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ADVANCING SPACE CAPABILITIES: THE SATELLITE TECHNOLOGY LADDER IN EMERGING
NATIONS

Abstract

The development of space technology has been historically shaped by geopolitical dynamics, notably during the Cold War era, characterized by the rivalry between the United States and the Soviet Union. Recently, however, there has been a notable democratization in space technology, evidenced by the increased involvement of various countries and private entities in the space industry. This shift has been largely enabled by technological advancements such as CubeSat-based small satellites, which have significantly reduced the barriers to entry in space exploration and development.

In 2012, D. Wood and colleagues introduced the concept of the Space Technology Ladder (STL), a framework focusing on the acquisition of space technology by emerging countries. The STL provides a categorization schema for countries based on their development and deployment of satellite technology, encompassing both low-orbit and geostationary satellites, as well as satellite launch capabilities.

Expanding on the STL framework, this study introduces the Satellite Technology Ladder (STL) to specifically analyze and categorize the progression of technology acquisition in emerging countries. The analysis encompasses a decade-long observation of countries including Algeria, Angola, Nigeria, Thailand, Malaysia, Egypt, Indonesia, the Philippines, Vietnam, the United Arab Emirates, and Argentina. These nations are observed to be transitioning from deploying small-scale satellites, such as CubeSats, to more advanced, larger satellite systems. This transition is evaluated with respect to regional distributions across Africa, Latin America, and Asia. The study identifies four distinct trends among these countries:

1. Government-led nations primarily focused on procuring satellite technology from developed countries.
2. Nations that procure satellites from developed countries while simultaneously fostering domestic satellite development initiatives.
3. Countries that actively integrate technology from developed nations into their own developmental frameworks.
4. Nations pursuing independent development of satellite technology.

The research underscores the significance of countries striving for autonomous acquisition of satellite technology. This can be achieved through fostering partnerships with local universities and industries, as well as through international collaborations. A notable trend observed is the increasing involvement of universities and private companies, often following initial developments by national space agencies. While some countries have successfully advanced up the STL by leveraging technology from developed nations, others have shown less progress due to reliance on continual satellite procurement.

In conclusion, the study highlights the critical importance of countries aiming for independent acquisition and efficient utilization of satellite technologies, employing the STL framework as a strategic guide to bolster their industrial capabilities in the space sector.