

Europe's space sector: unlocking potential through R&D

Investing in space R&D and hence encouraging innovation can foster firm-level growth in the space sector and ultimately boost the economy. Despite empirical evidence from the UK and support from the broader literature, there is still a large gap in R&D investments in the European space sector which needs to be filled to maintain the current market share. In this issue of Space in Focus, Katharina Knuth explores how investing in space R&D can help Europe to stay competitive and maintain strategic autonomy by looking at the dynamics in the UK space sector as well as investments in the European GNSS market.

Europe's space agencies - e.g. ESA, EUSPA, and UKSA - share more than just their grand titles. They all have a common goal: to drive their space economies forward and support competitiveness. One of the key strategies employed to achieve this is investing in Research and Development (R&D) and hence encouraging innovation within the space sector.

Related LE publications:

[Market Dynamics \(2023\)](#)

[GNSS Investment report \(2021\)](#)

[EO and GNSS Market Report \(2022\)](#)

Figure 1 Aims and ambitions of space agencies in Europe



Sources: <https://commercialisation.esa.int/about/>
<https://www.euspa.europa.eu/about/about-euspa>
https://defence-industry-space.ec.europa.eu/eu-space-policy/eu-space-programme_en
<https://www.gov.uk/government/publications/national-space-strategy>
<https://www.dlr.de/en/dlr/about-us>
<https://cnes.fr/en/web/CNES-en/3773-about-cnes.php>

Economic growth models, such as the Solow model, often discuss the importance of innovation in driving long-term economic growth and enhancing productivity. Innovation is one of the key drivers for economies on the path to prosperity.¹

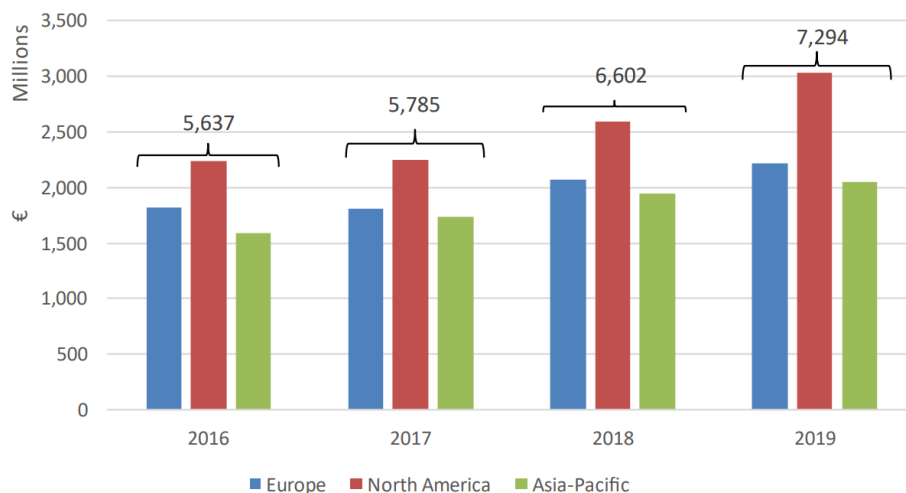
Aside from generally boosting competitiveness and growth, the main targets of major research and innovation funding programmes are tackling climate change and achieving the UN’s Sustainable Development Goals. Further, these programmes aim to support collaboration and thus the creation and diffusion of knowledge and technologies. Ultimately, R&D activities aim to support employment and build prosperity, placing economies in positions to best take advantage of future market opportunities.²

R&D funding gap: a challenge for Europe

Given the benefits of R&D funding for an economy and its people, this raises an important question: why is R&D funding in the European space sector falling behind other economies? Analysis conducted by the London Economics team in 2021 studied the investments in the European downstream Global Navigation Satellite Systems (GNSS) industry. The study revealed an R&D investment need of approximately €42bn by 2029 if European companies wish to match their non-European counterparts.³ If European GNSS R&D expenditure continues to grow at its current rate⁴, companies will be underinvesting, leading to a loss in market share and hence an erosion in competitiveness.

Figure 2 shows Europe’s lag in GNSS R&D expenditure when compared to North America. However, Europe not only lags behind in total expenditure but also exhibits slower growth. In contrast, North America and the Asia-Pacific region have experienced a compound annual growth rate (CAGR) of 8.6% and 8.7% respectively for GNSS-specific R&D expenditure. Europe, however, falls behind with a CAGR of only 5.7%. Slower growth and smaller total expenditure in R&D can lead the European market to drop behind non-European competitors and lose market share.

Figure 2 GNSS-focused expenditure by region



Source: LE Europe, Evenflow, and VVA: GNSS Investment Report 2021. Commissioned by the European Union Agency for the Space Programme (EUSPA) and the European Investment Bank (EIB).

¹ Samuelson, P. A., & Solow, R. M. (1956). A complete capital model involving heterogeneous capital goods. *The Quarterly Journal of Economics*, 70(4), 537–562.

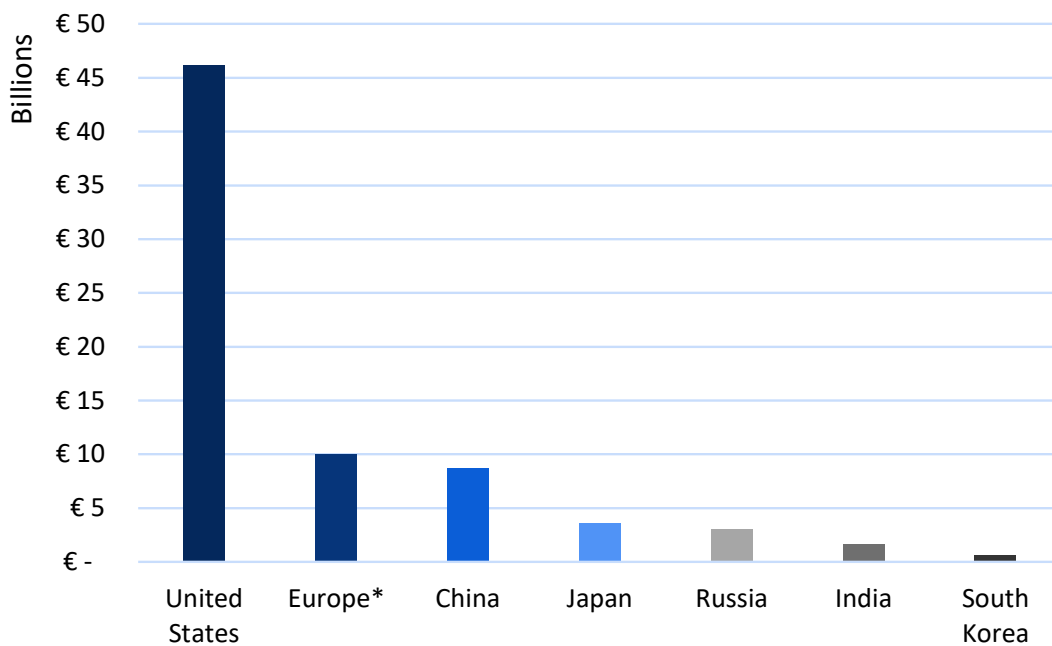
² https://research-and-innovation.ec.europa.eu/system/files/2022-06/ec_rtd_he-investing-to-shape-our-future_0.pdf

³ https://www.euspa.europa.eu/sites/default/files/uploads/gnss_investment_report_2021.pdf

⁴ At the time of the analysis.

At least in the GNSS sector, European companies are underinvesting in space-focused R&D. But what about European governments more generally? It is possible to make a rough approximation of total spend using data on national space budget. The shares of these budgets planned to spend on R&D specifically are not stated. The announced annual space budgets of the largest spenders for 2021 are shown in the chart below – the presented governments total approximately €74bn of expenditure. The numbers clearly show how Europe’s⁵ budget makes up less than a fourth of the US space budget. Some of this public expenditure will be used on operational costs and other items not relevant to R&D expenditure. Nevertheless, the chart indicates that it is not only European companies that lag behind in investments in the space sector, as shown in Figure 2, but also European governments.

Figure 3 Government space budgets (2021)



Source: Euroconsult, *Government Space Programs (2022)*

Note: ‘Europe’ includes ESA, the national space agencies of France, Germany, Italy, and the United Kingdom as well as the European Union

The rise of private investments in space R&D

In the EU space industry, GNSS currently accounts for the majority of revenues. In 2021, the Earth Observation (EO) market amounted to €2.8bn and the GNSS market revenues to almost €200bn. By 2031, these numbers are expected to grow to €5.5bn and €492bn respectively.⁶ These numbers are important to put the R&D investment gap of €42bn in GNSS by 2029 into perspective.

In the wider space industry, R&D investments are mainly funded through the government. ESA and national space agencies allocate significant R&D funding to support advancements in space technology, satellite systems, and other space capabilities. For instance, the European Union’s flagship research and innovation program, ‘Horizon Europe’, provides R&D funding totalling €95.5bn over seven years across various sectors, including space.⁷ An important space-focused funding

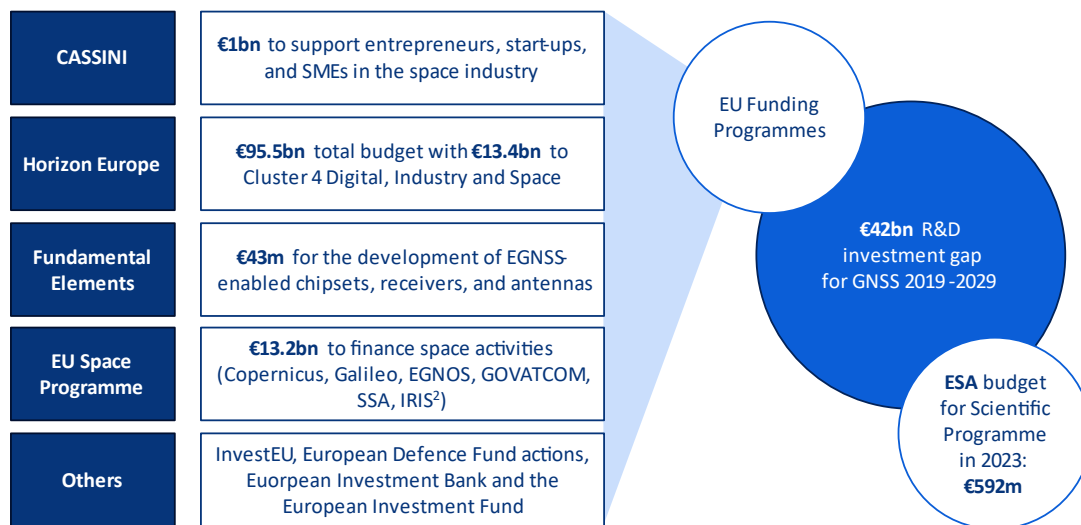
⁵ Defined as EU27 plus UK, Norway, and Switzerland.

⁶ https://www.euspa.europa.eu/sites/default/files/uploads/euspa_market_report_2022.pdf

⁷ https://research-and-innovation.ec.europa.eu/system/files/2022-06/ec_rtd_he-investing-to-shape-our-future_0.pdf

programme is the EU’s ‘CASSINI’, a €1bn initiative aiming to support entrepreneurs, start-ups, and small and medium-sized enterprises (SMEs) in the space industry, including the ‘New Space’.⁸ Companies in that market drive the development of a private space industry characterised by commercial motivations.⁹ Nevertheless, they receive further support through the European Investment Bank (EIB) acknowledging the importance of their role in economic growth and employment support.¹⁰ Other funding programmes in the European space sector include the recently announced ‘Space Clusters and Infrastructure Fund (SCIF)’ dedicating £50m towards the UK space infrastructure¹¹. The figure below presents some available EU funding programmes for organisations in the space industry.

Figure 4 Examples of EU funding programmes under the Multiannual Financial Framework (MFF) 2021-2027



Sources: <https://www.cassini.eu/cassini-initiative>
https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en
<https://www.euspa.europa.eu/opportunities/fundamental-elements>
<https://www.euspa.europa.eu/european-space/eu-space-programme>
<https://eufundingoverview.be/funding/space-programme>
https://www.esa.int/About_Us/Corporate_news/Funding

While extramural (external) R&D investments target external entities outside the organisation providing the funding, intramural (internal) R&D investments are allocated to activities within the organisation itself. Both play important roles in fostering innovation and technological advancements. Intramural investments enable an organisation to build internal capabilities and follow its own research agenda, while extramural investments facilitate collaboration and knowledge sharing.

Over the past decade, private investments in the space sector have witnessed significant growth, with contributions from individuals, investment firms, corporate investors, and banks. Between 2013 and 2018, total private R&D investments across the economy in Europe grew from €203bn to €279bn according to OECD data. While Europe has exhibited the highest growth rate in R&D

⁸ ‘New Space’ is an emerging market additional to the traditional space sector shaped by space companies that focus on developing innovative and affordable solution, increasing the access to space.

⁹ <https://op.europa.eu/en/publication-detail/-/publication/4c977a63-1f93-11e9-8d04-01aa75ed71a1/language-en>

¹⁰ <https://www.eib.org/en/press/all/2020-336-eib-announces-first-direct-financing-for-a-start-up-in-the-european-new-space-sector-eur20-million-venture-loan-for-spire-global>

¹¹ <https://www.gov.uk/government/news/first-dedicated-government-fund-to-build-space-infrastructure-launched-with-50-million>

investments by private companies compared to non-European regions, the total investment amount remains relatively smaller.¹² This could be attributed to a tendency for higher risk aversion in Europe, resulting in projects being funded through banks rather than capital markets, which typically involve lower risks. Funding programmes like CASSINI aim to highlight investment opportunities in the European space sector to venture capitalists. This can be particularly helpful as public funding often serves as a precondition for raising private funding.¹³

Analysing the dynamics of the UK space sector

In the UK, the 2021 Plan for Growth Report emphasizes the importance of a more equitable distribution of R&D activity across the UK.¹⁴ This is particularly important in the space sector as it is more than 5 times more R&D intensive than the UK average.¹⁵

In order to make policy decisions on funding strategies, it is useful to understand the dynamics in the respective market. Therefore, the UK Department for Science, Innovation & Technology (DSIT) commissioned an extensive analysis by LE, to gain a comprehensive and accurate understanding of the dynamics in the UK space sector. The analysis utilised the data from the 'Size and Health of the UK Space Industry' ('Size and Health'), a survey encompassing all UK organisations involved in space-related activities. The objective was to identify the size, performance, and characteristics of these organisations engaged in the UK space sector. LE's study aimed to enable trend identification and predictive forecasting of companies' growth and survival in the industry. The results obtained from this analysis provide valuable insights for policy decision-making, informing strategies that support the industry's evolution.

The analysis involved a literature review to understand the factors influencing firm growth within the industry. The variables identified were tested econometrically for their impact on a company's growth, ability to sustain high growth, and survival in the sector¹⁶ using Ordinary Least Squares (OLS) and Logit models¹⁷. The independent variables tested included the number of employees in space-related activities, export intensity, firm age, and firm size. For a detailed methodology, interested readers can refer to the report published [here](#).

Despite challenges arising from incomplete data, the analysis yielded significant results for the impact of R&D intensity on firm-level growth. R&D intensity reflects the proportion of investments allocated to space-related R&D in relation to a company's total Gross-Value Added (GVA). These findings imply that firms that invest more in R&D tend to grow faster than those that do not.

The findings from this study of the UK space sector align with broader literature emphasizing the positive impact of R&D investments. However, as highlighted in the GNSS investment report, there

¹² https://www.euspa.europa.eu/sites/default/files/uploads/gnss_investment_report_2021.pdf

¹³ <https://www.eib.org/en/publications/the-future-of-the-european-space-sector-report>

¹⁴ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/968403/PfG_Final_Web_Accessible_Version.pdf

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1023591/niesr-report.pdf

¹⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1148037/know.space-Size_Health2022-SummaryReport.pdf

¹⁶ The definition of a high growth company aligns with the OECD definition of a companies with annual growth of more than 20% over three years.

¹⁷ Ordinary least squares (OLS) investigates the association between variables by minimising the sum of the squared differences between the observed dependent variable and the output of the (linear) function of the independent variable. A Logit model is a regression model where the dependent variable is a categorical variable taking on only discrete values. The output of a Logit model is a probability that an event occurs and is constrained between the values 0 and 1. Both OLS and Logit regressions are analysed in order to cross-validate results.

remains a significant gap that must be bridged to ensure European companies can compete in the space sector.

Bridging the R&D gap: fostering competitiveness

In conclusion, the notion that R&D investments boost firm-level growth in the space sector is strongly supported by both empirical evidence and the literature. Beyond the direct benefits to individual companies, such investments have profound positive implications for the broader economy like supporting employment and generating spillover effects to innovation, coordination, and users of space-derived goods.

With space being an integral part of critical infrastructure, it is important to maintain the strength of this sector to secure strategic autonomy. The space sector supports security in various aspects including agriculture, maritime, telecommunication, transport, and the environment as well as crisis and border management. According to the EU Institute for Security Studies (EUISS), the EU has reached a degree of strategic autonomy in the space domain.¹⁸ To maintain this, investments in the development of new technologies and capabilities are integral.

It would be interesting to expand the analysis and examine the growth dynamics of the entire European space market get a holistic overview and inform policy and investment decisions. By iterating on the methodology employed in the UK space sector analysis, policymakers and stakeholders can gain further insights and develop targeted strategies that will drive the growth and competitiveness of the European space sector as a whole. Further, data on the space-focussed R&D budgets across Europe could help deepen the understanding of investment gaps and needs for Europe to strengthen its position in the global market.

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¹⁸ https://www.iss.europa.eu/sites/default/files/EUISSFiles/EXPO_IDA%282020%29653620_EN.pdf