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SUSTAINABLE SOLUTIONS IN THE SPACE SECTOR: FACTORS DETERMINING THE PERCEPTION OF THE OPPORTUNITY LANDSCAPE BY KEY PLAYERS IN THE SPACE INDUSTRY

Abstract

In essence, the problem of orbital pollution is a tragedy of commons. Space does not belong to anyone, thus, there is a tendency to exploit it excessively without accountability for mitigating the resulting consequences. While sustainable space solutions hold promise for collective benefit, the question persists: who should bear the associated costs? And in order to answer this question, one needs to understand how the opportunities for sustainable space technologies are perceived by key actors in the industry. Once the light is shed on this aspect of commercial space exploration, it will become clearer how to identify the scope of commercialisation potential of sustainable space solutions, and, consequently, how the associated costs can and should be distributed among key actors; which in turn would, hopefully, facilitate adjustment of the regulatory framework.

The paper investigates the factors shaping the perception of the opportunity landscape in the space industry regarding sustainable innovation, bridging streams of literature in the new space economy and technology management. It aims at bringing more clarity to the definition of 'sustainable space technology' by outlining the scope of technologies falling under this category and introducing a new approach to their classification. Through a set of quantitative and qualitative methodologies, including surveys, game theory models, input-output analysis, expert interviews, and historical analysis, the paper aims to develop a theoretical framework for understanding the factors influencing the perception of opportunities in the space industry. Additionally, it proposes a methodology for identifying commercialization avenues for sustainable space technologies, juxtaposing them with historical and contemporary examples from other sectors.

A pivotal part of this research is a case study on the space debris physical characterization tool developed by EPFL, showcasing the practical application of the proposed theoretical framework. The output is a roadmap for navigating the complexities of bringing the technology in question to market.

By identifying the key factors determining the perception of commercialisation opportunities for sustainable space technologies, this study contributes to the broader discourse on space sustainability and the future of commercial space exploration, proposing actionable strategies for future research and industry practices to ensure the long-term viability of outer space activities.