

GIS INSIGHTS

The Rise of GeoAI: Transforming India's Spatial Data into a Predictive Powerhouse

When Esri India was established in 1996, Geographic Information Systems were confined largely to government survey departments and a handful of academic institutions. The country's spatial data landscape consisted primarily of paper maps, topographic sheets, and the occasional digitized layer running on workstations. Early adoption came from natural resource and infrastructure sectors, where each deployment proved the value of GIS in decision-making. The early 2000s marked a turning point with the rise of internet-based GIS and greater access to satellite imagery through platforms like Bhuvan. The mobile revolution further accelerated adoption, enabling field workers to capture real-time geotagged data, making GIS more dynamic and accessible.

A major shift came in 2021 with the liberalization of India's geospatial policy, unlocking high-resolution data for wider use. GIS evolved into an enterprise platform, powering initiatives like Smart Cities, Digital India, SVAMITVA, and PM Gati Shakti by connecting infrastructure, data, and decision-making.

Today, GIS has entered a new phase with AI and digital twins. Advanced analytics can now derive insights from imagery in minutes, while digital twins create real-time, dynamic models of cities and infrastructure. Together, these innovations are transforming GIS into a powerful tool for predictive planning and smarter governance.

We are moving beyond the era of looking at what is on the ground to a phase where we can simulate, predict, and model the future.

Predictive Intelligence with GIS

At the heart of this transformation is **GeoAI** (GIS powered by AI). We are no longer just identifying patterns; we are building predictive models. In sectors like agriculture, GeoAI is helping us analyze soil moisture and weather patterns to advise farmers on crop management. In cities, it is increasingly shaping utilities and infrastructure planning by predicting demand, identifying risk-prone zones, and enabling smarter, data-driven development of critical infrastructure.

Furthermore, the integration of **Generative AI with GIS** is opening doors to advanced scenario simulation. Decision-makers can now ask "what if" questions: What happens to city traffic if we add a new flyover here? How will a sudden flood impact the local power grid? By combining large language models with spatial analytics, we are making complex data accessible and conversational, allowing for faster and more inclusive decision-making.

The Shift to 'Living' Digital Infrastructure

The shift from static mapping to dynamic modelling is perhaps most visible in the rapid transformation of India's urban landscape. Urban planning is evolving from traditional 2D master plans to multidimensional, data-driven simulations. One of the most exciting developments in this journey is the rise of GIS-enabled Living Digital Twins.

By integrating real-time data from multiple sources such as traffic systems, utility networks, surveillance feeds, environmental sensors, weather monitoring systems, and GPS-enabled public transport, Living Digital Twins are creating dynamic virtual models of cities. By continuously reflecting real-world conditions in a digital environment, these technological marvels are allowing city planners and administrators to analyse patterns, anticipate potential issues, and evaluate alternative planning scenarios.

These dynamic models are also enabling more informed

and proactive decision-making in sustainable resource management, a critical area of concern today. For instance, researchers at the Indian Institute of Technology, Delhi are developing a digital twin of the Ganga River Basin that integrates satellite data, hydrological models, AI, and real-time sensors to simulate water flows and climate interactions. Such a model allows policymakers to test various scenarios related to floods, droughts, groundwater management, and long-term ecological sustainability, supporting more resilient and sustainable planning.

The possibilities are thus endless!

In Closing

Undoubtedly, we are now at the most consequential inflection point in India's GIS journey, where emerging technologies are redefining its scale, impact, and possibilities. We began with contour lines, simple representations of elevation on paper, and are now moving toward dynamic digital twins of river basins that respond to monsoon data in real time. The distance between those two points is not merely technological. It is the story of a country discovering, with growing confidence, that to understand India you must first understand its geography, and that to shape India's future, you must make that geography intelligent.

