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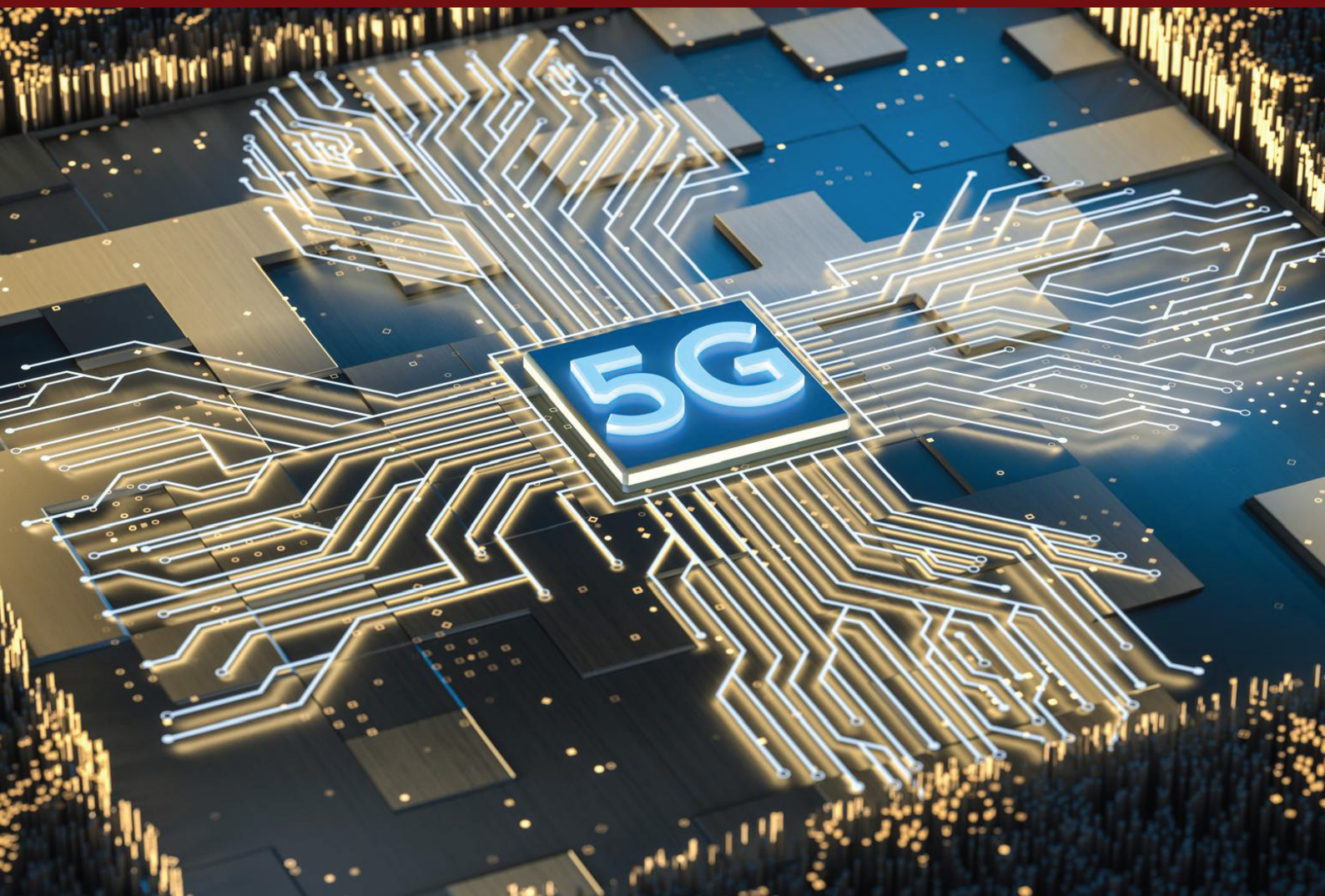
Advancing Connected Industries in ASEAN

Eight case studies of pioneering industrial deployments in logistics and port, manufacturing, mining, smart city and sea-crossing connectivity

December 2025



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EXECUTIVE SUMMARY

This booklet highlights eight real-world deployments at the frontier of Asia–Pacific's digital economy, where enterprises, governments, and technology providers are using advanced connectivity to solve critical operational challenges. Spanning smart manufacturing, logistics, transport infrastructure, mining, and urban management, these case studies illustrate how 5G, private LTE, AI, and data-driven solutions are redefining safety, efficiency, and resilience across the region.

In Thailand, AIS and Alliance Laundry Systems deployed the country's first 5G mmWave network in a manufacturing facility, connecting more than 300 devices for real-time production insight. The deployment enabled instantaneous machine data capture, latency-free video monitoring, and seamless integration with global R&D centers, demonstrating how advanced connectivity enhances manufacturing precision and coordination.

In Malaysia, CelcomDigi and government partners introduced an AI-powered traffic intelligence platform to support smart city development. By combining telco intelligence with multi-agency data sources, the pilot in Petaling Jaya models congestion, optimizes traffic light cycles, and reduces reliance on large-scale IoT hardware, establishing a scalable foundation for smarter urban mobility.

Malaysia's logistics sector has also advanced through CelcomDigi's 5G-powered autonomous warehousing solutions with ZTE, DHL, and CEVA Logistics. Robotics, drones, and AI-driven warehouse systems have delivered up to 20 times faster stock counting, 40 percent space optimization, and major improvements in accuracy and turnaround time, strengthening national supply chain performance.

Expanding on industrial transformation across Indonesia, Indosat Ooredoo Hutchison deployed private 4G and 5G networks across oil fields, mines, factories, and logistics hubs. These deployments achieved 99 to 100 percent coverage, reduced downtime by nearly 30 percent, and strengthened safety and productivity through edge computing and AI analytics. The model is now being replicated across major Special Economic Zones.

In Indonesia, Telkomsel and Huawei modernized port operations through an AI-enabled Smart Port platform that reduced truck gate processing times from five minutes to ten seconds. Unified camera intelligence and a centralized private network architecture improved predictive monitoring and lowered backup infrastructure requirements by 40 percent, creating a scalable model for future port modernization initiatives.

Telkomsel and Pegatron are collaborating on a 5G smart manufacturing lighthouse deployment in Batam. This partnership highlights how operators and leading device manufacturers are working together around advanced connectivity to support new models of industrial production.

In Malaysia, U Mobile and Huawei delivered continuous 5G-A coverage across the 13.5-kilometer Penang Bridge, maintaining average speeds of 597 Mbps and minimum speeds of 120 Mbps at highway velocities. The trial recorded zero call drops and demonstrated up to 99 percent idle power savings, underscoring the readiness of 5G-A for mobility-driven use cases.

Across Indonesia's mining sector, XLSMART deployed one of the nation's largest Private LTE networks, supporting reliable emergency communication, high-definition CCTV, and real-time fleet tracking across more than 20 sites. The dedicated LTE backbone allows concurrent voice, video, and IoT data flows without interference, improving operator safety and enabling future automation.

Together, these deployments demonstrate that advanced connectivity is now a strategic enabler of national competitiveness. By improving operational visibility, accelerating digital processes, and supporting automation, these eight initiatives offer replicable models for industries and governments seeking to build more resilient, efficient, and data-driven operations across the Asia–Pacific region.

Accelerating Smart Manufacturing: Thailand's First 5G mmWave Deployment

AIS's High-Band 5G Enables Real-Time Factory Automation at Alliance Laundry (Thailand) Co., Ltd

Smart Manufacturing, Powered by 5G: Pioneering mmWave in Thailand's Industrial Sector

AIS and Alliance Laundry (Thailand) Co., Ltd have deployed Thailand's first 5G mmWave network in a manufacturing facility, transforming factory operations at scale. This next-gen wireless solution enables real-time data access, connects over 300 smart devices, and supports automation across the Chonburi site. The deployment improves decision-making, enhances production agility, and enables seamless global system integration. By combining mmWave with a hybrid architecture for redundancy and reliability, the project sets a new benchmark for industrial 5G adoption-positioning Thailand at the forefront of smart manufacturing innovation.

AIS Business 5G
Your Trusted Smart Digital Partner

Clients and Partners Involved in This 5G Deployment

Alliance Laundry (Thailand) Co., Ltd, a key player in the global commercial laundry equipment market, has taken a major leap forward in digital transformation with the deployment of Thailand's first 5G mmWave network in a manufacturing setting. The initiative centers on the company's large-scale facility in Chonburi, operational since 2018 and expanded through more than US$4.5 million in investment for local growth and innovation. AIS was selected as the network provider for this groundbreaking deployment, delivering ultra-fast wireless connectivity through 5G mmWave. The goal: to connect hundreds of smart devices across the facility and move toward a real-time, automation-ready factory environment that integrates with Alliance's global operations.

Overview of 5G Network Deployment

Hybrid mmWave Architecture Supporting Redundant Industrial Connectivity

AIS implemented an active-active hybrid network setup, combining its 5G mmWave Fixed Wireless Access (FWA) technology over 26GHz with a leased line to ensure seamless redundancy. The design allows for the two connections to function in parallel or for 5G mmWave to serve as a full backup to the fixed line, ensuring no disruption to core factory systems. The network delivers guaranteed symmetrical speeds of 300 Mbps downlink and uplink—enough to support real-time industrial operations, automation control, and continuous data flow. Deployment was not without its challenges; the site's distance from the nearest mmWave tower posed signal delivery concerns. Despite this, AIS completed the rollout to specification, achieving full coverage across the production floor.

Accelerating Smart Manufacturing: Thailand's First 5G mmWave Deployment

Challenges in Deploying Wireless Connectivity for Manufacturing

Meeting Bandwidth, Redundancy, and Coverage Demands in a Complex Site

Alliance Laundry (Thailand) Co., Ltd required a wireless solution with guaranteed bandwidth that could either work in tandem with or replace its leased line under pressure. Typical Wi-Fi or non-5G wireless systems lacked the bandwidth, latency performance, and reliability needed to support mission-critical operations. Further, transmitting stable mmWave signals over long distances is technically complex, especially in industrial settings with heavy machinery and interference sources. These challenges made conventional setups impractical. AIS needed to overcome these barriers to deliver a solution that supported high device density, zero-lag data transmission, and uninterrupted system uptime across multiple production zones.

Objectives of the 5G Network Deployment

Enhancing Connectivity and Automation Capability in Factory Operations

Alliance Laundry (Thailand) Co., Ltd approached this deployment with a forward-looking vision. The company's aim was to enable highly mobile, flexible, and data-driven manufacturing by using wireless infrastructure in place of static cables. A primary objective was to create conditions for the free operation of AGVs (Automated Guided Vehicles), which must roam the entire facility without losing signal. Further objectives included automating sensor data collection, supporting smart scanning tools, and laying the foundation for scalable automation systems. Alliance Laundry (Thailand) Co., Ltd also anticipated that 5G would support ongoing integration between its Thailand facility and global units in the US and Europe, enabling remote coordination and faster business decisions.

Innovative 5G Solutions for Smart Manufacturing

5G mmWave Integration Supporting Real-Time Operations and Mobility

AIS tailored its deployment to the high-performance requirements of modern smart factories. The 5G mmWave solution now connects over 300 devices within the facility. These include industrial sensors, robotic arms, unmanned AGVs, smart scanners, and surveillance cameras. With the network's low latency, engineers can collect machine data in real time and trigger instant corrective actions. The facility now uses real-time camera feeds for production monitoring without visual lag. Importantly, the wireless setup allows for quick reconfiguration of production lines—something that was previously slowed by reliance on physical cables. This improves agility and supports mixed-model production without extensive rewiring or planning delays.

Achievements and Significance

Operational Outcomes from AIS's 5G mmWave Deployment

The impact of the 5G mmWave deployment has been clear and measurable. Over 300 devices are now live on the network, and latency has been reduced to near real-time—enabling time-sensitive processes such as robotic adjustments and machine coordination. With smart devices feeding data continuously, engineers and managers can pinpoint production bottlenecks and take immediate action. Visual monitoring through cameras provides high-quality, zero-delay footage for line supervision and quality control. This has improved detection of defects, reduced waste, and increased line efficiency. Perhaps most notably, the facility is now tightly integrated with Alliance's headquarters and R&D functions across the US and Europe. Information can flow securely and quickly between locations, supporting synchronized production decisions and regional responsiveness.

Valuable Insights and Key Learnings from the 5G Deployment

Observations from Deploying mmWave for Industrial Use Cases

This deployment provided several important takeaways. One major lesson is that high-band 26GHz spectrum—despite challenges—can deliver the necessary performance for dense, real-time industrial environments when engineered correctly. The experience also underscored the advantage of wireless over fixed cabling in environments where line flexibility and rapid reconfiguration are critical. Real-time data access from devices like sensors and cameras supports quicker decision-making and helps prevent small problems from escalating into costly delays. Finally, close cooperation between Alliance's internal global teams and local implementation partners such as AIS was essential for success. That coordination ensured alignment between infrastructure rollout and factory operations without halting production or impacting daily workflows.

Conclusion of the 5G Network Deployment Case Study

Summary of 5G Implementation and Its Role in Enabling Factory Modernization

The 5G mmWave deployment at Alliance Laundry (Thailand) Co., Ltd demonstrates how advanced wireless technology can solve traditional infrastructure challenges in manufacturing. By using 5G mmWave with a redundant leased line, the company achieved both flexibility and reliability. The network enables automation, mobility, and real-time control across hundreds of connected devices, while also facilitating seamless global collaboration. This case highlights how tailored 5G deployments—grounded in specific industrial requirements—can support tangible improvements in speed, quality, and operational resilience. With this initiative, Alliance Laundry (Thailand) Co., Ltd has taken a definitive step toward factory digitization, and Thailand has seen its first use of mmWave 5G in manufacturing successfully go live.

Future Outlook and Partnership Expansion

Exploring Further Industrial 5G Applications and Scalability

The successful implementation at Chonburi sets a strong precedent for future use cases across Alliance Laundry (Thailand) Co., Ltd.'s operations. The company and AIS are now in a position to explore the next phases of factory automation, using the existing 5G mmWave infrastructure as a foundation. Whether through more advanced AGV fleets, deeper integration with IoT systems, or real-time cross-border analytics, the groundwork has been laid for ongoing transformation. The current network model-featuring mmWave, redundancy, and full wireless mobility-can serve as a repeatable model for other facilities. As enterprise demand for industrial 5G continues to rise in Asia Pacific, both AIS and Alliance Laundry (Thailand) Co., Ltd are poised to lead in scalable, high-performance manufacturing solutions.

"Digital transformation has become imperative for the manufacturing sector. AIS Business stands ready to empower manufacturers with our intelligent 5G ecosystem, offering robust and reliable connectivity to advance automation, optimize production processes, and enable smart factories to achieve greater precision, efficiency, and operational resilience."

- Mr. Phupa Akavipat, *Chief Enterprise Business Officer, AIS.*

"With AIS 5G mmWave, we've connected over 300 devices across our Thailand facility - all seamlessly integrated into our global systems. This real-time connectivity empowers faster, smarter decision-making on the factory floor, helping us deliver better products with greater efficiency and speed."

- Mr. Ben Dobbs, *Managing Director, Alliance Laundry Thailand Co., Ltd.*

"Today, 85% of enterprises consider 5G networks and connectivity essential to achieving their digital transformation goals. It's not just about faster speeds - it's about unlocking new capabilities across automation, AI, and real-time operations."

- GSMA Intelligence

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AI-Powered Neural Network Traffic Intelligence for Smarter Urban Mobility

CelcomDigi and key government authorities transform AI neural network traffic intelligence in Malaysia

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Data-Led Traffic Insights for Malaysia's Urban Mobility Future

AI and Government Collaboration Enable Smarter, More Predictive Traffic Flow Management

CelcomDigi has introduced Malaysia's first AI-powered neural network traffic intelligence platform to enhance urban mobility through a data-led, scalable framework. Developed in collaboration with MyDigital, MDEC, DNB, and MBPJ, the pilot leverages telco intelligence and multi-source government data to model congestion, optimise traffic light cycle time, and enable more efficient transport interventions. The solution reduces reliance on large-scale IoT or CCTV infrastructure by using existing data sources, making it highly cost-efficient and replicable. Set to pilot across PJ Sentral, SS2, and LDP in Petaling Jaya, the initiative supports Malaysia's Digital Economy Blueprint and sets the foundation for nationwide smart mobility expansion.

celcomdigi

Clients and Partners Involved

Collaboration for a Data-Led, Scalable Traffic Management Framework

CelcomDigi is reimagining urban infrastructure with intelligent traffic management solutions powered by AI, data, and neural networks to drive greater mobility, safety, and urban efficiency. The initiative leverages telco intelligence and multi-source data collaboration to enable impactful and replicable smart mobility solutions. CelcomDigi collaborated with key government authorities, MyDigital Corporation (MyDigital), Malaysia Digital Economy Corporation (MDEC), Digital Nasional Berhad (DNB), and the Petaling Jaya City Council (Majlis Bandaraya Petaling Jaya, MBPJ), to build a data-led, scalable, and cost-efficient traffic management framework. The pilot is set across several areas within the Damansara constituency in Petaling Jaya (PJ) City, namely PJ Sentral, SS2, and areas along the Damansara–Puchong Expressway (LDP), with expansion to wider areas planned. The Phase 1 pilot represents Malaysia's first AI-powered traffic intelligence platform using neural networks and marks a significant milestone as a large-scale traffic intelligence solution.

Overview of the Solution

AI and Multi-Source Data as the Foundation for Urban Traffic Intelligence

CelcomDigi's solution is built around an AI-powered traffic intelligence platform that uses neural networks, telco intelligence, and multi-source data from state and federal agencies. This data-first approach brings together information such as traffic light phasing and cycle time, number of road lanes, planned roadworks and closure schedules, CCTV records to create a more comprehensive and predictive traffic management model.

To obtain information effectively and in near real-time from the traffic light sections, the AI neural networks rely on an infrastructure that is low latency, secure, ultra-reliable, and scalable, capabilities enabled by 5G network. The collaboration resulted in an initial concept showcase at the Smart City Expo 2025, supporting Malaysia's Digital Economy Blueprint and advancing national smart city ambitions. The platform is designed to reduce congestion caused by peak-hour queue times and enable more efficient transport intervention strategies to optimise travel times.

AI-Powered Neural Network Traffic Intelligence for Smarter Urban Mobility

Challenges

Addressing Congestion, Queue Times, and Planning Constraints

The initiative is designed to solve major urban mobility challenges in Malaysia, particularly rising traffic congestion, long queue times at intersections, and structural planning issues that disrupt smooth traffic flow. Without real-time and integrated data, authorities struggle to respond quickly to incidents or adjust traffic patterns effectively. A key challenge is finding cost-efficient alternatives to large-scale CCTV and IoT deployments, which are expensive and difficult to scale. By using existing telco data and AI modelling, the project aims to overcome these limitations and improve overall traffic management. These issues significantly affect productivity and quality of life in Malaysia's cities, making a data-led and scalable approach essential for the pilot.

Objectives

A Data-First, Replicable Model to Improve Mobility and Urban Efficiency

The main objective of this initiative is to build a data-led traffic management framework that can improve mobility, safety, and urban efficiency across Malaysia. By using AI-powered neural networks and combining telco intelligence with data from state and federal agencies, the project aims to create a more predictive and effective way to manage traffic. The solution focuses on reducing costly large-scale IoT deployments with a smarter, more efficient approach that leverages existing telco data. Another key goal is ensuring the framework can be replicated across different urban or rural areas, starting with the pilot zone in Petaling Jaya. Ultimately, the objective is to reduce peak-hour congestion, shorten queue times at intersections, and enable better decision-making for transport interventions, supporting Malaysia's broader smart city ambitions under the Digital Economy Blueprint.

Strategies and Implementation

Telco Intelligence, Government Data, and AI Neural Networks at Pilot Scale

By collaborating closely with MyDigital, MDEC, DNB, and MBPJ, the project brings together the necessary datasets, such as traffic light phasing and cycle time, number of road lanes, planned roadworks and closure schedules, and CCTV records to create a more predictive, automated, and cost-efficient traffic model. Instead of relying on expensive, large-scale CCTV and IoT infrastructures, the solution uses existing telco data to model real traffic conditions and generate accurate forecasts.

From a network perspective, the AI system depends on a low-latency, secure, ultra-reliable, and scalable infrastructure, aligning with the capabilities provided by 5G network. The initial concept showcase at the Smart City Expo 2025 demonstrates how this integrated approach supports Malaysia's Digital Economy Blueprint and accelerates progress toward smart city goals. With the pilot set to be implemented across PJ Sentral, SS2, and areas along the LDP in the Damansara constituency, the initiative sets a foundation for wider deployment across Malaysia.

Achievements and Significance

Expected Outcomes for Smart Traffic Operations and Planning

The solution is designed to deliver smarter traffic light management by using AI to dynamically optimise signal cycles and reduce queue times during peak periods. It is also expected to generate predictive insights that support more effective urban planning, including guidance for road design and infrastructure improvements. Additionally, the framework anticipates enabling dynamic road diversion strategies to ease congestion during heavy traffic or emergencies.

These expected outcomes highlight the importance of real-time, integrated data in helping authorities respond more effectively to incidents and make timely adjustments to traffic flows. With Phase 1 showcased at the Smart City Expo 2025, the pilot represents a major milestone toward broader deployment, serving as the foundation for scaling the platform across additional locations based on its progress.

Lessons Learned

Early Insights from a Data-Led, Scalable Approach

This collaboration with MBPJ has demonstrated that a data-led approach is essential for developing intelligent traffic systems that can be expanded across Malaysia. One of the key lessons is that combining telco intelligence with multi-source government data makes it possible to create a smarter and more scalable urban mobility framework. The project also highlights the importance of using existing telco data instead of relying on costly and extensive IoT infrastructure, allowing the model to remain cost-efficient and replicable. This early phase confirms that the framework can be adapted to different urban or rural areas, and it sets the foundation for expanding intelligent transportation systems nationwide.

Conclusion

A Foundation for Predictive, Replicable Smart Mobility in Malaysia

CelcomDigi's initiative brings together telco intelligence, AI neural networks, and multi-source government data to address long-standing mobility challenges in Malaysia, particularly congestion, extended queue times, and limited real-time visibility in traffic management. By adopting a data-led approach that uses existing telco insights instead of large-scale IoT or CCTV deployments, the project provides a cost-efficient alternative to conventional traffic monitoring methods. The platform's ability to integrate state and federal inputs, such as traffic light phasing and cycle time, number of road lanes, planned roadworks and closure schedules, and CCTV records creates a more predictive ecosystem for traffic planning and incident response. Through its pilot deployment in Petaling Jaya, supported by MyDigital, MDEC, DNB, and MBPJ, the solution establishes the groundwork for smarter urban operations aligned with the Malaysia Digital Economy Blueprint. This early implementation positions the platform as a scalable model for future smart mobility systems across other Malaysian cities experiencing similar congestion and planning constraints.

Future Plans

Scaling to Wider Areas and Building a Robust Digital Transportation Ecosystem

The AI-powered neural networks traffic intelligence pilot in Petaling Jaya is the first step toward scaling intelligent traffic systems nationwide to major cities across Malaysia. The project is set to pilot across PJ Sentral, SS2, and areas along the LDP within the Damansara constituency, with expansion to wider areas soon. The stated aim is to create a robust digital ecosystem for intelligent transportation through a data-led, scalable, and cost-efficient framework that can be replicated across urban or rural zones with traffic issues. The network perspective continues to emphasize low latency, security, ultra-reliability, and scalability aligned with what 5G network can provide to support AI processing and decisioning.

"AI-powered traffic intelligence demonstrates how data collaboration and advanced connectivity can transform urban mobility. By combining telco insights with multi-agency datasets, we can help cities plan better, respond faster, and build smarter transport ecosystems for Malaysia's digital future."

T. Kugan
Chief Innovation Officer, CelcomDigi

Redefining Malaysia's Logistics Landscape with 5G-Powered AI Autonomous Warehousing

CelcomDigi with Ecosytem Partners Drive Autonomous Warehousing to Advance National Supply Chain Resilience

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5G-Powered Intelligent Warehousing: Transforming Malaysia's Logistics Landscape

CelcomDigi, in collaboration with ecosystem partners including ZTE, DHL Supply Chain among others, is redefining warehouse operations with 5G-powered AI autonomous solutions. Leveraging robotics, drones, and computer vision, the initiative delivers real-time automation and seamless inventory control. Early implementations have achieved up to 20 times faster stock counting, 40% space optimization, and 57% quicker turnaround times. Supported by Malaysia's Digital Economy Blueprint, the project strengthens supply chain resilience and showcases how 5G, AI, and IoT integration can create smarter, safer, and more sustainable logistics networks, positioning Malaysia as a regional leader in next-generation warehousing innovation.

Clients and Partners Involved

Collaboration Driving Malaysia's 5G-Powered Intelligent Warehousing

CelcomDigi is leading Malaysia's logistics transformation through strategic collaboration with ecosystem partners and industry players, including ZTE, DHL Supply Chain among others. The initiative focuses on implementing 5G-powered AI autonomous warehousing solutions to modernize logistics operations and strengthen supply chain resilience in alignment with Malaysia's Digital Economy Blueprint.

The deployment span multiple key locations, DHL warehouses in Shah Alam and Penang and CelcomDigi's own warehouse in Shah Alam. These facilities serve as pilot and reference sites for end-to-end automated warehousing models powered by AI, robotics, and IoT, supported by CelcomDigi's widest, fastest, and secured 5G and 4G LTE network.

Overview of 5G Network Deployment

Enabling Real-Time Automation Through Intelligent 5G, AI and IoT Connectivity

The intelligent warehousing initiative leverages CelcomDigi's 5G and IoT technologies to enable real-time automation, visibility, and precision across logistics operations. Supported by Malaysia's widest, fastest, and secure network, the system integrates AI, robotics, and computer vision to create a fully autonomous warehouse ecosystem.

By deploying AI-driven and 5G-powered solutions through autonomous drones, automated guided vehicles (AGVs), and IoT devices, we are able to improve operational accuracy and efficiency. Low-latency and high-reliability connections allow for continuous automation, inventory verification, and remote monitoring, reducing human dependency and error.

By combining 5G, IoT, and automation, CelcomDigi and its partners are transforming warehouse management into a data-driven, high-efficiency model, improving productivity, reducing costs, and strengthening national supply chain resilience in line with Malaysia's Digital Economy Blueprint.

Redefining Malaysia's Logistics Landscape with 5G-Powered AI Autonomous Warehousing

Challenges

Overcoming Inefficiency, Cost Pressures, and Data Gaps in Traditional Warehousing

Before the introduction of 5G-powered automation, Malaysia's logistics and warehousing operations faced multiple persistent challenges. Manual processes led to slower task completion, higher labor costs, and frequent human errors, directly impacting efficiency and profitability. Rising fuel price volatility added further financial pressure, complicating budgeting and increasing transportation expenses.

Customer expectations also evolved rapidly, requiring faster delivery and sustainable operations. However, longer lead times and a lack of real-time visibility made it difficult to meet these expectations. Inventory tracking and warehouse management often relied on outdated, manual methods, resulting in stock discrepancies and delayed responses to market shifts.

Additionally, poor data integration and limited analytical capabilities hindered effective decision-making. Without real-time information, operators struggled to optimize space, plan resources, or adjust to fluctuating demand, underscoring the urgent need for a smarter, data-led logistics solution powered by advanced connectivity.

Objectives of the 5G Deployment

Transforming Logistics Operations Through Intelligent, Automated, and Efficient Warehousing

The primary goal of the 5G-powered AI Autonomous Warehouse initiative is to revolutionize Malaysia's logistics and warehousing sector by integrating intelligence, automation, and real-time connectivity into daily operations. The deployment seeks to achieve smart operations within warehouses by automating key tasks, connecting devices seamlessly, and enabling adaptive, intelligent workflows driven by data and AI.

A second objective is to optimize efficiency, productivity, and compliance. Through predictive maintenance, automated monitoring, and streamlined processes, the initiative aims to maximize labor utilization, space management, and operational accuracy while proactively addressing compliance and risk management requirements.

Lastly, the project serves as a reference model for innovation, demonstrating to clients and industry partners how 5G, AI, and robotics can reshape logistics performance. It reflects CelcomDigi's broader vision of positioning Malaysia as a regional digital powerhouse in supply chain and industrial transformation.

Innovative 5G Solutions for Smart Warehousing

Automation, Robotics, and AI at the Core of Digital Logistics

The 5G-powered AI Autonomous Warehouse integrates advanced technologies such as autonomous drones, computer vision, and robotics to deliver fully automated, end-to-end warehousing solutions. These systems are designed to handle critical tasks including stock-taking, verification, and movement of goods, significantly reducing human labor dependency and eliminating operational errors.

Through 5G-enabled real-time connectivity, all devices communicate seamlessly, supporting autonomous guided vehicles (AGVs), reconciling all records to the digital warehouse management system (WMS), and robotics-based automation workflows. This interconnected setup allows precise coordination between machines and data systems, ensuring continuous visibility and optimized control of inventory.

By leveraging Malaysia's widest and most reliable digital network, CelcomDigi's solution enhances efficiency, scalability, and reliability for partners such as DHL, CEVA Logistics, and its own facilities in Shah Alam.

Achievements and Significance

Quantifiable Efficiency Gains and Operational Transformation

The implementation of CelcomDigi's 5G-powered AI Autonomous Warehouse has delivered measurable improvements in warehouse operations, accuracy, and efficiency. Stock counting operations achieved up to 20 times greater efficiency, while automated high-density storage led to a 40% reduction in required space. Inbound and outbound processes became 57% faster, significantly enhancing turnaround times.

Operational accuracy has also advanced, with inventory scanning and verification reaching up to 100% precision, virtually eliminating manual discrepancies. In addition, automation has contributed to 50% savings on third-party labor and equipment, reflecting major cost efficiencies. Energy use was optimized through reduced electricity consumption and improved space utilization, reinforcing sustainable warehouse practices.

Together, these outcomes position CelcomDigi and its partners, ZTE and DHL Supply Chain as front-runners in driving 5G-enabled digital logistics across Malaysia.

Lessons Learned and Future Plans

Scaling Innovation and Strengthening Malaysia's Digital Supply Chain

The deployment of the 5G-powered AI Autonomous Warehouse has underscored the critical role of automation and next-generation connectivity in transforming logistics operations. Key takeaways highlight the value of integrating 5G, AI, and robotics to enhance efficiency, accuracy, and cost-effectiveness while reducing manual intervention. The collaboration among CelcomDigi and its ecosystem partners has shown that digital innovation, when applied to logistics infrastructure, can redefine operational resilience and agility.

Moving forward, CelcomDigi will continue evaluating and expanding the implementation of 5G-powered AI autonomous drones and robotic inventory management systems across warehouses nationwide. The company has been selected under the Bengkel Inovasi GLC (BIG) programme, organized by the Ministry of Finance (MOF) in collaboration with the Ministry of Science, Technology and Innovation (MOSTI) and Cradle. This initiative enables further endorsement and funding to scale next-generation logistics innovation powered by 5G, AI, and robotics, supporting Malaysia's transition toward a resilient digital economy.

Conclusion

Redefining Logistics Through 5G-Driven Automation and Intelligence

CelcomDigi's 5G-powered AI Autonomous Warehouse represents a major step toward redefining Malaysia's logistics landscape through digital transformation. By integrating AI, robotics, and IoT over advanced 5G connectivity, the initiative demonstrates how technology can streamline warehouse operations, enhance accuracy, and reduce operational costs. The collaboration with key industry partners such as ZTE and DHL Supply Chain reflects a united effort to strengthen Malaysia's supply chain resilience and advance the goals of the Digital Economy Blueprint.

The project's success underscores the practical value of 5G in creating data-driven, intelligent logistics systems capable of real-time coordination and automation. It positions CelcomDigi as a leader in enabling smart warehousing innovations that drive efficiency and sustainability. As implementation expands nationwide, this initiative sets a strong precedent for Malaysia's transition toward a more connected, efficient, and technology-empowered logistics ecosystem.

Future Outlook and Next Steps

Scaling 5G-Powered Warehousing Across Malaysia's Logistics Network

Building on the success of the 5G-powered AI Autonomous Warehouse initiative, CelcomDigi is preparing to extend its next-generation warehousing model across Malaysia. The company plans to continue evaluating and deploying 5G-enabled autonomous drones and robotic inventory systems nationwide, strengthening supply chain resilience and operational intelligence.

CelcomDigi's selection under the Bengkel Inovasi GLC (BIG) programme, organized by the Ministry of Finance (MOF), in collaboration with MOSTI and Cradle, marks a significant endorsement of this vision. Through this initiative, CelcomDigi will further accelerate logistics digitalization by combining 5G, AI, and robotics to enhance efficiency, sustainability, and productivity across warehouse ecosystems.
This expansion supports Malaysia's ambition to build a resilient digital economy, where smart logistics and industrial automation play a vital role in achieving national digital transformation goals under the Digital Economy Blueprint.

"5G is more than a network, it's the foundation for intelligent logistics ecosystems. Through our 5G-powered AI Autonomous Warehouse initiative, we're enabling Malaysia's logistics sector to operate with precision, sustainability, and resilience. This collaboration demonstrates how digital innovation, powered by 5G, AI, and robotics, can redefine efficiency and strengthen national supply chain capabilities for the future."

T. Kugan
Chief Innovation Officer, CelcomDigi

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Private 4G–5G Networks for Smarter Industries: Indosat Ooredoo Hutchison's Blueprint for Indonesia

Enabling Smart Manufacturing, Mining, and Energy Operations through Secure Edge Connectivity in Indonesia

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Smart Industry Transformation in Indonesia
Private 4G–5G Networks Driving Industrial Digitalization

Indosat Ooredoo Hutchison, in collaboration with key partners from global technology companies, including Cisco, HPE, Huawei, Nokia, Weatherford and ZTE, has deployed nationwide private 4G and 5G networks to modernize Indonesia's energy, mining, and manufacturing sectors. The initiative delivers 99–100% coverage, 30% downtime reduction, and 25–30% productivity gains through edge computing, AI analytics, and automation. Enhanced safety and 25% energy-efficiency improvements align with ESG goals, while the model's expansion to SEZs such as Smart Manufacturing & Integrated Township Developer, Cross-Border Manufacturing & Digital Gateway, Smart & Sustainable Manufacturing Destination accelerates industrial digitalization. This large-scale deployment positions Indonesia as a leader in sustainable, intelligent industrial connectivity across Asia Pacific.

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Clients and Partners Involved

Collaborative 5G Deployment for Industrial Transformation

The private 4G and 5G network deployment across Indonesia was led by Indosat Ooredoo Hutchison, in collaboration with key partners from global technology companies, including Cisco, HPE, Huawei, Nokia, Weatherford and ZTE. The initiative covered various industrial sectors and locations, including digital oil field modernization in Duri, Riau, smart mining with fleet tracking and AI safety systems in Sulawesi and Sumbawa, smart factory automation and AI inspection in Java, and plantation and pulp logistics digitalization in Sumatra. The deployment involved private LTE and 5G networks across key industrial regions and has been fully implemented and operational in multiple customer sites. The model is now being scaled to industrial estates and Special Economic Zones, including Smart Manufacturing & Integrated Township Developer, Cross-Border Manufacturing & Digital Gateway, Smart & Sustainable Manufacturing Destination

Overview of the Private 4G–5G Network

Building Secure, High-Performance Connectivity for Industrial Operations

The 5G-enabled private network architecture deployed across Indonesia combines the strengths of private and hybrid slicing models to meet the high demands of industrial environments. Operating on licensed spectrum bands at 900 MHz, 1800 MHz, and 2100 MHz, the system integrates local EPC and 5GC cores to ensure complete on-premises data sovereignty.

Edge computing is a key component, deployed on-site to support AI analytics, real-time monitoring, and automation. This distributed computing model reduces latency and enables deterministic performance critical for industrial IoT, SCADA systems, and AI-powered applications.

From a performance standpoint, the network delivers latency below 30 milliseconds, with sub-10 ms latency achieved on 5G NR deployments. Network availability consistently exceeds 99.5%, enabling reliable, always-on connectivity even in remote or metallic environments.

To ensure robust security, the network uses industrial-grade SIMs, private APNs, and isolated local cores. These elements safeguard data integrity and support critical systems including SCADA, IoT devices, AI CCTV, and predictive maintenance. The design ensures that operations can run with precision, safety, and efficiency which is vital for mission-critical industries.

Private 4G–5G Networks for Smarter Industries: Indosat Ooredoo Hutchison's Blueprint for Indonesia

Overcoming Operational Challenges

Addressing Connectivity and Safety Barriers in Industrial Environments

Before the implementation of private 4G and 5G networks, industries across Indonesia faced persistent connectivity and operational challenges. Many remote or metal-rich sites experienced weak or unreliable signal coverage (RSRP < –110 dB), resulting in communication blind spots and frequent system downtime. Operations were often hindered by fragmented monitoring systems and delayed data flow, making it difficult to respond quickly to safety incidents or equipment malfunctions. Energy inefficiencies and lack of real-time visibility further compounded productivity losses.

Public LTE and Wi-Fi networks proved inadequate for mission-critical operations, as they could not deliver the necessary reliability, low latency, or security required for industrial automation. These challenges created a strong imperative for a new generation of industrial connectivity — one capable of supporting automation, safety systems, and data-intensive AI applications in even the most demanding environments.

Driving Transformation Through 5G

Strategic Objectives for Industrial Modernization

The key objective of the initiative was to modernize industrial operations through the deployment of private 4G and 5G networks. Indosat Ooredoo Hutchison aimed to establish a deterministic, interference-free connectivity layer capable of supporting AI-driven automation, connected workers, and digitalized production environments.

By integrating ultra-low latency and edge computing capabilities, the project sought to enhance safety, efficiency, and sustainability across Indonesia's industrial landscape. Another crucial objective was to ensure local data sovereignty through on-premises processing, particularly for sectors dealing with sensitive operational information such as oil, gas, and mining.

Scalability was also a primary goal, allowing the model to expand seamlessly across multiple sites and industrial zones. By supporting energy optimization, automation, and AI analytics, the initiative directly contributes to ESG compliance targets, enabling industries to reduce emissions and improve resource utilization.

Innovative 5G Solutions and Implementation

Integrating Edge Intelligence and Hybrid Connectivity for Industrial Excellence

To overcome traditional connectivity barriers, Indosat Ooredoo Hutchison implemented a combination of Private LTE and 5G hybrid architectures, utilizing licensed spectrum and localized network cores for full operational independence.

The rollout included edge computing infrastructure that supports AI analytics for automation and safety applications, such as AI-powered CCTV for hazard detection and predictive maintenance systems for equipment reliability. The network supports Autonomous Guided Vehicles (AGVs) and other mobile robotic systems through its ultra-low-latency design, ensuring real-time responsiveness.

In industries such as oil and gas, the private LTE network connects thousands of wells via real-time SCADA and telemetry, delivering 99.5% uptime and a 40% improvement in field response. Mining operations leverage AI-based safety systems, environmental IoT, and fleet tracking to reduce accident risk by 30%. Meanwhile, smart factories in Java utilize Private 5G NR and edge servers for AI inspection and zero-lag video analytics, driving unprecedented automation precision.

This unified network design enables consistent performance, reliability, and security across geographically diverse and operationally complex industries.

Transformative Achievements and Impact

Quantifiable Results and Sustainable Industrial Growth

The deployment of private 4G and 5G networks across Indonesia has delivered substantial operational, safety, and business benefits for a wide range of industrial sectors. From energy and mining to manufacturing and logistics, each implementation has demonstrated measurable improvements in efficiency and reliability.

Operationally, the networks achieved between 99 and 100 percent coverage, successfully eliminating previous connectivity blind spots that once disrupted communications and workflows. Incident response times improved by 40 percent, while fleet operation downtime was reduced by nearly 30 percent. Across mining and manufacturing sites, productivity increased by approximately 25 to 30 percent, illustrating the direct correlation between advanced network infrastructure and enhanced industrial output.

In terms of safety and environmental performance, AI-driven monitoring and predictive analytics reduced accident risks by 30 percent, supporting safer working conditions and proactive risk management. Energy efficiency also improved by 25 percent through greater automation and optimized resource utilization, aligning the project's outcomes with broader ESG objectives and sustainability goals.

From a business perspective, the private 4G–5G rollout contributed to a notable reduction in operational expenditure by minimizing downtime and reducing the dependence on manual monitoring. It also opened new revenue streams for Indosat Ooredoo Hutchison through the expansion of industrial connectivity services. Moreover, the proven success of the model led to its adoption by multiple industrial partners, facilitating replication and scaling across industrial estates and Special Economic Zones nationwide. These quantifiable results underscore the pivotal role of private LTE and 5G technologies in enabling smarter, safer, and more sustainable industrial ecosystems across Indonesia.

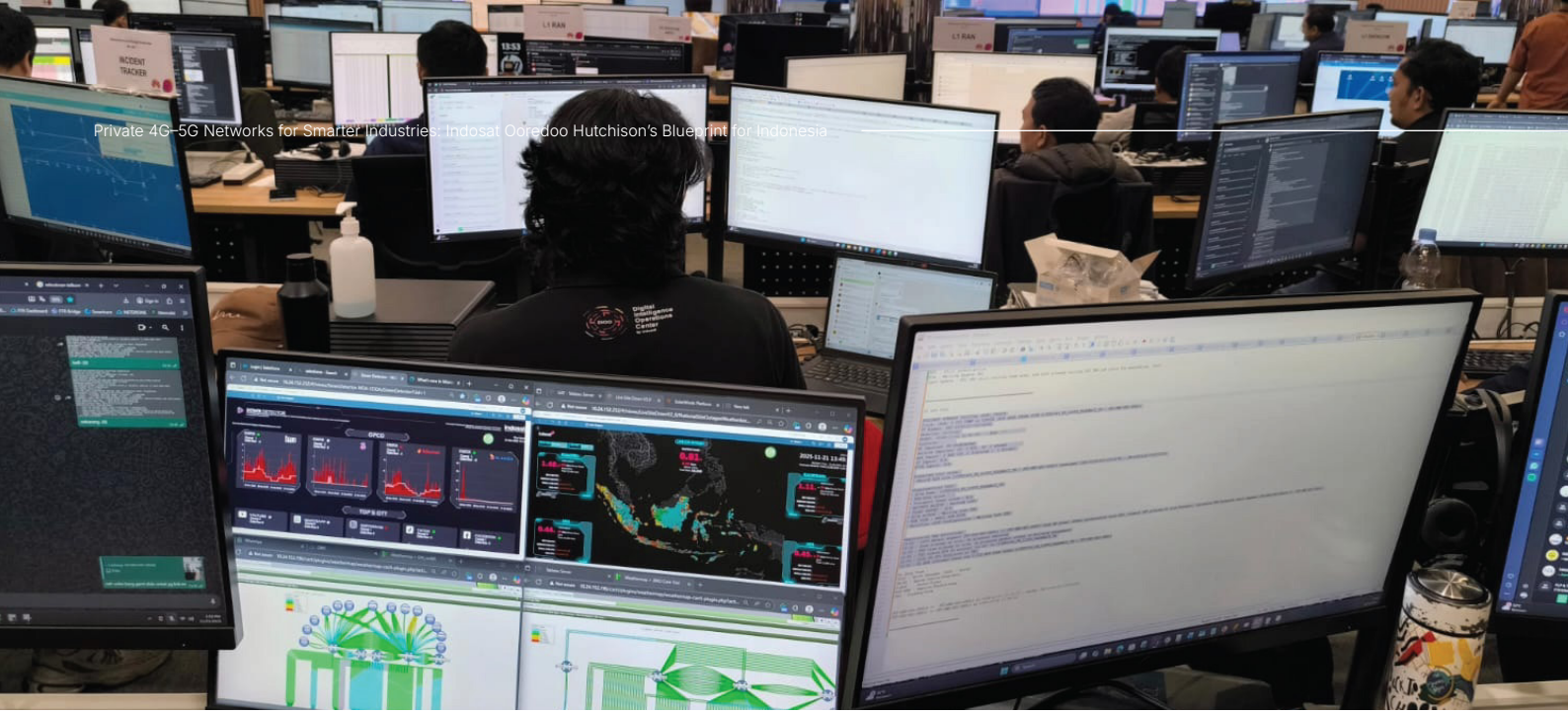
Lessons Learned

Insights from Implementation and Integration

The experience gained through nationwide industrial 5G deployments has offered valuable lessons for all stakeholders. One key learning is that licensed Private LTE remains essential for reliability, particularly in areas where Wi-Fi networks are unreliable or obstructed.

Deploying local edge cores proved critical to maintaining ultra-low latency and protecting sensitive data, ensuring operations remain uninterrupted even during public network disruptions. The use of hybrid slicing enabled seamless worker mobility while preserving network security, demonstrating the flexibility of 5G for multi-site and dynamic environments.

Perhaps most importantly, the project reaffirmed that strong collaboration among operators, enterprises, and technology vendors is vital for successful integration. Close alignment between network design, industrial processes, and ESG goals ensures that technology deployment directly contributes to measurable outcomes.



Future Plans

Expanding the Blueprint for Smart Industrial Ecosystems

Building on the success of current deployments, Indosat Ooredoo Hutchison is well equipped to extend its private network capabilities to major SEZs and industrial estates, from Smart Manufacturing & Integrated Township Developers to Cross-Border Manufacturing & Digital Gateways, as well as Smart & Sustainable Manufacturing destinations. Indosat can also enable advanced solutions such as the AI Data Analytics Platform (iDA) for real-time operational intelligence, along with a SOC + ZTNA–based cybersecurity framework designed to deliver stronger and more adaptive network protection.

The company is also well positioned to bring "0 Bit 0 Watt" green connectivity model to industries seeking to minimize idle power consumption, while enabling 5G-driven automation for robotics, drones, and autonomous vehicles. These capabilities strengthen Indonesia's pathway toward sustainable and intelligent industrial connectivity.

"Private LTE and 5G are the foundation for Indonesia's industrial future. Indosat Ooredoo Hutchison empowers enterprises to operate smarter and safer — connecting people, machines, and AI into one digital ecosystem."

Muhammad Danny Buldansyah
Director & Chief Business Officer,
Indosat Ooredoo Hutchison

"Reliable and intelligent connectivity transforms how industries run. Indosat Ooredoo Hutchison delivers secure, low-latency networks that enable automation, analytics, and sustainability."

Ganda Pradita
SVP Enterprise Product & Solution,
Indosat Business

"Indosat Business provides Connectivity and IoT solutions as the fundamental enablers of digital transformation in the mining sector, including in remote areas such as Sumbawa Timur Mining. With reliable network infrastructure and IoT-based monitoring technology, we can now collect operational data in real time, maintain stable communication between sites, and automate reporting processes that were previously done manually.

This collaboration has helped us extend connectivity to the Nangadoro area and eliminate blank spots within our operational zones. Our digital infrastructure is now far more capable of supporting work efficiency, field management, and long-term expansion.

Together with Indosat Business, we are building the foundation for a smarter, more efficient, and sustainable digital mining operation."

Christianus Mangiwa
IT Manager, PT Sumbawa Timur Mining

Smart Port Transformation in Indonesia with 5G AI

Telkomsel's 5G AI Deployment Enhances Efficiency and Safety Across the Nation's Largest Port Network

Smart Port, Smarter Future
5G AI Driving Efficiency and Safety in Indonesia's Logistics

Telkomsel and Huawei have implemented a 5G-powered Smart Port solution to modernize Indonesia's largest port network. Built on a private 5G backbone, the project integrates AI surveillance, automated gates, and AI tallying to improve efficiency and safety. Truck gate processing time was reduced from five minutes to ten seconds, while centralized monitoring strengthened incident response. A unique backup core reduced infrastructure by 40%, lowering costs and enabling scalability across more than 100 ports. The initiative provides a replicable model for smart logistics transformation in Asia Pacific.

Telkomsel by Telkom Indonesia

HUAWEI

Clients and Partners Involved in This 5G Deployment

Telkomsel, Indonesia's largest digital telecommunications provider, has taken a major step toward modernizing national logistics with the launch of a 5G-powered Smart Port solution. The initiative was realized in collaboration with Huawei, which contributed network equipment, AI platforms, and integration services tailored for large-scale industrial use. The project addresses the operational challenges of Indonesia's busiest port environments, where heavy machinery, congestion, and complex logistics demand advanced connectivity. By leveraging a 5G private network integrated with AI applications, the deployment demonstrates how critical infrastructure can be transformed to meet the country's ambition of becoming a global maritime hub.

Overview of 5G Network Deployment

Private 5G Architecture Delivering Secure, High-Performance Connectivity

Telkomsel deployed a dedicated 5G private network to provide secure, high-speed, and low-latency connectivity across port operations. The system supports seamless device handovers, edge computing integration, and deterministic quality of service for mission-critical applications. Compact base stations reinforce reliability even under adverse conditions or emergencies, while the use of licensed spectrum eliminates interference in the metal-dense port environment. With throughput of up to 1 Gbps per user, the deployment ensures stable connectivity for automation, monitoring, and coordination, embedding digital intelligence into every layer of port operations.

Smart Port Transformation in Indonesia with 5G AI

Challenges in Deploying Wireless Connectivity for Ports

Overcoming Legacy Systems and Inefficiencies in Complex Environments

Before the introduction of 5G, ports relied on Wi-Fi and fiber connections, both of which proved inadequate. Wi-Fi coverage was unstable and prone to interference, while fiber was costly, inflexible, and slow to deploy across wide areas. Safety systems were fragmented, relying on manually monitored camera feeds that delayed response times and limited visibility across large facilities. Traffic congestion was another major issue, with manual gate checks taking at least five minutes per truck, creating long queues and service delays. Operations remained heavily dependent on manpower, from crane shifts to weather-affected tallying, while security lacked predictive intelligence. Finally, scaling traditional 1+1 private core solutions across more than 100 ports nationwide would have driven excessive capital and operating expenditure, creating redundancy and maintenance complexity.

Objectives of the 5G Network Deployment

Enhancing Connectivity, Efficiency, and Nationwide Scalability

The project was designed to deliver reliable and seamless connectivity across sprawling port environments, enabling real-time visibility and faster decision-making. A key objective was to cut gate processing delays and improve throughput by automating data capture and verification. Safety goals centered on introducing AI-powered surveillance to provide proactive monitoring and reduce incident response times. The deployment also aimed to automate tallying processes, reduce reliance on outdoor staff, and mitigate weather-related inefficiencies. At a national scale, the initiative sought to lower costs and complexity by moving away from redundant core architectures, creating a scalable model that could be replicated across more than 100 Indonesian ports.

Innovative 5G Solutions for Smart Port Operations

AI Surveillance, Smart Gates, Automated Tallying, and Centralized Backup Core

Telkomsel and Huawei introduced a series of innovations anchored by a private 5G backbone. AI-powered surveillance systems consolidated fragmented camera feeds into a unified command center, delivering real-time alerts and predictive monitoring to improve safety. Smart gate automation replaced manual checks with license plate recognition, ID scanning, cargo data capture, and sensor integration, reducing truck processing time from five minutes to just ten seconds. AI tallying automated damage detection and logging, moving operations indoors and improving both safety and accuracy. To address scalability, a centralized backup private network architecture was introduced, reducing the number of deployed backup nodes by 40%. This design significantly lowered capital and operational expenditure while ensuring high availability and simplified nationwide management.

Achievements of the 5G Deployment

Efficiency Gains, Safer Operations, and a Replicable National Model

The deployment has already delivered measurable results. Gate processing times were reduced by more than 95%, easing congestion and improving overall vehicle throughput. AI tallying improved detection accuracy, reduced reliance on outdoor staff, and enhanced worker protection. Safety levels increased with real-time surveillance and faster response to abnormal activity, reducing risks such as theft and unauthorized access. The system's modular design provides a flexible foundation for future enhancements, including digital twins, IoT sensor networks, and integration with enterprise platforms. With its centralized architecture, the model is scalable across Indonesia's 100+ ports, directly supporting the government's strategy of establishing the country as a global maritime axis.

Valuable Insights from the Deployment

Scalable Design and Intelligent Visibility Are Key to Industrial 5G

The Smart Port initiative demonstrated that licensed-spectrum 5G can outperform Wi-Fi and fiber in complex, mobile industrial environments where reliability and seamless handovers are essential. Integrating AI-driven monitoring strengthened both operational transparency and worker safety, replacing manual oversight with predictive intelligence. The centralized backup core proved crucial in reducing infrastructure duplication, simplifying management, and lowering costs while ensuring resilience. Embedding edge computing ensured uninterrupted operations even during backbone disconnections, underlining the importance of distributed intelligence in critical logistics environments.

Conclusion of the 5G Smart Port Deployment

Setting a Benchmark for Digital Logistics Transformation

The Smart Port deployment illustrates how a 5G private network, combined with AI and automation, can redefine operational standards in logistics. By reducing gate delays, enhancing safety, and cutting costs through centralized design, Telkomsel and Huawei have created a transformative platform that addresses both immediate challenges and long-term scalability. The initiative positions Indonesia's ports at the forefront of digital innovation and establishes a repeatable model for modernizing critical infrastructure across Asia Pacific.

Future Outlook for Smart Port Expansion

Toward Autonomous Ports and Integrated National Platforms

The Smart Port solution will continue to evolve with the adoption of predictive analytics, automated cranes, advanced robotics, and deeper AI integration. Future plans include linking port operations with national logistics and customs systems to create a fully digital trade facilitation platform. As the architecture matures, the model will expand across additional ports and industrial zones, offering a lighthouse example for smart logistics transformation throughout the region.

"With Telkomsel's 5G AI Smart Port solution, congestion has been significantly reduced and safety boosted across Indonesia's ports, building a scalable foundation for national logistics excellence. This transformation offers a glimpse into the future of intelligent, connected infrastructure for Indonesia and beyond."

Kwok Wai Kiat, VP - *Enterprise Product Management and Development Telkomsel*

"Huawei's partnership with Telkomsel has delivered advanced AI and 5G solutions that empower Indonesia's ports with real-time operations, predictive security, and enhanced efficiency. Together, we are setting new standards in smart logistics and unlocking greater potential for maritime operations across the region."

- Wang Xu, *Director of Telkomsel Account Department, Huawei Indonesia*

GSMA

Telkomsel – Pegatron 5G Smart Manufacturing Lighthouse in Batam

5G Standalone (SA) at the Core of Smart Manufacturing Enhancing Safety, Efficiency, and Reliability

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Advancing Smart Manufacturing with a 5G SA Private Network in Batam

Telkomsel and Pegatron 5G have deployed a 5G Standalone (SA) private network at Pegatron's Batam facility. The air-gapped, SIM-based zero-trust design with end-to-end encryption enables <10 ms latency for real-time control, massive IoT connectivity, and network slicing for secure, dedicated bandwidth. Core use cases, AGV automation, AI-driven SOP quality inspection, and predictive maintenance, have delivered measurable gains: >70% faster reconfiguration, 20% cost reduction (50% tied to cabling elimination), +5% OEE, –10% unplanned downtime, and 99.9% AGV uptime.

Telkomsel by Telkom Indonesia

PEGATRON 5G

Clients and Partners in This 5G Deployment

Telkomsel and Pegatron 5G jointly deployed a 5G Standalone (SA) private network at Pegatron's facility in Batamindo Industrial Park, Batam, Indonesia. Telkomsel serves as the prime partner, system integrator, and service provider, delivering licensed spectrum, carrier-grade private 5G Core software, and on-premise MEC to ensure low latency and end-to-end reliability. Pegatron 5G, as the product solution provider and use case owner, contributes its purpose-built 5G RAN and industrial-grade 5G UEs, dongles, CPEs, AGV modules, and cameras.

Together, the two companies have created a fully integrated private network supporting three key smart manufacturing applications: AGV fleet automation, AI-driven quality inspection, and predictive maintenance. This deployment is part of a joint go-to-market (GTM) initiative, showcasing a replicable model for industrial customers across Indonesia.

Overview of 5G Network Deployment

Laying the Digital Foundation for Smart Manufacturing

The Batam facility's 5G SA private network, co-designed by Telkomsel and Pegatron 5G, forms a dedicated, secure, and industrial-grade digital foundation that powers every operation across the 85,000 m^2 plant. The system ensures deterministic performance, low latency, and guaranteed service isolation for all mission-critical workloads.

Unlike Wi-Fi or public cellular networks, this jointly engineered solution integrates Pegatron's RAN and user equipment with Telkomsel's 5G Core and licensed spectrum, providing seamless, carrier-class connectivity for factory automation, video analytics, and predictive maintenance. By positioning 5G SA as a core reliability layer, Telkomsel and Pegatron 5G have built a private enterprise-grade network capable of supporting thousands of connected devices and serving as Indonesia's first 5G Smart Manufacturing Lighthouse.

Telkomsel–Pegatron 5G Smart Manufacturing Lighthouse in Batam

Challenges in Enabling Smart Manufacturing

Overcoming Real-World Hurdles in Batam

- Integrating the veterans (legacy equipment): Many existing machines lacked interfaces/OS support for new 5G dongle drivers. Pegatron and Telkomsel addressed this with custom 5G industrial gateways that translate traditional ports (e.g., RS-485, Ethernet) to 5G, protecting prior capital investments.
- Building a living network: Constant line changes and evolving processes required dynamic tuning. A rapid-response mechanism with AI/ML monitoring enables fast parameter optimization and resource reallocation.
- Fostering human-machine prosperity: Workforce apprehension around automation was addressed via retraining and upskilling into roles such as process supervisors, data analysts, and robotics coordinators.
- Empowering the architects (IT evolution): Traditional IT skills were augmented with RF planning, core management, and mobile troubleshooting through intensive training and collaboration with 5G product teams.

Objectives of Deployment

Establishing a Carrier-Grade, Future-Ready Digital Backbone

The deployment's objective is to build a resilient, enterprise-grade connectivity foundation that delivers predictable, differentiated performance across mission-critical workloads. By adopting 5G SA with on-premise MEC, the factory targets single-digit millisecond latency for real-time automation, massive connectivity for sensors and devices, and secure, dedicated bandwidth via slicing and licensed spectrum. This foundation enables factory-wide wirelessization, real-time data collection, and integration of AI-enabled inspection, predictive maintenance, and AGV automation, advancing OEE and operational agility.

Innovative 5G Solution

Purpose-Built Architecture for Industrial Performance

At Pegatron's Batam facility, digital transformation is anchored on a proven 5G standalone (SA) private network, the hygiene layer that guarantees reliability, responsiveness, and security for every industrial application. Developed jointly with Telkomsel, the solution delivers carrier-grade performance that replaces the unpredictability of legacy systems with deterministic control and consistent throughput across the entire plant.

This architecture transforms the factory floor into a dynamic, real-time environment. Dedicated network slices and quality-of-service tiers ensure that mission-critical functions, such as automated guided vehicles (AGVs), AI-enabled visual inspection, and predictive maintenance, each operate within their own assured bandwidth and latency envelopes. The result is a truly converged industrial ecosystem where thousands of devices communicate seamlessly, video analytics process in real time, and automation systems function without interference.

By positioning 5G SA as the operational hygiene factor, Pegatron 5G and Telkomsel ensured that innovation rests on a stable, predictable network core. The design eliminates performance compromises between applications, allowing production engineers to integrate AI, robotics, and IoT-based sensing with complete confidence in network responsiveness. This consistent reliability has transformed the site into a model of future-ready manufacturing, one that balances cutting-edge technology with the discipline of engineered stability.


Telkomsel–Pegatron 5G Smart Manufacturing Lighthouse in Batam

Achievements and Significance

Measured Impact on Agility, Quality, and Uptime

- Operational agility & cost: Production line reconfiguration time reduced by over 70%; initial deployment costs for new lines reduced by 20%, 50% due to elimination of extensive physical cabling.
- Manufacturing efficiency & quality: OEE increased by 5% within the first year; unplanned downtime reduced by 10%; AI-driven SOP compliance lowered in-process human errors by 30%, reducing scrap and rework.
- Automation & logistics: AGV fleet uptime at 99.9%, with seamless handover eliminating network-related stoppages.
- ESG & governance: Higher OEE reduces energy per unit; predictive maintenance and AI inspection reduce waste; workforce upskilling improves job quality; real-time visibility strengthens governance. These outcomes stem from the SA network's low latency, licensed spectrum, MEC, and secure, air-gapped architecture, enabling reliable real-time control, uplink-heavy video analytics, and massive device connectivity at scale.

Lessons Learned

Principles for Successful Industrial 5G

This Lighthouse project demonstrated that industrial 5G success depends on collaboration between telco operators and manufacturing enterprises. Telkomsel and Pegatron 5G learned that 5G SA is not just connectivity, it's a strategic enabler for production reliability and digital intelligence.

Human–machine synergy and workforce retraining proved vital, while open multi-vendor collaboration avoided lock-in and ensured flexibility. The Lighthouse model, co-led by both companies, serves as a replicable GTM blueprint for similar factories across Indonesia.

Telkomsel–Pegatron 5G Smart Manufacturing Lighthouse in Batam

Future Plans

Scaling Today's SA Foundation and Advancing to 5G-Advanced

In the next 12–18 months, Pegatron 5G and Telkomsel will scale their private 5G network from about 600 to over 1,200 connected devices, supporting more than 4,000 terminals. The partners will execute a joint go-to-market alliance through shared marketing, onboarding new enterprise clients, and establishing Batam as the regional Center of Excellence for industrial 5G. Trials of 5G-Advanced capabilities, such as RedCap for large-scale IoT, enhanced positioning for precise AGV and robotics control, and AI-native network management for self-optimization, are also underway.

Over the next three to five years, Pegatron aims to replicate its Lighthouse Factory model across India, Vietnam, and North America, develop a full-scale digital twin for real-time simulation, and evolve from a solution provider into an open industrial 5G platform leader, empowering a wider ecosystem of innovation.

"Telkomsel remains steadfast in its commitment to be a trusted partner for industries across Indonesia, delivering tailored 5G-based solutions that accelerate digital transformation. Through this collaboration with Pegatron, we demonstrate how advanced connectivity can unlock new levels of efficiency, safety, and sustainability in manufacturing. This initiative reflects our broader mission to empower industries with future-ready digital infrastructure, enabling smarter operations and reinforcing Indonesia's position as a regional leader in industrial innovation."

Wong Soon Nam
Telkomsel's Chief Strategy & Planning Officer

"Telkomsel's support in implementing 5G Smart Manufacturing at PT Pegaunihan Technology Indonesia will help us optimize production processes with more advanced automation and improve labor safety standards. This solution also aligns with our strategy to implement smarter, greener, and more sustainable manufacturing."

CY Feng
General Manager of Pegatron Business Group of Communication Products

Next Gen ULTRA5G: Seamless 5G-A Connectivity Across One Of The World's Longest Sea-Crossing Bridges

U Mobile delivers seamless 5G-A connectivity with speeds of over 500 Mbps and zero dropped calls across the 13.5 km Penang Bridge 1 with Huawei | Malaysia

Driving Malaysia's 5G Future
From Bridge Connectivity to Nationwide Transformation

U Mobile and Huawei have proven seamless 5G-A performance across Malaysia's 13.5 km Penang Bridge 1, achieving average speeds of over 500 Mbps with zero dropped calls at highway speeds. Using MetaAAU, ELAA beamforming, and "0 Bit 0 Watt" energy-saving technology, the trial overcame structural and mobility challenges while reducing power use. Now moving towards commercial rollout, the project marks a critical step in U Mobile's plan to deliver 80% 5G Coverage of Populated Areas (CoPA) by second half of 2026 and expand enterprise adoption through its innovation platform.

Clients and Partners Involved

Driving 5G Innovation Across Malaysia

U Mobile, Malaysia's newest 5G network provider, partnered with Huawei to pioneer an advanced 5G deployment across the 13.5 km Penang Bridge 1, one of the world's longest sea-crossing bridges. This collaboration showcased how next generation solutions like MetaAAU and Extremely Large Antenna Array (ELAA) can be applied to deliver the ULTRA5G experience - high-speed, stable connectivity across complex infrastructure. By eliminating the need for a mid-bridge base station and enabling consistent performance even at vehicle speeds of 80 km/h, this initiative sets a new standard for large-scale 5G rollouts in challenging environments.

Seamless 5G-A Across the Penang Bridge 1

Redefining Connectivity Across One of the World's Longest Sea-Crossing Bridges

The Penang Bridge 1, stretching 13.5 km across the sea, has long posed significant engineering and connectivity challenges. As one of the world's longest sea-crossing bridges, ensuring uninterrupted mobile coverage for commuters has been a persistent hurdle. Traditional network approaches had required installing a 4G base station at the midpoint of the bridge to sustain coverage, but this solution remained limited in capacity and performance, often leaving passengers with inconsistent connectivity.

With the rise of 5G and its role in enabling Malaysia's smart city vision, U Mobile recognised the need for a more resilient and innovative approach. Rather than depending on mid-bridge installations, engineers designed a system where MetaAAU sites, powered by Huawei's Extremely Large Antenna Array (ELAA), were strategically placed at both ends of the bridge. This innovation not only eliminated the need for intrusive structural modifications but also allowed for more efficient network propagation across the entire bridge.

Next Gen ULTRA5G: Seamless 5G-A Connectivity Across One Of The World's Longest Sea-Crossing Bridges

Engineering Against the Elements

Overcoming Distance, Mobility, and Harsh Environments on the Penang Bridge 1

Deploying a seamless 5G-A network across the 13.5 km Penang Bridge 1 meant facing some of the toughest connectivity challenges in the region. The bridge's sheer length demanded precise signal propagation management, ensuring coverage without the traditional reliance on a mid-bridge base station. Adding to the complexity, the structure endures continuous environmental stress — strong winds causing slight movements, coupled with the corrosive effects of saltwater, threaten long-term equipment durability.

High-speed mobility introduced another layer of difficulty. Vehicles traveling at speeds up to 80 km/h required rapid and uninterrupted handovers between network sites. Traditional networks often falter under these conditions, dropping connections during transitions. Placement restrictions only raised the stakes, as structural modifications to the bridge were not viable.

Energy efficiency presented the final challenge. Traffic density on the bridge fluctuates dramatically between peak and off-peak hours, forcing engineers to seek power-saving mechanisms that could reduce energy use without compromising performance. Together, these challenges defined the project's scale — an environment where only next generation 5G-A technologies could succeed.

Defining the Mission

Building a Reliable, Energy-Efficient 5G-A Network for Seamless Mobility

The primary objective of the Penang Bridge 1 deployment was clear: deliver uninterrupted, high-quality 5G connectivity across one of the world's longest sea-crossing bridges. For decades, travelers had to contend with inconsistent coverage and connection drop-offs, as traditional engineering relied on a mid-bridge base station to sustain signals. U Mobile set out to remove that dependency by leveraging advanced 5G-A technologies capable of spanning the full 13.5 km without structural intervention.

Beyond connectivity, the project aimed to enhance the commuter experience — ensuring that passengers could stream 4K video, play latency-sensitive online games, and make uninterrupted calls, even at highway speeds. Equally important was sustainability. With traffic density fluctuating between day and night, the network had to dynamically scale its power use without affecting performance.

Innovative 5G-A Solution

Harnessing MetaAAU and 5G-A Green Technologies for Seamless Coverage

To address the challenges of the 13.5 km Penang Bridge 1, U Mobile deployed Huawei's MetaAAU technology, a critical advancement in 5G-A. By doubling the antenna elements through its Extremely Large Antenna Array (ELAA) design, the solution extended coverage distance and improved edge user experience by more than 30%. This meant that full-span connectivity could now be achieved with base stations positioned only at each end of the bridge — eliminating the need for mid-span installations that had complicated previous generations of network design.

In parallel, the deployment introduced another 5G-A green network technology known as "0 Bit 0 Watt". This feature allows modules to automatically shut down during periods of low demand, reducing power consumption by up to 99%, and reactivate as traffic increases. This approach ensured that network performance remained consistent while maximizing energy efficiency.

Together, these innovations enabled U Mobile to transform the Penang Bridge 1 into a showcase of future-ready connectivity, combining seamless high-speed coverage with intelligent energy management — a balance of performance and sustainability that defines next generation 5G networks.

Achievements of the 5G-A Deployment

Delivering High-Speed, Reliable, and Sustainable Connectivity

The Penang Bridge 1 trial proved that U Mobile's deployment of 5G-A technology could overcome the longstanding challenges of sea-crossing connectivity. By leveraging Huawei's MetaAAU solution and advanced beamforming algorithms, the trial achieved average network speeds of over 500 Mbps, with a guaranteed minimum of 120 Mbps even at vehicle speeds of 80 km/h. Importantly, no dropped calls were recorded throughout the test, marking a major leap over legacy 4G systems.

In addition to performance, the energy-saving capabilities of the "0 Bit 0 Watt" mode demonstrated that 5G-A could deliver both speed and sustainability. Modules were able to power down during off-peak hours, conserving up to 99% energy, without compromising service quality once reactivated. This positioned the deployment not only as a technical achievement but also as a model for green network innovation.

For commuters and passengers, the benefits were tangible: uninterrupted 4K video streaming, smooth short video switching, immersive mobile gaming, and reliable HD live broadcasting across one of the region's busiest transport arteries. With seamless 5G-A across the bridge, U Mobile can also enable relevant enterprise use cases, such as road safety services, smart traffic management during peak traffic periods, AI-powered surveillance and drones for emergency response. This achievement reinforces Malaysia's ambition to lead in 5G adoption and validated U Mobile's role as a forward-looking operator capable of delivering transformative digital experiences.

Lessons from the Penang Bridge 1 Trial

Engineering Resilience for Complex Environments

The Penang Bridge 1 deployment highlighted the importance of designing 5G solutions that can withstand extreme and variable environments. Spanning 13.5 km across open sea, the route posed formidable engineering challenges, from signal interference caused by surrounding base stations to saltwater corrosion, wind-induced movement, and unpredictable traffic loads. Overcoming these challenges required careful planning of site placement, advanced beamforming to manage high-speed mobility, and weather-resistant hardware to ensure long-term reliability. The use of MetaAAU with advanced beamforming capabilities ensures the presence of a dominant serving base station along the entire span of the bridge, overcoming the challenges particularly at mid-bridge where it is subjected to most severe radio interference.

Another key lesson was the integration of energy efficiency into the core of the solution. The "0 Bit 0 Watt" feature showed that sustainability can be embedded into network performance, setting a precedent for operators facing rising energy costs and environmental pressures.

Equally important, the deployment demonstrated that eliminating a central base station was not only feasible but advantageous. By relying on MetaAAU sites at both ends of the bridge, U Mobile and Huawei showcased how infrastructure limitations can be turned into opportunities for innovation. This lesson will guide future 5G-A deployments in similarly constrained or high-mobility environments across Asia Pacific.

Future Expansion of 5G-A in Malaysia

Scaling Penang Bridge 1's Success into Nationwide Rollouts

Following the success of the Penang Bridge 1 trial (which is now live), U Mobile is preparing to scale its 5G-A deployment across Malaysia with an emphasis on both consumer and enterprise markets. The immediate focus is on expanding population coverage to 80% by second half 2026 and 90% in the following year, ensuring millions of users can benefit from high-speed, low-latency connectivity.

On the infrastructure side, over 600 in-building sites are planned within four years, targeting critical locations such as hospitals, data centres, industrial parks, and transport hubs. These strategic deployments are designed to accelerate enterprise adoption while also delivering consistent, high-quality service to everyday commuters.

At the same time, U Mobile is advancing its Enterprise Innovation Platform, bringing together partners, system integrators, and government bodies to pilot real-world use cases. With the integration of technologies like AI, digital twins, and private networks, future 5G-A rollouts will not only increase speed and reliability but also embed sustainability and automation as core principles.

"As Malaysia's newest 5G network provider, U Mobile is delighted to have successfully completed this 5G trial with Huawei, demonstrating our ability to leverage next generation technologies to provide a significantly enhanced ULTRA5G experience. 5G and IoT are redefining connectivity across Asia Pacific, unlocking new economic and societal value, and this initiative showcases our commitment to innovation as well as our capability to roll out the nation's second 5G network efficiently and effectively, even in challenging environments. With 5G-A, we can enable advanced enterprise use cases such as road safety services, AI-powered surveillance, and drones for emergency response. U Mobile is committed to ensuring that the benefits of this transformation reach communities and businesses everywhere, enabling smart, secure, and sustainable growth for Malaysia and the region."

Woon Ooi Yuen
CTO, U Mobile

"This trial on the Penang Bridge 1 has proven how one of the critical technologies of 5G-A, MetaAAU, can extend coverage distance and improve user experience, while another 5G-A green network technology, the "0 Bit 0 Watt" mode, ensures energy savings without compromising service. Our strong Research and Development capabilities will also ensure the best and latest technologies are applied in the country. This is part of Huawei's dedication in supporting the nation in its digital transformation journey, towards ensuring better connectivity and efficiency for Malaysians."

Zac Chow, Deputy CEO
Carrier Business, Huawei Malaysia

GSMA

Transforming Remote Mining Operations: Indonesia's Largest Private LTE Network Deployment

XLSMART's Dedicated Connectivity Enables Safer, Smarter, and More Efficient Coal Mining

Smarter Mining, Powered by Private LTE
Building the Digital Backbone for Safer, More Efficient Operations

XLSMART has deployed one of Indonesia's largest Private LTE networks across more than 20 coal mine sites, transforming connectivity in some of the country's most remote areas. The dedicated LTE system provides reliable communication, real-time fleet monitoring, and enhanced safety tools such as emergency communication and high-definition CCTV. It has become the foundation for digital transformation in mining, reducing downtime and improving visibility across operations. With this platform in place, the operator is positioned to transition seamlessly into 5G, enabling advanced capabilities such as remote vehicle operation, drone surveillance, and AI-powered automation.

XLSMART

Clients and Partners Involved

One of Indonesia's leading coal mining operators, partnered with XLSMART (formerly Smartfren) to deploy a dedicated Private LTE network spanning more than 20 mine sites — one of the largest private deployments in the country. Working with IoT, surveillance, and fleet management solution providers, XLSMART built a secure, high-capacity digital backbone to support the mine's operations. The goal: deliver seamless coverage across pits, haul roads, and remote work zones while laying the foundation for smart mining and future 5G innovation.

Overview of Private LTE Network Deployment

Dedicated Connectivity Backbone Enabling Smarter and Safer Mining Operations

XLSMART delivered a large-scale Private LTE deployment across more than 20 mine sites, creating one of Indonesia's most extensive private networks to date. Designed for full coverage of pits, haul roads, and remote work areas, the system provides the seamless connectivity that public mobile networks and Wi-Fi could not achieve in such rugged terrain. Unlike conventional wireless solutions, the LTE network was purpose-built to segregate and secure mission-critical services while delivering the bandwidth, latency, and reliability required for industrial operations.

With the new infrastructure in place, the mines transitioned from a disconnected environment to fully connected digital work zones. Voice, video, and IoT data now flow in real time between workers, fleets, and command centers. High-definition CCTV, fleet tracking, and IoT monitoring are supported on the same resilient backbone, while redundancy and coverage ensure uninterrupted safety and operational visibility. This deployment marks the mine's first critical step toward Industry 4.0 transformation and prepares the operator for future 5G adoption.

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Challenges in Mining Connectivity

Overcoming Safety Risks, Communication Gaps, and Harsh Terrain

Operating one of Indonesia's largest coal mines came with a critical limitation: there was no mobile network coverage across the vast and remote sites. Without reliable connectivity, communication between workers and supervisors was fragmented, emergencies could not be managed effectively, and daily operations lacked visibility. Supervisors had no real-time insight into fleet movements or mining conditions, forcing reliance on delayed or incomplete reports.

Legacy options such as Wi-Fi or public mobile networks proved unworkable. Wi-Fi could not extend coverage across pits and haul roads, and public networks did not reach the remote sites at all. Even where temporary links were attempted, they lacked the resilience, security, and segregation required for mission-critical services. The absence of dependable infrastructure not only compromised worker safety but also prevented the mine from adopting digital tools and modern fleet management systems.

In this environment, the ambition to move toward Industry 4.0 practices — including automation, predictive maintenance, and intelligent monitoring — was stalled. Connectivity gaps stood as the single largest barrier to digital transformation.

Objectives of the Private LTE Deployment

Building a Safe, Connected, and Digitally-Ready Mining Environment

The mining operator approached this initiative with a clear vision: to establish reliable, site-wide connectivity that could transform both safety and operational practices. The first priority was ensuring that every worker, regardless of location within the mine, could communicate instantly in the event of an emergency. Seamless voice and data channels were seen as essential to protect lives in such a high-risk environment.

Beyond safety, the operator sought to unlock visibility over its vast fleet of vehicles and heavy machinery. Real-time tracking and monitoring were critical for reducing downtime, improving coordination, and optimizing fuel and maintenance schedules. Reliable connectivity was also a prerequisite for deploying IoT devices and surveillance systems, which would provide constant insight into equipment health, environmental conditions, and site security.

Innovative 5G Solution for Smart Mining

Private LTE as the Digital Backbone of Mining Operations

To overcome the absence of public mobile coverage across its remote coal sites, the mining operator partnered with XLSMART to deploy one of Indonesia's largest Private LTE networks. Spanning more than 20 mine locations, this dedicated infrastructure was engineered to provide seamless, high-capacity connectivity across pits, haul roads, and distant work areas where traditional Wi-Fi or public 4G networks had consistently failed.

The Private LTE system delivers secure and segregated communication channels for mission-critical operations. Unlike conventional networks, it ensures that voice, video, and IoT data can run simultaneously without interference, safeguarding the reliability of real-time fleet management, emergency response, and safety monitoring. This integration transforms previously disconnected zones into fully connected digital work areas, where workers, vehicles, and machines can interact continuously with command centers.

Achievements and Significance

Transforming Safety, Productivity, and Operational Control

The deployment of Private LTE across more than 20 mining sites has delivered immediate, tangible improvements to daily operations. Safety, once compromised by patchy communication, is now reinforced by reliable emergency channels and real-time video surveillance. Supervisors have constant visibility of conditions across vast and remote work zones, enabling quicker intervention when incidents occur and creating a significantly safer environment for workers.

Productivity has also risen as fleet management systems now operate with continuous connectivity. Haul trucks and support vehicles can be tracked in real time, their routes optimized to reduce idle time and inefficiency. The availability of IoT data on equipment health and environmental conditions has introduced predictive maintenance practices, minimizing costly breakdowns and extending asset life.

Equally important is the new level of operational transparency. Where once information was fragmented or delayed, the Private LTE network ensures a steady flow of critical data to command centers. This visibility allows managers to make informed decisions faster, boosting efficiency across the value chain.

Valuable Insights and Key Learnings from the Private LTE Deployment

Connectivity as the Cornerstone of Mining's Digital Future

This deployment demonstrated that reliable connectivity is not just a technical upgrade but the essential foundation for safe and intelligent mining. Traditional Wi-Fi and public 4G networks proved insufficient in harsh and remote environments, lacking the reach, resilience, and traffic segregation needed for mission-critical operations. By contrast, the Private LTE model showed that a dedicated, high-capacity network can provide continuous coverage across expansive mine sites while supporting diverse use cases simultaneously.

A key learning is that step-by-step modernization works best: beginning with Private LTE allows operators to stabilize communications and build digital habits before advancing into more complex 5G-enabled automation. The experience also highlighted the importance of integrating voice, video, and IoT traffic within a single secure system. This centralization simplifies control, enhances visibility, and allows mines to respond rapidly to operational or safety issues.

Finally, the project reinforced the value of strong collaboration between mining operators, network providers, and technology partners. Each stakeholder played a critical role in ensuring that connectivity aligned with on-the-ground realities, from fleet control to surveillance integration. This cooperative approach ensured that the new digital backbone supported day-to-day operations without disrupting production.

Future Outlook and Partnership Expansion

From Private LTE to 5G-Enabled Autonomous Mining

With Private LTE firmly established as the digital backbone of operations, the mining operator and XLSMART are now positioned to take the next step toward 5G-powered transformation. The current network has already delivered safer and more efficient mining practices, but its design also provides a scalable foundation for advanced use cases that require ultra-low latency and higher bandwidth.

Future phases will focus on enabling remote heavy vehicle operations, drone-based surveillance and mapping, and AI-driven automation. These capabilities will not only enhance productivity but also reduce risks by moving workers away from hazardous areas and into centralized, secure control centers. The pathway from LTE to 5G ensures a smooth evolution — protecting existing investments while unlocking new horizons in mining automation.

Beyond this single deployment, the success of this project signals opportunities for wider industry replication. Mining operators across Indonesia and other resource-rich regions can adopt similar models, using private wireless networks as a stepping stone toward Industry 4.0 adoption. For XLSMART and its technology partners, the initiative opens the door to long-term collaboration with the mining sector, driving continued innovation and establishing benchmarks for safer, smarter, and more sustainable mining operations.

"Reliable connectivity is no longer optional in mining — it is the foundation for safety and efficiency. With our Private LTE, we are giving operators the digital backbone they need to modernize, integrate new technologies, and prepare for 5G."

- Kharris Wiseso, *Head of Natural Resource Industry Solution, XLSMART for Business*

"By deploying a Private LTE network across our remote mine sites, we now have continuous communication, fleet visibility, and the ability to scale into automation. This has transformed how we manage safety and productivity on the ground."

- Arif Widya, *Senior Manager, Mine Technology*

" Reliable connectivity has already transformed mining. While 4G laid the first stone of digital transformation, 5G will unlock the next wave — enabling automation, remote operations, and safer, more efficient mines"

- Irwan Setiawan, *Head of Enterprise Industry Solution, XLSMART for Business*

GSMA

About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

We invite you to find out more at gsma.com

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GSMA APAC 5G Industry Community

Launched at the Mobile 360 Asia Pacific 2021, the APAC 5G Industry Community is a forum for people to learn and advocate 5G benefits to industries and enterprises. The Community has been designed for stakeholders across the value chain including government and agencies, industry associations, mobile network providers, enterprises and industry players, solution providers, analysts, and consultants. It serves as a collaboration platform to support 5G industry innovation, application and business opportunities, and to unlock the power of 5G connectivity so that people, industries and society thrive.

www.gsma.com/asia-pacific/communities/ap5gic/

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