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Navigating Business Opportunities and Challenges in 5G Communication Technology: Insights from Asean Case Studies

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ABSTRACT

The presence of the fifth generation (5G) communication technology has become the digital transformation cornerstone across Southeast Asia, offering opportunities that have never emerged before, innovation, and connectivity across sectors. In the ASEAN region, 5G has the role of technological and strategic driver boosting the digital ecosystem, supporting Industry 4.0, and strengthening the competitiveness through integration with Artificial Intelligence (AI), Internet of Things (IoT), and cloud computing. However, apart from its transformative potential, 5G development has still not yet been distributed evenly due to policy fragmentation and spectrum allocation challenges, including the infrastructure readiness level. This research is meant to explore the business opportunities and challenges around 5G implementation through case studies from prominent markets in ASEAN, covering Singapore, Malaysia, Thailand, Vietnam, and Indonesia. By utilizing the knowledge from policy analysis, recent industry reports published in 2022-2025, and interviews with 10 consultants from IT implementers executing the 5G projects across the ASEAN region, this study identifies key factors supporting the 5G monetization success, evaluates the corporation adoption strategy, and confers imperative policies to support the inclusive and sustainable digital growth. Lastly, it ends with the conclusion that the alignment among regional collaboration, AI-based innovation, and spectrum policy is essential to explore the full potential of 5G in ASEAN and mark this region as a future global center for connectivity.

***Keywords**: 5G; digital transformation; ASEAN; business opportunities*

INTRODUCTION

The ASEAN region is currently experiencing an intense digital transformation, pushed by the convergence of 5G communication technology, Artificial Intelligence (AI), and sophisticated data analytics. As emphasized by Vu Min Khuong (2025), 5G is not only about network advancement, but also a vital infrastructure for the next growth of ASEAN, which enables automation, smart manufacturing, precision for farming, and modern logistics systems. Advantageously located between China and India, ASEAN has the combined population of more than 700 million people and developing digital economy, which is projected to surpass USD 1 trillion in 2030 (World Economic Forum, 2024). Nevertheless, the digital readiness varies among the member countries.

This zone achieved the 5G cellular penetration rate of 10.35% in 2022, which was the highest globally. Singapore and Thailand appeared as early leaders with the commercial coverage around the world, while Malaysia and Vietnam followed the footprint with the progressive spectrum liberalization and trial deployment (Zhao et al., 2022). These accomplishments resolve the continual gap, starting from the infrastructure gap and regulation irregularity till the limited corporation adoption, mainly at the small and medium enterprises (Khuong, 2025).

The incorporation of 5G with AI and IoT symbolizes the transformative movement from connectivity to value generation. Thompson (2024) estimates that global 5G IoT connections will grow from 58 million in 2023 to 2.2 billion connections in 2030, with Asia Pacific as the leader in adopting smart manufacturing, logistics, and energy. In ASEAN, this technology is opening the new business model, such as private 5G networks for industry automation, smart network management, and digital health solutions. Nevertheless, the monetization is still limited due to the high deployment cost, ambiguous regulatory context, and slow corporation awareness.

Port Tuas in Singapore is the real successful example of 5G integration. The port which is entirely automated and AI-based, was launched in 2022. It has received the global acknowledgement for the application of 5G network slicing and robotics to improve the efficiency and sustainability of logistics. On contrary, other ASEAN countries are experiencing slower commencing due to capital expenditure and policy coordination challenges. Spectrum pricing and infrastructure allocation issues in Indonesia and Philippines are the valid evidence, where local operators have difficulties in justifying the investment return (ASEAN, 2021).

In general, the ASEAN outlook has substantial potential and operational challenges. To realize the whole impact of 5G technology, it requires synchronized policy framework, partnership between public and private institutions, and cross-border collaboration to support the broad and complete transformation in the region. As ASEAN is progressing towards 2030, 5G has significant role in enabling the AI-based digital economy to support the competitiveness, resilience, and global innovation leadership in the region.

METHODS

This study applies qualitative research design to identify both business opportunities and operational challenges of 5G technology in ASEAN. To pursue a comprehensive analysis, the author used data source triangulation by combining the secondary data analysis with primary insights gathered from industry experts. In order to get better understanding regarding the technology pillars and current regional development, the methodology applied in this study includes policy and literature review (covering extensive analysis to national 5G strategies, regulation framework, and academic literature), secondary market analysis (by combining the latest industry reports published in 2022-2025, such as Omdia, Frost & Sullivan, GSMA, etc.), and expert interviews through in depth interviews with 10 consultants from international IT vendors and implementors which have been actively implementing 5G projects in Southeast Asia, mainly Singapore, Malaysia, Thailand, Vietnam, and Indonesia.

Problem Formulation

Despite the fact that the 5G rollout in ASEAN is moving rapidly, this region is facing irregular development, limited monetization, and uneven policy, which impede sustainable implementation. Countries like Singapore and Thailand have reached the commercial development, but others are still lagging behind as the consequence of infrastructure gaps, regulation uncertainties, and corporation unpreparedness. The problem formulated by the author to be answered in this study is “How can ASEAN countries effectively determine the business opportunities and manage the operational together with policy challenges of 5G communication technology in order to reach comprehensive and sustainable digital transformation?”

Research Objective

The accomplishment of this study is expected to provide insights on key recommendations for ASEAN countries to effectively determine the business opportunities and manage the operational together with policy challenges of 5G communication technology in order to reach comprehensive and sustainable digital transformation.

Literature Review

The advancement of 5G communication technology is broadly considered as the transformative influence which supports global digitalization. Scholars steadily define 5G not only as the fastest mobile network, but also as the paradigm shift regarding the connectivity. It is described as "the next generation of wireless network which provides higher capability than 2G, 3G, and 4G communication technologies" by emphasizing that its design should be in line with ITU's three core categories (Mwang'onda and Phiri, 2023). First, eMBB, which has been the focus of 5G since its early stage. This 5G category is seen as a speed enhancement over 4G, allowing data-driven applications that require high bandwidth, such as high definition (HD) video, to be streamed and enabling virtual reality (VR) streaming or gaming. Second, mMTC which is a category of devices that needs very low data transmission rates. This includes sensor-type devices used out in the field, which send a few bits of data per day. Higher importance is placed on low cost and long device lifecycles as opposed to higher speeds and low latency. NB-IoT and LTE-M have been designed to cater to this group. Third, URLLC – a category that relies on the low latency capabilities of 5G. The aim is to reduce latency for 5G down to 1ms, which will enable use cases such as smart traffic systems, smart grid, remote manufacturing, etc, shown in Figure 1.

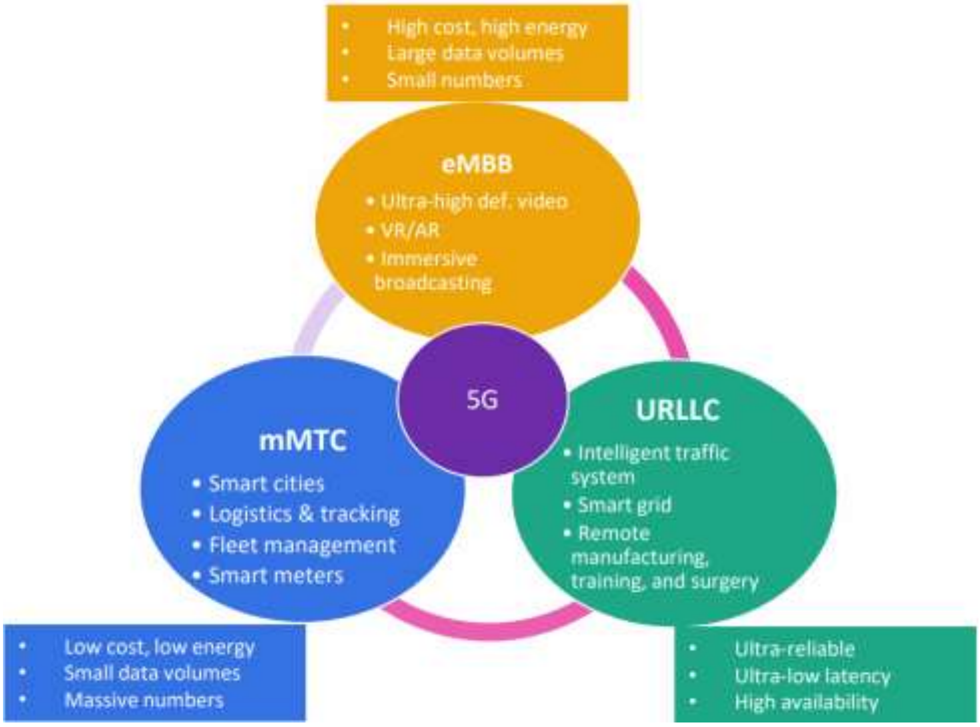
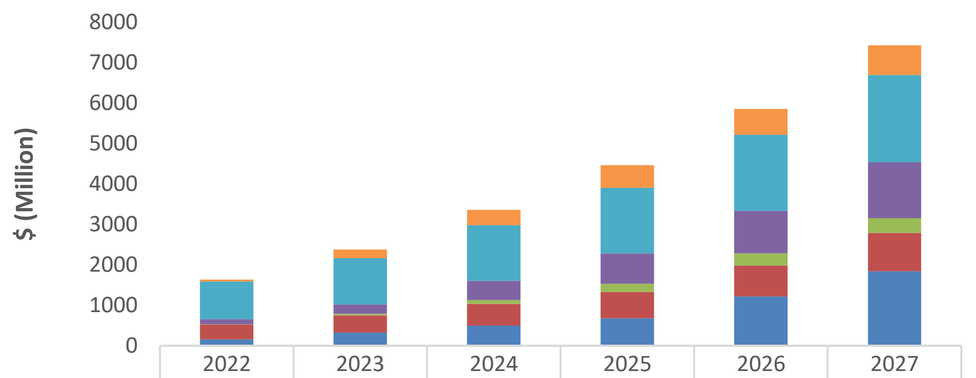


Figure 1. The Three Pillar of 5G
(***Source***: *Omdia, 2024*)

Correspondingly, 5G is also illustrated as "the fifth generation of wireless technology which provides holistic view on technology advancement, current implementation, and the future prospects" (Bamniya and Panchal, 2024). This emphasizes 5G role as the basic infrastructure for digital transformation, including smart manufacturing, AI-driven automation, and digital platform ecosystems.

In the ASEAN region, 5G is progressively outlined not only as technical advancement, but also as a strategic economy asset. It forms "significant infrastructure for ASEAN's economic transformation which is driven by AI," which emphasizes its role in manufacturing, logistics, healthcare, and public administration sectors (Khuong, 2025). Yet, ASEAN's advancement is uneven, which is formed by varied economy capacities, policy framework, and market structure (Zhao et al., 2022) and this is supported by data shown in Figure 2.



	2022	2023	2024	2025	2026	2027
Malaysia	51.6	212	380.8	558	643.5	732.5
Thailand	935	1,146.90	1,375.30	1,620.30	1,881.90	2,160.00
Philippines	126.6	224	474	750	1,052.00	1,380.00
Vietnam	3.7	45.6	96.4	203.2	293.7	364
Singapore	362	420.8	530.8	646.8	768.8	945
Indonesia	160.8	328	501.9	682.6	1,218.40	1,845.00

Indonesia Singapore Vietnam Philippines Thailand Malaysia

Figure 2. 5G Revenue Forecast in ASEAN
(***Source**: Frost and Sullivan, 2023*)

Overall, the total 5G revenue in the ASEAN region will increase from $1.64 billion in 2022 to $7.43 billion in 2027, at a CAGR of 35.3% (Quah, 2023). 5G revenue will remain driven by 5G connectivity, the main contributing factor during this period. 5G subscriptions have received a boost from the accelerated migration from 4G and the implementation of embedded subscriber identity modules (eSIM). eSIM will contribute more to the revenue growth, especially in Singapore in the coming years.

On the consumer side, revenue growth has started to stagnate. AIS in Thailand has reported a decline of 0.7% YoY in 5G mobile revenue in 2022. AIS has dropped unlimited plans to monetize 5G better. Singtel 5G, priced as premium service, is facing intense competition from smaller players that offer either cheaper plans or more data with plans. Meanwhile, AIS's use of low-frequency spectrum bands (700 MHz) for 5G is impacting the experience of users paying for 5G bandwidth and speed, particularly indoors. This has not been much development regarding 5G consumer services, apart from fixed wireless access (FWA), which has been successful mainly in the Philippines. In this region, FWA is not likely to be swapped out for 5G, but FWA implementations are rising as fixed broadband providers are extending their services with 5G FWA.

Although 5G revenue registered CAGR growth overall, in some markets, like the Philippines and Indonesia, 5G faces adoption challenges that impact further investment, supported by the statement from Economic Research Institute for ASEAN and East Asia which states that ASEAN's digital path is repressed by uneven readiness among member countries (ERIA, 2025). Difficulties in 5G monetization are not helping justify the high cost of 5G network equipment. Furthermore, with fewer restrictions, 5G must compete with cheaper (Wi-Fi hotspots) and better (fiber) technologies from 2023. This shows that technology development is essential, but the cost incurred is even more critical, especially to maintain stakeholder and investor buy-in.

From the governance point of view, a successful national 5G strategy involves collaboration among multi-stakeholders, strong regulatory alignment, and synchronized investment charter (Köstereli and Ergün, 2024). This argument is in line with the development in ASEAN region dominated by varied speed of member countries, where those with policy and investment incentive consistency develop rapidly, while others have issues in spectrum, access to sites, and monetization of 5G networks.

It is obvious that corporation adoption is considered as main source of 5G monetization. The private 5G networks supports "expected delay, safe local data management, and industrial level trustworthiness," which then makes it look appealing for manufacturing and logistics sectors (Eswaran and Honnavalli, 2022). Some real proofs of successful 5G implementation in certain industry are showed through Tuas Port in Singapore, where it supports autonomous led vehicles, digital twins, and network slicing as blueprint for AI-based logistics modernization in Southeast Asia; while from Indonesia, effective 5G trials in Tanjung Priok Port in Indonesia show performance improvement in monitoring containers, automated cranes, and asset in real-time basis (Andriani et al., 2023).

As part of 5G technology, the 3rd Generation Partnership Project (3GPP) will be pivotal for IoT growth. 3GPP Release 17 was finalized in July 2022 and introduced a new category of devices called RedCap (reduced capability). The "reduced capability" refers to RedCap's reduced functionality: 20MHz bandwidth, 50Mbps uplink (UL) (vs. 10Gbps for eMBB, according to the International Telecommunication Union [ITU]) and 150Mbps downlink (DL) (vs. 20Gbps for eMBB according to the ITU). 5G RedCap has been specifically touted as an IoT technology. The aim is to keep hardware costs and complexity low for devices that do not require the high functionality of eMBB and URLLC but still require higher functionality than mMTC. This is greatly beneficial to IoT devices that are nearly always size and power constrained. RedCap will sit among the three pillars of 5G, as shown in Figure 3.

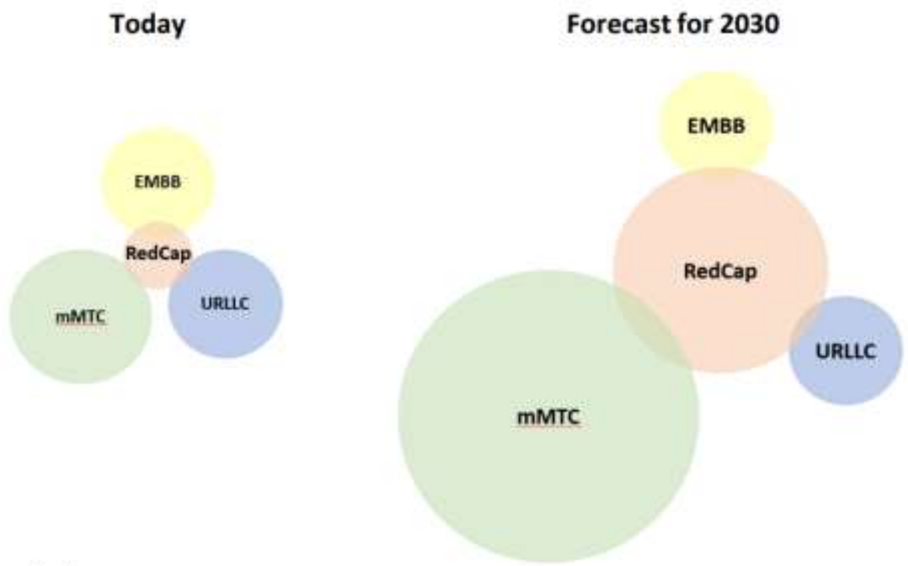


Figure 3. Approximate 5G Connections Volume by Technology
(***Source***: *Omdia, 2024*)

5G is important for the sustainability goals of many communication service providers (CSPs) and network infrastructure providers. A 5G cell site uses just 15% of the energy of a 4G cell site to transmit the same data (Williams et al., 2022). According to Ericsson (2023), 90% of its carbon emissions come from network usage. The information transmitted/received per unit of energy is significantly higher in 5G than in 4G, a ratio that will increase efficiency. Using sensors on hardware such as factory equipment, etc., AI and digital twins can create virtual replicas of enterprise locations, such as manufacturing plants to locate and correct inefficiencies, enabling improved efficiency and lower emissions. Many stakeholders are pointing to the use of AI to more intelligently manage RANs to save energy. Network infrastructure providers have developed programs for recycling retired network equipment. CSPs and enterprises can use 5G to schedule device updates at times (such as nighttime) that require less energy to cool their networks. Cloud RAN is making it possible to incorporate renewable energies, and stakeholders are moving data centers to locations that can be more easily cooled. RAN sharing is another possibility for carriers, including RAN sharing with private networks. It is a means to increase coverage cheaply through mutual agreement to share networking resources among operators to improve customer experience.

RESULTS AND DISCUSSIONS

During in-depth interviews with international IT vendors and business consultants which were intended to understand the 5G use cases, the author followed the 5G use cases mapping from Omdia (2024) showed in Figure 4. Use cases are ranked based on a combination of financial impact and technological maturity. The financial impact score is defined by the level of value/efficiency that particular 5G use case will add, while the technical maturity is defined by a combination of factors, including the 5G maturity level, technological advancements in other emerging technologies, and the mission-critical level of each use case. By considering input from Omdia's analysis, the case description in this study will focus on the video surveillance cameras, connected cars, and Automated Guided Vehicle (AGV), as they offer potentially large revenue streams with the lowest technical barriers.

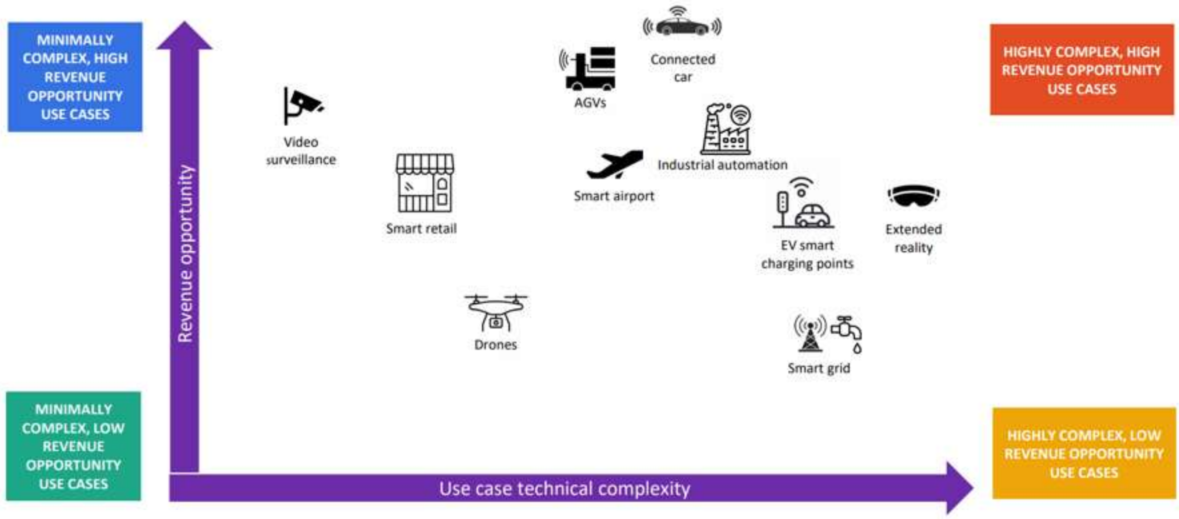


Figure 4. 5G Use Cases Mapping
(***Source**: Omdia, 2024*)

5G Video Surveillance Use Case

5G video surveillance uses advanced technologies such as AI/ML, computer vision, and image processing techniques to analyze real-time video streams and provide immediate alerts, notifications, and insights to property owners and authorities. Industries using this solution are military, smart cities, smart buildings, smart stadiums, entertainment, logistics, retail, hospitality, manufacturing, construction, agriculture. This solution is applied in facial and object recognition, traffic management, building security, public safety, workflow/stock monitoring, anomaly detection, livestock monitoring.

5G brings at least four benefits to video surveillance solutions. First, 5G brings higher network capacity to enable more connected cameras. Second, 5G delivers a high bandwidth that meets the standards of high-resolution video (4K, 8K) and allows for real-time video analysis to provide time-efficient notifications. Third, network slicing capability as key feature of 5G technology can support video surveillance, data traffic, and ensuring Quality of Service (QoS). Fourth, video streams can be analyzed locally on the 5G edge, decreasing delay/latency, providing immediate notifications, and addressing privacy and security concern, shown in Table 1.

Table 1. 5G Video Surveillance Applications in ASEAN Countries

Country	Key Application Sector	Specific Use Cases (Video-Dependent)	Technology Maturity	Financial/Revenue Impact
Singapore	Smart ports, advanced manufacturing	Remote control of cranes, real-time Machine Vision (MV) for defect detection, Autonomous Guided Vehicle (AGV) video feeds.	Highest maturity. Uses 5G Standalone (SA) and deep integration with edge computing for real-time video processing. Focus is on network slicing to guarantee mission-critical performance.	Maximum ROI via productivity. Revenue is unlocked through ultra-high automation; one study shows 5G enterprise deployments increasing productivity by 52% to 245%.
Thailand	Smart manufacturing in the Eastern Economic Corridor (EEC) in Thailand, Intelligent Transport Systems (ITS)	Cloud MV for quality control, Augmented Reality (AR) remote guidance using live video feeds, high-resolution public safety surveillance.	Medium-high maturity. Strong government-led initiatives supporting 5G mmWave deployment in industrial zones to support high-density video data transfer.	Cost reduction & efficiency. Initial investment is supported by government testbeds/subsidies. Focus on reducing operational costs by 10% to 90% through automation and streamlined industrial processes.
Malaysia	Smart infrastructure	HD traffic monitoring (in Penang Bridge), real-time 4K/8K video uplink for media/broadcasting, security surveillance.	Medium maturity. Deployment is driven by the Digital Nasional Berhad (DNB) single wholesale network model, focusing on wide coverage and basic enterprise services.	Network monetization. Revenue is generated by the wholesale model, selling guaranteed-bandwidth slices to enterprises and media companies for reliable HD video streaming.
Indonesia	Smart ports & logistics, mining	AI-powered CCTV for cargo tracking and security, digital twin visualization of warehouses, remote monitoring of mining operations.	Medium maturity. Focus on deploying Private 5G networks within limited industrial/port areas to overcome existing infrastructure gaps and ensure high reliability for video applications.	Accelerated enterprise revenue. The enterprise segment is forecast to see 103% CAGR in 5G revenue contribution between 2022 and 2027, driven significantly by logistics and industrial applications like video analytics.

***Source**: Author (2026)*

Apart from the benefits, 5G surveillance application has some challenges to consider. First, the scaled installation of new image analytics techniques may raise privacy and security concerns; for example, instant recognition may be able to combine data with the person in a video. Still, 5G networks can apply real-time “masking” techniques to anonymize and protect individual identity. Second, video camera manufacturers need to clearly understand the 5G/IoT security challenges to tackle issues at the hardware layer. Third, scaled installation may generate challenges when enterprises need to deal with different operators, especially in different geographical areas. Lastly, the hardware landscape is currently relatively poor as there are not many 5G-ready cameras commercially available, although the software/analytics side is richer and better prepared.

5G Connected Car Use Case

A 5G connected car will have an OEM-embedded 5G radio. This technology will support multiple applications that improve road safety and the driving experience. These applications include 5G advanced driving assistance systems (ADAS) with features such as park assist, lane departure warning, adaptive cruise control, etc.; V2X for data exchange with pedestrians, cyclists, and other cars and integration with smart city applications; and 5G telematics, emergency calling, in-car payments, 5G over-the-air software updates, and 5G in-vehicle infotainment (faster Wi-Fi, HD video, cloud gaming, web browsing, etc.).

5G brings several benefits to connected car solution. As connected cars are moving objects that need real-time decisions, mobility is a segment in which 5G can demonstrate its benefits, especially when combined with other technologies. Meanwhile, connected cars require the ultra-low latency capabilities of 5G to ensure that there are no potential lags that could lead to a life-threatening delay in maneuvering or signaling. This can be achieved using both edge computing (to decrease the distance between sensors and the data-processing site, thus increasing how fast vehicle sensors can process data) and smart city infrastructure, ensuring that informed decisions can be made rapidly. Moving the processing closer to the edge will allow for large volumes of real-time data to be analyzed without sending it into the cloud, shown in Table 2.

Table 2. 5G Connected Car Applications in ASEAN Countries

Country	Key Application Sector	Specific Use Cases	Technology Maturity	Financial / Revenue Impact
Singapore	Autonomous mobility & port logistics	Autonomous Vehicle (AV) fleets in designated zones (Science Park, Jurong Island); C-V2X for non-line-of-sight awareness; Automated Guided Vehicles (AGVs) in Tuas Port.	High trial/early commercial (for logistics); pilot/testbed (for public road autonomy). C-V2X trials are advanced.	High long-term value: focus on unlocking the AV market for public and goods transport. Significant cost reduction and efficiency gains in maritime and urban logistics.
Thailand	Smart manufacturing & enterprise telematics	Real-time visual monitoring in connected factories; self-driving hospital shuttles (Siriraj Hospital pilot); enhanced fleet management and telematics.	Medium commercial (enterprise/fleet); pilot (autonomous driving). Strong maturity in applying 5G to manufacturing supply chains.	Immediate enterprise revenue: higher ARPU (13–29%) for MNOs through enterprise connectivity. Improves manufacturing efficiency.
Malaysia	In-Vehicle Infotainment & urban Intelligent Transport Systems (ITS)	High-speed data for in-car streaming/cloud services; OTA software/firmware updates; traffic monitoring and smart traffic optimization in major cities (Kuala Lumpur, Penang).	High commercial (consumer services); medium deployment (ITS). Core 5G rollout focused on eMBB.	Direct consumer revenue: premium in-car data packages. Enhances OEM revenue through subscription services and telematics.

***Source**: Author (2026)*

5G connected car applications have some challenges. The delay in 5G SA networks is a significant barrier that does not allow 5G-powered cars to reach their potential. Countries with more advanced 5G network deployments will lead to 5G connected car adoption. Most of Asia and Oceania, including China, lead in this market thanks to government support and advanced network infrastructure. Then, data management and revenue sharing are key issues to be addressed. Stakeholders and regulators must agree on who owns and manages/monetizes the vehicle-generated data, especially as new players enter the automotive software market (hyperscale's/CSPs/semiconductors/start-ups). Potential owners of the data include car manufacturers, telecom operators, or third-party companies. It should be noted car manufacturers have less frequent customer relationships than telcos, which could prove difficult to navigate. Moreover, several vehicle OEMs lack internal expertise in connectivity and software development, which can affect their competency in innovation. Therefore, strategic partnerships are essential to address these limitations. Also, as in any other industry, the rise of the connected car raises concerns regarding cybersecurity threats that need to be continuously monitored and addressed.

5G Automated Guided Vehicles (AGV) Use Case

Automated Guided Vehicles (AGVs) represent significant progress in industrial robotics, which functions as portable system designed to speed up the processes, completing recurring tasks, and simplifying the movement of heavy materials. In the Industry 4.0 framework, such vehicles are increasingly used in several sectors, including manufacturing, healthcare, logistics, and port transportation. Although traditional AGVs have been used for long time for basic material handling, the integration of 5G technology changes them into smart and highly communicative nodes which are able to interact smoothly with other connected machines and human operators.

The transition from legacy Wi-Fi to private 5G network addresses the basic connectivity challenges inborn in the industrial environment. Metal with high-density structures often interferes with Wi-Fi signals, while 5G ensures the constant connection with low latency. Furthermore, the combination of 5G and edge computing enables AGV to process massive data volumes at the edge network instead of on the vehicle itself. This decentralization reduces the hardware cost and energy consumption on the vehicle as well as enabling the real-time decision-making abilities. Therefore, AGV supported by 5G can navigate complicated spaces with high precision, detect advanced obstacles, and collaborate safely with the workforce in the dynamic environment.

The main catalyst for AGV technology adoption is the workforce shortage globally, especially in the sector involving time-consuming or dangerous manual work. Large e-commerce and retail entities have revealed the effectiveness of AGV in automating the warehouse processes to facilitate delivery services on the same day. Outside logistics, high investment level in the robotics manufacturers – mainly companies like VisionNav Robotics and Seer Intelligent Technology – indicates the strong market interest in autonomous solutions supported by 5G. This investment is expected to boost the growth of AGV portfolios, offer clear Key Performance Indicators (KPIs) and rapid Return on Investment (ROI) through improved operational efficiency.

Apart from the clear benefits, the remarkable barriers for extensive adoption still exist. The main obstacle is the required high capital spendings, including the cost of vehicle supported by 5G itself, the operation of private 5G network infrastructure, and continuous maintenance. At this point in time, these expenses often limit the large-scale implementation of large enterprises with sizeable financial resources. Besides, most modern AGV applications are still limited to defined operational areas with minimum barriers or labor interactions. Overcoming this spatial limitation and reducing the entry cost will be very essential in order to ensure that the technology can reach broader market penetration among small and medium enterprises, shown in Table 3.

Table 3. 5G Autonomous Guided Vehicle (AGV) Applications in ASEAN Countries

Country	Key Application Sector	Specific Use Cases	Technology Maturity	Financial / Revenue Impact
Singapore	Maritime & Port Logistics	Mission-critical AGVs for container hauling at Tuas Port; automated quay cranes.	High (Commercial): Nationwide 5G Standalone (SA) coverage; fully integrated port ecosystems.	High; 5G enterprise segment growing at 100%+ CAGR; significant port efficiency gains.
Thailand	Smart Manufacturing	Parts delivery in automotive plants (Eastern Economic Corridor); hospital logistics AGVs.	Moderate High: 80% population coverage; rapid industrial 5G rollout in special zones.	Leading regional revenue share (~22%); driven by manufacturing productivity boosts of 50–200%.
Malaysia	Public Transport & Electronics	5G autonomous shuttle buses; intra-facility transport for semiconductor assembly.	Moderate: 80% population coverage; shift from pilots to fleet orchestration in 2025-26.	High growth potential; target to become 'ASEAN Digital Capital' attracting FDIs in automation.
Vietnam	E-commerce & Smart Factories	Last-mile delivery bots; warehouse sorting AGVs for	Emerging: Rapid infrastructure scaling; high adoption of AI-	Forecasted fastest CAGR (~12.7%) through 2031; impact centered on

		global electronics brands.	driven navigation (SLAM/LiDAR).	reducing high labor/logistics costs.
Indonesia	Mining & Logistics	Remote-controlled/autonomous heavy haulage in mining; industrial park yard automation.	Developing: Early stage; focus on private 5G networks for high-value isolated industrial sites.	Moderate; cost reductions in mining ops (10–90% per task) offset high upfront hardware costs.

CONCLUSIONS

The rapid progress of 5G communication technology has become the important basis for digital transformation in ASEAN. As shown by the integration of AI, IoT, cloud computing; 5G is evolving from just cellular network improvement to strategic economic asset which is capable of boosting Industry 4.0. Although countries like Singapore and Thailand have emerged as early leaders in adopting commercial 5G, the broader region is still struggling with the uneven development. This gap is fundamentally caused by fragmented policy frameworks, inconsistent spectrum allocations, and different infrastructure readiness.

There are eight key findings considered as suggestions for enterprises and technology vendors, where the first four findings will be focused on enterprises while the rest will be referring to technology vendors. First, as mass market solutions versus customized solutions will likely use different flavors of 5G, enterprises should weigh the benefits of technologies and their implementation against the often less secure but also less expensive implementation of unlicensed LPWAN or short-range technologies such as Wi-Fi or Zigbee. Second, enterprises should consider network sunsets and device longevity. Although 5G devices will remain more expensive than LTE devices, they could be worthwhile absorbing the upfront costs to mitigate the future cost of network migration. Third, enterprises should unlock the value of data. Data is only valuable if it can be used to drive better decisions. Hence, enterprises need to assess their abilities to collect the right data and then use it to make decisions including considering the possibility of employing system integrators with required skills in case they lack internal expertise. Fourth, enterprises should develop an understanding of AI as they need to develop AI strategies and plot how those fit with IoT strategy through the initiation of test pilots to see where AI and IoT can provide predictive maintenance, reduce costs, and improve user experience. Fifth, technology vendors should focus on solving enterprise problems, not selling technology. In this case, technology and service provider marketing stories should focus on using 5G to alleviate customer pain points and improve customer experience. Sixth, technology vendors should continue to educate enterprises even though the technologies are becoming better understood given the fact that 5G continues to evolve. Seventh, technology vendors should develop vertical and domain expertise as they need to determine where 5G is needed to achieve enterprises' goals as well as understanding what type of 5G is the most appropriate. Lastly, technology vendors should hold off on promoting the potential of 6G. Despite the importance of monitoring the goals of 6G and taking part in standards development and even R&D, discussing technology externally will only create confusion in the market.

This study acknowledges limitations in current 5G landscape, especially the reality that the dependence on high-cost infrastructure often limits the high scale deployment to large enterprises, which leaves small medium enterprises with limited access to this transformative technology. Furthermore, the nascent hardware ecosystem and evolving consumer services which indicate stagnation sign in some markets, complicate the immediate profitability for telecommunication operators. This study also notes that market euphoria around 5G sometimes hides the implementation complexities, resulting in the requirement to shift the vendor focus from selling technology to solving specific enterprises' problems.

Moving forward, the sustainable growth of 5G ecosystems in ASEAN requires various approaches. Future research should prioritize the investigation of long-term impacts of synchronized policy framework on regional competitiveness and the potential for cross-border collaboration in order to balance spectrum and infrastructure standards. Additionally, as industries start considering 6G, it's essential for stakeholders to still focus on current 5G standardization and R&D to anticipate market confusion and ensure that current investments will result in long term resilient infrastructure. Ultimately, aligning the regional policies, incentivizing private-public partnerships, and prioritizing the industry-level use cases will be the key drivers in making ASEAN as the global hub for connectivity and innovation in the future.

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