

Transforming Supply Chains with Space Technology

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The global space economy was valued at approximately ₹44.25 lakh crores in 2022 has been projected to reach approximately ₹81 lakh crores by 2040. To keep pace with these global dynamics the Indian government liberalised the space sector under the Aatma Nirbhar Bharat vision, specifically aiming at Antariksh mein Aatmanirbharata i.e. Self-reliance in Space Technology. Following that the Department of Space (DoS) announced its vision for the Indian space sector through Indian Space Policy, 2023 enabling and encouraging the formal participation of private players in the space sector. This is a strategic move by Government of India (GoI), considering the paradigm shift from Conventional space to NewSpace.

Conventional Space is characterized by highly regulated and government owned space entities with centralized decision making and limited commercialization and industry partnerships. On the other end of the spectrum, NewSpace is characterized by democratization of space sector by private sector participation, decentralized decision-making structures, industry collaborations and cross-border partnerships. The commitment of GoI for NewSpace is evident from the establishment of NewSpace India Limited (NSIL), the commercial wing of ISRO. The shift from Conventional Space to NewSpace will be accelerated by government schemes and initiatives for fostering entrepreneurship in space technologies, strategic global collaborations for technological advancement and increasing adoption of space-based services in the industry.

On the supply side, the GoI, specifically DoS, is empowering the Space Start-up sector through start-up programme under ISRO such as SEED (Space Entrepreneurship & Enterprise Development) and creation of a conducive ecosystem comprising of Angel Investors, Venture Capitalists, Incubators and Accelerators. However, on the demand side, identification of practical use cases and adoption of innovative technologies would be critical for a sustainable NewSpace sector in the country. This is where the significance of a sunrise sector like logistics sector becomes evident. The PM Gati Shakti National Master Plan is devoted to transform the logistics infrastructure and multi-modal connectivity for seamless movement of people and goods. The NewSpace initiative of GoI can contribute towards this transformation through digitalization of logistics and supply chain operations through space technology applications.

There are numerous applications of satellite imagery and remote sensing in upstream, mid-stream and down stream stages of supply chain. In the upstream supply chain, for instance, mining industry employs satellite imagery for mineral exploration. By analyzing high-resolution satellite images, trained photogeologists can decode the geological features for detecting the presence of minerals. Targeting the mining area based on mineral concentration can lead to efficient mining operations, saving money and time. Geospatial Applications like ArcGIS when blended with satellite images, can create precise mining site map showing the details of nearby infrastructure such as buildings and roads further enhancing the efficient project planning and execution. A commendable initiative of Ministry of Mines is the development of Mining Surveillance System (MSS) through Indian Bureau of Mines (IBM) in collaboration with Bhaskaracharya Institute for Space Applications and Geo-informatics (BISAG -N), Gandhinagar and Ministry of Electronics and Information Technology (MEITY).

MSS, a satellite-based monitoring system has been found effective in preventing illegal mining activities outside the lease boundary.

Oil and Gas sector has also immensely benefitted from the accurate satellite imagery techniques especially for locating oil and gas reservoirs and for mitigation of exploration risks making the projects cost-effective. Further, pipeline monitoring for leak detection is a satellite imagery use case of paramount significance on account of its potential for prevention of disasters and immense financial loss.

The logistics operations derived advantage of the satellite technology by adopting automatic identification system (AIS) for tracking of cargo. In maritime logistics, Vessel Traffic Services (VTS) apply the AIS technology for real-time tracking of goods in transit and for the prediction of arrival time of the vessel at the port. Real time monitoring and tracking adds immense value to global operations by making the intricate supply chains visible. The prediction of arrival time enabled by the tracking, can help managers to take proactive decisions on inventory management. For instance, prior information on delayed arrival of a ship can trigger the decision of local inventory sourcing thereby preventing a stockout scenario. Such decision support systems integrate various technologies like IoT, remote sensing, machine learning and AI for creating digital twins of supply chains.

In the road transport logistics, the shortest path can be computed with the help of various road extraction algorithms applied to high-resolution satellite images. In future, satellite communications may drive the last mile hyper local delivery by smart drones. Further, the ge-positioning technologies like GNSS (Global Navigation Satellite System) – based electronic toll collection system can enable seamless movement of vehicles replacing the existing toll gates to virtual ones thereby contributing towards the vision of PM Gati Shakti.

In summary, the paradigm shift towards NewSpace and subsequent innovations in space technology will be transformative for business operations across the sectors.