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A SUSTAINABLE APPROACH FOR NORDIC SMALL BUSINESSES TO DESIGN, LAUNCH AND
OPERATE EARTH OBSERVATION SATELLITE CONSTELLATIONS

Abstract

As the space industry experiences a paradigm shift from government-led to privatedominated exploration, Low Earth Orbit (LEO) is becoming increasingly privatized. The rapid growth of satellites in LEO, expected to grow over 100,000 in the next decade (IAU, 2020), is primarily driven by the emergence of small satellite constellations developed, manufactured, launched, and operated by small businesses. While these constellations, referring to groups of satellites that have similar types of functions such as GPS, offer immense potential for technological advancements and societal benefits, their rapid growth also creates significant challenges. These challenges include the potential for increased orbital debris, satellite collisions, astronomical interference, and increased emissions from rocket launches and satellite reentries (Bernhard, 2023).

In this paper, we study the dynamic and evolving landscape of satellite Earth Observation (EO) constellations owned by small businesses, emphasizing the critical need for sustainability in their design, deployment, and operation. EO refers to the use of remote sensing technology to monitor the Earth's characteristics (EUSPA, 2023). We are especially interested in satellite-based EO as the data acquired through EO constellations can be processed and analyzed in order to be employed in a wide range of applications and industries. In addition, we study the emerging challenges and potential solutions in terms of sustainability, highlighting the importance of a forward-looking, environmentally conscious approach in shaping the future of satellite constellations operated by small businesses.

This study applies a qualitative research methodology which includes online surveys and interviews. Semi-structured interviews are used for background research to comprehensively investigate the challenges small businesses operating in this segment of the industry face to implement sustainability. Furthermore, small space businesses case companies in the Nordics region are studied utilizing observations and discussions with the local space ecosystem stakeholders. The findings of this study indicate a perspective on the dynamic nature of sustainability for small business-owned satellite constellations and their environmental impact, providing a foundation for proposing sustainable frameworks and guidelines for the future practices and research.

References [1]International Astronomical Union 2020 Satellite Constellations <https://www.iau.org/public/themes/satellite-constellations/> [2] Bernhard, 2023. Large satellite constellations and space debris: Exploratory analysis of strategic management of the space commons [3]<https://www.euspa.europa.eu/european-space/eu-space-programme/what-earth-observation>