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Advanced GIS reshaping infrastructure, utilities and urban governance

The Malaysian Reserve, Malaysia

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Data readiness remains a major challenge, particularly when dealing with legacy systems and decades of unstructured records

by SHAUQI WAHAB

GEOINNOVATION Malaysia 2026 (GIS2026) highlighted how next-generation geographic information system (GIS) from 3D digital twins and integrated spatial analytics to real-time sensor data and disaster simulation is transforming decision-making, operational efficiency and resilience across urban planning, infrastructure management and emergency response.

Gamuda Engineering Sdn Bhd showcased its Enterprise GIS Platform for Infrastructure Delivery, which unified spatial, engineering, environmental, building information modeling (BIM) and field data into a single ArcGIS Enterprise system.

Previously operating with fragmented, project-based GIS tools, the company now supports more than 400 users on a real-time, standardised platform that enhances collaboration, planning speed and project monitoring.

The transformation has reduced duplication, minimised risks and strengthened sustainable infrastructure development, aligning with long-term smart city and digital construction initiatives.

Hulu Selangor Municipal Council (MPHS) was recognised for its EIS MPHS — Smart City and Enterprise GIS Platform, which integrates planning, revenue management, enforcement, smart city monitoring and public services across 13 departments.

Before GIS adoption, operations were largely manual and siloed, with limited data sharing and public engagement.

The new centralised enterprise GIS now features real-time dashboards, 3D mapping, mobile inspections and public-access spatial tools.

This has improved governance efficiency, accelerated decision-making, increased revenue collection and supported low-carbon urban planning while reducing paper usage and resource wastage.

Meanwhile, Tenaga Nasional Bhd (TNB) demonstrated operational excellence through its Land Management Unit Mobile & Web Application (LMU-MoWA), a nationwide GIS-enabled platform for land enforcement, inspections and land health assessments.

Previously reliant on manual inspections and hardcopy processes, TNB has transitioned to digital workflows with mobile data collection, geotagged imagery, route optimisation and real-time dashboards.

The system has improved accountability, reduced errors, cut operational costs and supported sustainable land management by optimising manpower and monitoring accuracy.

At the national level, Pusat Geospatial Negara (PGN) was recognised for Malaysia Geospatial Online Services (MyGOS), a cloud-based platform that centralises geospatial data sharing and collaborative application development across government agencies.

Replacing fragmented datasets and duplicated systems, MyGOS now serves as a unified, Application Programming Interface (API)-enabled platform supporting multiple national applications in areas such as environment, health and safety.

The initiative aligns with the Sustainable Development Goals (SDGs), promotes transparency, strengthens inter-agency collaboration and enhances data-driven governance.

TNB Digitises Land Reviews with Geospatial Data

At the event, TNB's LMU highlighted how geospatial technology has transformed its land inspection and management operations through LMU-MoWA.

The presentation was delivered by TNB-LMU project land data and support services manager Muhammad Shafiq Kasti who outlined the unit's role in overseeing TNB's extensive land assets nationwide.

He explained that TNB manages a large volume of land associated with its infrastructure, ranging from power stations to substations and other facilities that support electricity supply to customers.

These assets require continuous monitoring through a process known as Land Status Assessment (LSA), which previously relied heavily on manual workflows.

Muhammad Shafiq said before the introduction of LMU-MoWA, the LSA process was highly inefficient and time-consuming to complete from start to finish.

It was also heavily dependent on physical documentation, with each assessment requiring between 30 and 36 pages of printed reports.

This not only increased operational costs but also placed a burden on staff, resulting in low user satisfaction and intensive manual report management.

"The earlier LSA process was conducted entirely manually and was very time-consuming, taking nearly five hours to complete end to end, while also being heavily reliant on paperwork and printing," he explained during the winners presentation session.

To address these challenges, TNB-LMU developed LMU-MoWA as a multi-tier digital solution integrating a centralised database with mobile and web applications.

The platform enables land inspectors to conduct field assessments digitally, capture geotagged data and synchronise information in real time with a web-based portal hosted on a dedicated server.

This allows for task assignments, workflow management and monitoring through dashboards.

Muhammad Shafiq added that the system was designed by integrating internal databases with mobile technologies, creating a seamless ecosystem that supports both on-site operations and back-office oversight.

The web portal sits on top of the server infrastructure and connects with the mobile applications, providing users with tools to manage workflows, inspections and reporting more efficiently.

"LMU-MoWA is a tiered solution that integrates our central database with mobile applications and a web portal, allowing inspections, workflows and reporting to be managed digitally in real time," he added.

The implementation of LMU-MoWA has greatly improved operational efficiency for TNB-LMU by reducing paperwork, shortening inspection cycles and improving data accuracy.

It has also enhanced accountability and user satisfaction among employees, while supporting sustainable practices through reduced printing and optimised resource use.

Muhammad Shafiq said the implementation of LMU MoWA has significantly enhanced the efficiency and productivity of TNB's Land Holding Assessment (LHA) process.

By streamlining workflows, the system reduced processing time by nearly four hours per LHA, enabling annual productivity to rise from about 2,500 land parcels to almost 6,500 parcels.

This improvement allows TNB to complete a full LHA cycle within approximately 3½ years compared to the previous manpower-driven approach.

The time savings have also delivered substantial financial benefits. Over 17 months of implementation covering roughly 8,980 sites, LMU MoWA helped TNB monetise manpower efficiencies, generating close to RM1.9 million in cost savings under the LHA evaluation framework.

Muhammad Shafiq highlighted the impact of the shortened workflow. He said by reducing nearly four hours from each LHA process, TNB managed to generate almost RM1.9 million in manpower cost savings.

In addition, the introduction of a zero-printing policy through MoWA resulted in savings of nearly 300,000 sheets of paper within 12 months, cutting operational costs by about RM132,000 while supporting sustainability goals.

From a strategic perspective, LMU MoWA demonstrated strong interoperability, enabling seamless data exchange across different systems.

The platform also proved its architectural stability, opening opportunities for TNB to develop more advanced and future-ready solutions.

Through live integration, it established a single source of truth while allowing TNB to leverage advanced visualisation, data management and spatial analytics technologies.

These capabilities have helped unlock the value of TNB's land assets, including clearer boundary demarcation and improved site development outcomes.

Looking ahead, TNB plans to further enhance LMU MoWA by integrating more comprehensive tools such as Relative Fit Index (RFI) and Normed Fit Index (NFI).

It is also developing a centralised geogrid database, digitising existing TNB buildings for digital twin applications and introducing graphical user interfaces to support more proactive and reactive maintenance strategies.

GIS, Data Integration Reshaping Critical Sectors

The fireside chat highlighted how geospatial intelligence is reshaping operations across forestry, utilities, waste management and asset-intensive organisations, with panellists sharing real-world challenges and transformation journeys driven by GIS and data integration.

Kumpulan Pengurusan Kayu Kayan Trengganu Sdn Bhd (KPKKT) geomapping and data centre head Amirul Syafiq Che Ajizi explained how the forestry sector struggled for decades with manual processes that led to untraceable trees, inefficiencies and financial losses.

Each year, thousands of trees were left unharvested due to poor visibility in dense tropical forests, resulting in millions of ringgit in missed value.

The introduction of the E-Balak GIS system enabled precise geolocation of trees, improving traceability while supporting sustainability goals under the United Nations' SDGs, particularly SDG 15 (Life on Land) and SDG 8 (Economic Growth).

The system also positioned KPKKT to comply with the European Union Deforestation Regulation (EUDR), which requires geolocation data for timber traceability.

Muhammad Shafiq said successful digital transformation depends on strong user engagement, aligning systems with organisational objectives, solving real operational problems and ensuring continuous communication before and after system deployment.

Data accuracy should be prioritised based on business needs, with critical assets such as land parcels and infrastructure requiring higher precision, while other datasets

Pics courtesy of Esri Malaysia

(From left) **Esri Malaysia chief technology strategist Joanne Loh, Ong, Mohd Zubaidi, Muhammad Shafiq and Amirul Syafiq during The Resilience Blueprint: Reimagining Operations with Geospatial Intelligence fireside chat session**

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(From left) **Pinnacle Award winners Seremban City Council Mayor Yang Dipertua Datuk Masri Baharuddin, SWM Environment Sdn Bhd CEO Ho De Leong, National Geospatial Centre director Rusliza Hanim Maarif, MPHS assistant secretary Shaiful Rizza Plamin, Esri South Asia MD Leslie Wong, Esri Malaysia CEO Tan Choon Sang, MPHS Town Planning Department director Azlina Mokhtar, MPHS IT Division head Mohamad Ramdan Ibrahim, IWK Planning and Engineering Department head Mohd Lutpee Salleh and TNB LMU lead Muhammad Syafi'i Gampang**

can be managed with flexible standards depending on strategy and investment capacity, he added.

From the utilities perspective, Indah Water Konsortium Sdn Bhd's (IWK) asset management manager Mohd Zubaidi Daud shared how GIS played a crucial role during emergency incidents, including a high-profile case in Jalan Masjid India in Kuala Lumpur, where rapid access to accurate sewerage data supported search and rescue operations.

He stressed that GIS often becomes the first point of reference during crises, making data accuracy, timeliness and integration with business systems such as Systems, Applications and Products Enterprise Resource Planning (SAPERP) essential.

IWK has embedded GIS directly into operational workflows, linking it with asset management, vehicle systems, billing platforms and maintenance processes through APIs and data integration.

Meanwhile, SWM Solutions Sdn Bhd GIS manager Ong You Shu highlighted how artificial intelligence (AI) combined with GIS has streamlined data capture and improved efficiency.

Previously, manual data entry and mapping required multiple staff, but AI-powered systems now scan, validate and geocode customer forms directly into a single spatial platform, reducing tasks from two people to one while improving data awareness and quality through periodic checks.

Across the session, panellists acknowledged that data readiness remains a major challenge, particularly when dealing with legacy systems and decades of unstructured records.

Amirul Syafiq described the difficult process of cleaning and digitising 45 years of forestry data, noting that digital transfoormation is a gradual journey rather than a one-time project.

The consensus was that organisations should not wait for perfect data before adopting GIS, but instead start with available information and continuously improve accuracy and completeness over time.

The session concluded with advice for organisations embarking on GIS transformation to remain persistent, focus on practical problem-solving, invest gradually in data quality and build systems that integrate seamlessly into daily operations to drive long-term resilience and value creation.

Next-gen GIS for Smart, Resilience Cities

The GIS2026 Tech Talk highlighted how Esri Malaysia's GIS ecosystem is enabling smarter cities through integrated digital twins, rapid disaster response, AI-powered damage recovery, automated infrastructure prioritisation and carbon-aware urban planning.

Industry consultant Lo Kit Yeng explained that traditional maps have evolved into dynamic 3D basemaps and digital twins that allow decision-makers to visualise existing conditions and simulate future scenarios such as new developments, zoning changes and disaster impacts.

These digital environments combine real-world data with advanced visualisation and geospatial analytics, enabling more informed and proactive planning.

She outlined a structured approach to building 3D basemaps, starting with clearly defining project objectives, identifying key challenges such as infrastructure management and emergency response, and selecting critical assets including buildings, utilities and terrain.

The process is supported by a three-stage workflow covering data generation, processing and 3D map production using ArcGIS tools, which transform high-resolution imagery into realistic, shareable 3D environments.

"The 3D basemap connects real-world data with visualisation and analysis to support smarter, more informed urban planning," Lo said in her tech talk.

She added that the resulting 3D scenes can be used across multiple applications, including flood simulation, urban development analysis and digital twin initiatives, while integrating both above-ground and underground infrastructure into a single platform.

Meanwhile, senior consultant Afif Abu Bakar focused on early warning systems and disaster simulation, highlighting the limitations of traditional flood preparedness methods that rely heavily on manual reporting and delayed decision-making.

He stressed the importance of real-time data integration from sensors monitoring rainfall, water inflow, outflow and dam levels.

Through Esri's real-time platforms and dashboards, sensor data is automatically processed, classified by risk thresholds and used to trigger alerts without human intervention.

This continuous monitoring approach allows authorities to anticipate flood risks rather than reacting after flooding occurs.

"The real question is not where we get the data, but whether we make the right decision based on the changes in the flood situation," he said.

Afif further demonstrated how live sensor data can be fed into 3D flood simulations to model water flow, depth and velocity under different rainfall and dam release scenarios.

These simulations provide emergency teams with predictive insights on flood spread and impact, enabling faster and more controlled response actions.

Meanwhile, senior consultant Rasydan Ahmad presented how GIS and GeoAI are accelerating flood damage assessment and recovery, particularly for agricultural communities impacted by large-scale flooding.

Traditionally, agencies rely on manual surveys that take weeks and are difficult to conduct in waterlogged areas.

"Recovery is not just about draining water or replanting crops, it is about restoring livelihoods and food security as quickly as possible," he said.

Rasydan explained that by combining satellite imagery, drone data and AI-driven analysis within ArcGIS, flood-affected areas, paddy fields and buildings can be automatically detected and classified within days instead of weeks.

According to him, using GeoAI allows users to move from slow manual surveys to automated impact detection which gives decision-makers a clear picture immediately.

The workflow integrates pre- and post-flood imagery, deep learning models, field validation through Survey123 and real-time dashboards to quantify damage, estimate yield losses and prioritise recovery funding.

This approach enables authorities to allocate resources more effectively and help communities return to normalcy sooner.

Meanwhile, lead industry consultant Amir Faisal focused on early warning systems and data-driven climate mitigation through automated prioritisation of stormwater infrastructure upgrades.

He said while most cities already have extensive drainage networks, floods often occur because certain assets cannot cope with increasing rainfall pressure.

"The issue is not about not having infrastructure, but identifying which hotspots need priority for upgrades and investment," he said.

Fragmented data across spreadsheets, reports and manual assessments makes it difficult for authorities to justify spending decisions.

By bringing stormwater data, human activity, complaints and environmental factors into one GIS model, users can quantify risk and create a clear prioritisation score, added Rasydan.

Through an automated scoring system, Amir said drainage assets are classified into high, medium and low priority zones based on overlapping risk factors such as flood complaints, proximity to schools and population density.

The results are published into interactive dashboards, providing management with visual justification for capital investment planning.

Finally, Esri Nalaysia GIS consultant Nurul Sofiana Syafril presented scenario-based planning approaches for building sustainable, carbon-neutral cities.

She stressed that urban areas are responsible for a significant share of global emissions, driven largely by building energy use and transportation patterns.

"Planning decisions tend to have long-term and often irreversible impacts on carbon emissions," she said.

Nurul Sofiana explained that addressing carbon outcomes must begin at the early planning stages, where there is still flexibility to adjust density, land use and transport infrastructure.

"By using scenario-based simulations in GIS, planners can evaluate carbon emissions, energy use and demographic impacts before developments are finalised," she added.

Using ArcGIS Urban and ArcGIS Pro, local land use and transport data are transformed into simulation models that measure future environmental outcomes.

These insights help city planners design developments that balance growth with sustainability goals while monitoring progress through dedicated dashboards.

Esri Malaysia CEO Tan Choon Sang delivers the opening speech at the event