activity lines and 30,000 commitments from 1986 to end 2012. In the framework of the study, the economic impact of the European launcher programmes is measured through a GDP impact defined as the straight economic activity deriving from the injection of Participating States funding channelled through ESA into the space upstream (manufacturing) industry, and through a cumulative assessment of the enabled revenues (catalytic impacts) arising from Ariane 5 and Vega operations.

1. Introduction

The ESA Council meeting at ministerial level in December 2014 had to take decisions on a number of fundamental questions critical for the future of the European space sector. Among these issues, Ariane developments and Vega evolutions had a specific bearing on the Member States' strategic industrial capabilities and on the sustainability of the European guaranteed access to space. Given the importance of the subject, and following similar approaches undertaken in the past for e.g. the Ariane 1–4 programme,[1] with the objective of providing the Ministers with solid background elements in view of their discussions and decisions, the Agency requested an independent consulting team[2] to perform a dedicated study to assess ex-post the direct, indirect and induced socio-economic impacts of the Ariane 5 programme (mid-term evaluation) and of the Vega programme (early evaluation) globally, at European level, and within the economies and industries of each ESA Member State. The assessment of the socio-economic impacts allowed the evaluation of the return on public investments in launchers through ESA in a wider perspective, going beyond the purely economic terms. The scope of the assessment covered in total approximately 25 ESA programmatic and activity lines and 30,000 commitments from 1986 to the end of 2012. In the framework of the study, the economic impact of the European launcher programmes was measured along its entire value chain, including the totality of the satellite service industries and the related enabled terrestrial services representing its downstream sector.

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[1] Bramshill Consultancy Ltd. Study on the economic effects of the Ariane 1–4 programmes. Prepared under ESA Contract Number 11606/96/F/TB CCN Number 01 (2001)

[2] Socio-Economic Impact Assessment of Access to Space in Europe: an Ex-Post Analysis of the Ariane 5 and Vega Programmes. Prepared under ESA contract Number 4000110988-14-F-MOS (2014) by PricewaterhouseCoopers – Strategy&, Cambridge Econometrics.

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2. Methodology

In line with their strategic importance, ESA investments in space launch capabilities brought upon a plethora of socio-economic benefits on European society. Such benefits include immediate economic impact (on Gross Domestic Product, GDP impact) materializing right after the institutional spending; medium and long term catalytic effects (space launch revenues and downstream sector revenues, in both satellite services and enabled non-space industries and services), as well as non-quantifiable wider social and environmental benefits.

The assessment included the following:

1. *A GDP impact assessment:* In the space sector, spending injected in the upstream industry leads to a cascade of spending and economic activity down the supply chain. The space industry spends a portion of this funding through its suppliers (e.g. for components or subsystems), which in turn spend a portion further down the supply chain (e.g. for raw materials); and so on. Furthermore, all companies within the supply chain pay their employee's salaries that in turn provide consumer spending in the larger economy. The compounding effect of all the spending originated from the initial upstream funding injection constitutes the 'GDP impact' from the initial investment. The GDP impact assessment includes an assessment of the *Employment impact* (i.e. the employment supported by the gross domestic product generated by those programmes) and of the *Government revenues* (tax and social security revenues associated with the wide GDP impact of the programmes).
2. An assessment of the *enabled revenues* associated with Ariane 5, and of the projected enabled revenues for Vega: Enabled revenues are represented by sales within industries and services that are enabled by Ariane 5 and Vega launches. These include downstream satellite industries as well as non-space industries and services that leverage satellite services and capabilities. The concept of enabled revenues reflects the creation of larger economic effects down the line over time and over the enabled value chain, less straightforward than GDP impact, still demonstrating the effectiveness of access to space as an enabling factor for a rich downstream economy.
3. An assessment of *qualitative impacts*: Those include several non-quantifiable, yet significant, effects in different areas: technology development, workforce skills, outreach, strategic capabilities, and national prestige.
4. A scenario analysis: a 'what if' analysis aimed at understanding what would have been the space launch market evolution in the absence of Ariane 5, and what would have been Europe's position in such a case.
5. A case study on French Guiana: a GDP impact assessment of the space launch activities on French Guiana local economy.

The funding data were used at the end of the GDP impact assessment analysis to relate the GDP impact to the initial funding for each of the involved countries, while the rest of the data fed the various analyses. While the available payments data from ESA is comprehensive, no contracting relationship data is available or can be derived from the data set. With the difficulty in understanding the contractual relationships between companies in the list of suppliers, and with the sheer scale of the supply chain (counting several hundred companies) the rebuilding of the supply chain original structure (as envisaged in the original methodology) was based on a modelling approach involving the following 3 steps:

1. Classification of companies involved in the programmes into related groups.
2. Single tier supply chain modelling.
3. Input interface harmonisation into the so-called input/output sectoral E3ME model.[3]

Such a modelling involved an initial classification stage where all companies were analysed and classified as:

1. Aerospace companies/plants.
2. Non-Aerospace companies/plants.

The classification was carried out on the basis of the nature of the companies' prevailing area of business, defined in terms of relative volume of revenues for the company or plant in the specific country under analysis.

Aerospace companies were further classified into the following sub-categories of economic activity:

1. Space system integration.
2. Space system propulsion.
3. Chemical.
4. Mechanical / Structure.
5. Electronics/Avionics.
6. Ground Software.
7. Space Agency.
8. Research Centre.

For each of those categories, estimation was carried out for the typical cost-structure in terms of:

1. Labour: direct labour working on launchers' activities: this labour is typically identified in contracts as direct labour involved in launcher projects.
2. Processes, capturing all insourced or outsourced activity, which may include for instance test centre support activities, also general administration, further broken down into indirect labour and spending into other sector including utilities.
3. Raw materials: purchases of raw materials not tracked by ESA, typically procured with purchase orders.
4. Profit: the part of economic activity retained by the company or used to remunerate its shareholders.

The estimation was conducted through primary research (direct consultation and data retrieval with selected high earners for each of the categories above). The non-aerospace companies, on the other hand, were classified along a pre-identified list of industrial sectors that are modelled in the E3ME (i.e. sectors following the NACE convention for which statistical spending ratios are available across Europe and for a wide time period). The above modelling of the launcher supply chain resulted into a detailed cost breakdown of all economic activities carried out by companies involved in the ESA launcher programmes, as well as the cost break down of non-aerospace activities into sectorial buckets, whether directly performed under ESA contract by non-aerospace companies, or procured by aerospace companies from other sectors. This resulted in a detailed allocation by country, by sector, by aerospace activity type, by year, which was used to feed the E3ME input/output modelling. The results included:

1. Spending in aerospace, used then in E3ME to calculate the GDP direct impact.
2. Spending in labour in aerospace, used (as part of the input) to

[3] The E3ME input-output software tool developed by Cambridge Econometrics was employed for this analysis. It is a computer-based model of the world's economic and energy systems and the environment. It was originally developed by Cambridge Econometrics for the European Commission's research framework programmes and is now widely used in Europe and beyond for policy assessment, for forecasting and for research purposes. In this study, the model has been applied for investigating supply change, multipliers and labour market impacts.