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UNLOCKING THE VALUE OF SATELLITE SYSTEMS THROUGH MODULARITY: A REFERENCE FRAMEWORK

Abstract

In the evolving ecosystem of the New Space Economy, characterized by a pressing need for cost- and time-efficient solutions, the demand for innovative satellite design and development practices is growing. Modularity, extensively explored outside the satellite industry as both a design concept and a strategic paradigm, has seen relatively limited adoption and implementation in satellite systems. While traditional approaches to satellite architecture rely heavily on extensive customization and integral design, recent commercialization and market-driven imperatives within the satellite industry have created an environment keen to explore more modularized and standardized approaches. This shift transcends technical considerations, emphasizing the imperative to understand the broader business implications associated with modularity in satellite systems. A comprehensive exploration of the intricate dynamics of value creation and capture is essential to navigate a rapidly evolving ecosystem. To this end, it is necessary to move forward the body of knowledge in two directions: (i) translating the existing knowledge on modularity in complex product systems to the satellite industry; (ii) expanding the contribution of servitization literature to infrastructure design and operations domains.

This study adopts a qualitative research approach grounded on the concept of "maturity model". We introduce the "Satellite Modularity Maturity Model" that delineates the various levels of competence for an organization in adopting modularity, ranging from viewing modularity solely as a technical means to rationalize design to leveraging it as a framework for business innovation. Building upon this model, we develop a preliminary framework outlining the value generated at different modularity competence levels. Our aim is to unveil the mechanisms through which satellite manufacturers can capitalize on this value, translating it into tangible economic opportunities and thus making better strategic decisions about modularity adoption. Furthermore, we identify and characterize the key drivers essential for value creation and capture throughout the satellite lifecycle in the relation to different stakeholders. The study contributes to unveiling and framing value creation mechanisms through modularity in the satellite industry. The results are translated into a set of actionable recommendations, fostering informed decision-making and strategic advancements in design and operational practices.