Access Partnership

Growth through connectivity:

Supporting ASEAN's vision with non-geostationary satellite systems

May 2026

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Executive summary

A connected ASEAN is critical to driving digital transformation and access to emerging technologies. In 2025, the Association of Southeast Asian Nations (ASEAN) adopted an ambitious growth vision that will set the tone of its development for the next two decades. The ASEAN Community Vision 2045 (ACV 2045) envisions a developed ASEAN as the epicenter for growth in the Indo-Pacific region and calls for the creation of a connected digital community underpinned by advanced digital services.[1]

ASEAN has made significant strides over the past decade. ASEAN Member States (AMS) have spent significant resources and undertaken extensive analysis on how to future-proof their economies, going to exceptional lengths to make sure they can connect into, and benefit from, the digital economy. This progress has accelerated against the backdrop of the COVID-19 pandemic. The region's overall Internet penetration rate increased from 63% in 2020 to 82% in 2024, placing it above the global average of 71% in the same year.[2]

Despite the progress made, a "connectivity gap" persists. More than 150 million people across the region still lack a reliable and affordable connection, particularly in rural and remote areas.[3] There is a significant gap between the region's thriving urban centers and cities, and rural, landlocked or archipelagic regions. While urban hubs see rapid uptake in new technologies enabled by access to high-speed Internet, nearly half of the region's population resides in rural zones where Internet networks could be limited or simply not available.[4]

A broader connectivity mix could increase coverage in the region and make broadband more affordable. Despite the efforts and investments made by ASEAN governments to strengthen Internet coverage and affordability, extending coverage to some underserved areas in Southeast Asia presents significant technical and financial hurdles. The region's archipelagic and mountainous geography makes building and maintaining terrestrial infrastructure costly, often requiring major investment in long-distance fiber or wireless backhaul networks to reach end-users and leaving many commercially unviable, particularly in rural areas where users are few and sparsely distributed.

Against these constraints, Non-Geostationary Satellite Orbit (NGSO) systems offer a potentially viable option to increase affordability and coverage as part of the region's connectivity mix. Modern NGSO systems provide extensive coverage with a significantly smaller infrastructure requirement than traditional terrestrial networks.[5] Unlike fiber or wireless networks, which require extensive civil engineering and often struggle to reach inland or mountainous locations, NGSO systems rely on localized user terminals and gateway stations.[6] This makes such systems potentially the most technically feasible, and often the only practical, option for providing high-speed broadband to ASEAN's highly remote or topographically challenging terrains.[7]

The use of NGSO systems for backhaul to extend broadband coverage across ASEAN countries could provide cost savings of at least $15 billion to mobile network operators (MNOs). By serving as a

1 ASEAN Secretariat (2025), ASEAN Community Vision 2045: "Resilient, Innovative, Dynamic, and People-Centred ASEAN". Available at: https://asean.org/wp-content/uploads/2025/05/05.-ASEAN-Community-Vision-2045_adopted.pdf

2 Sources include: ASEAN (2021), "ASEAN Statistical Yearbook 2021". Available at: https://www.aseanstats.org/wp-content/uploads/2021/12/ASYB_2021_All_Final.pdf; ASEAN (2025), "ASEAN Statistical Highlights 2025". Available at: https://www.aseanstats.org/wp-content/uploads/2025/10/ASH2025.pdf; and World Bank (2024), "Individuals using the Internet (% of population)". Available at: https://data.worldbank.org/indicator/IT.NET.USER.ZS

3 World Economic Forum (2022), *Bridging Southeast Asia's digital divide to drive financial inclusion.* Available at: https://www.weforum.org/stories/2022/05/bridging-southeast-asia-digital-divide-driving-financial-inclusion/

4 World Bank (n.d.), "Rural population (% of total population)." Available at: https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS

5 African Telecommunications Union. (2024). *Evaluating the impact of satellite communication on achieving sustainable development goals in Africa: Opportunities, barriers, and future pathways* (Version 3). Available at: https://atuuat.africa/wp-content/uploads/2024/07/V3-Empowering-Africa-SDGs-and-Satellite-Connectivity.pdf

6 Bamford, R., Hutchinson, G., & Macon-Cooney, B. (2021). *The progressive case for universal Internet access: How to close the digital divide by 2030.* Tony Blair Institute for Global Change. Available at: https://assets.ctfassets.net/75ila1cntaeh/5EwsYtqgYOXh8SjCkcKNGj/653ea680f47be555757553d652885f7e/The-Progressive-Case-for-Universal-Internet-Access-How-to-Close-the-Digital-Divide-by-2030.pdf

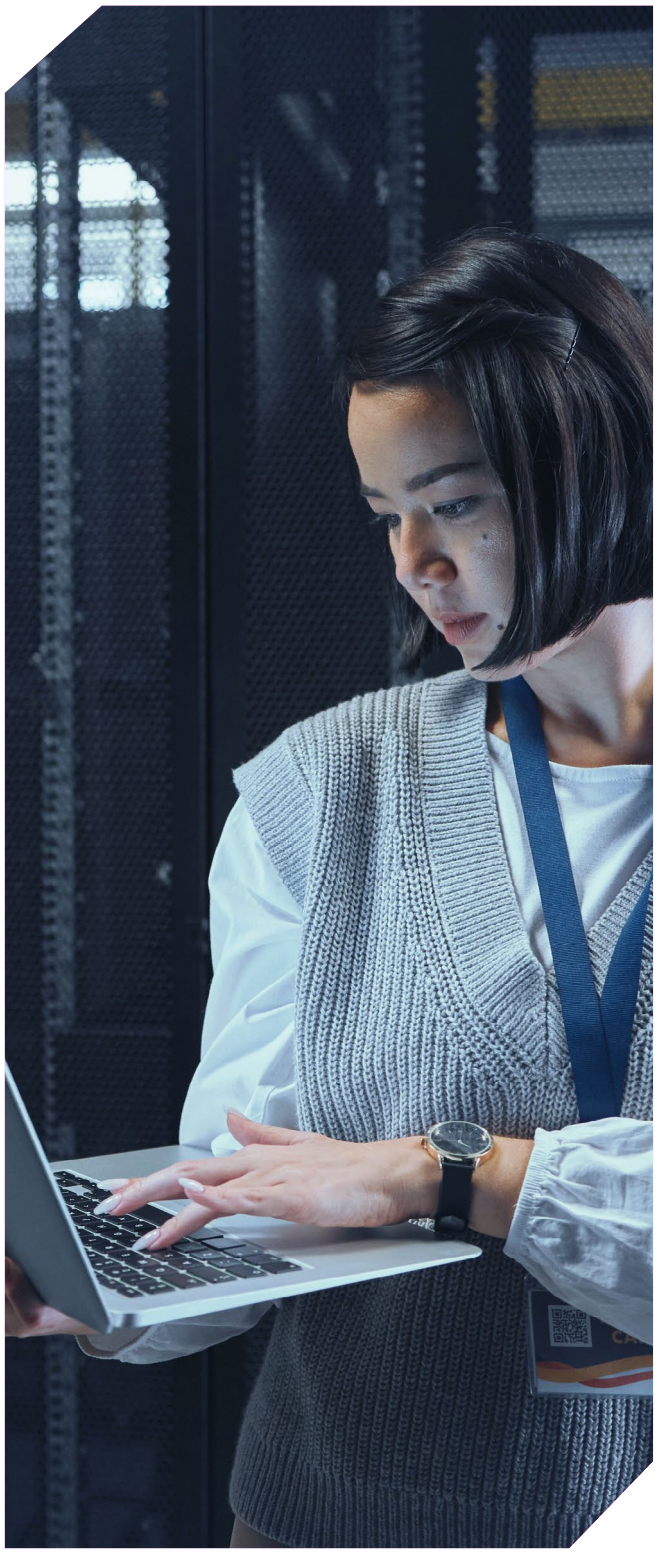
7 Sources include: Wyles, L. (2024). Satellite is an increasingly cost-effective means for MNOs to reach remote mobile customers. Analysys Mason. Available at: https://www.analysysmason.com/research/content/articles/remote-satellite-viability-nsi039/; and Preciado, E. (2022). *Using CBH over satellite to bridge the digital divide in Mexico.* Gilat Satellite Networks. Available at: https://www.gilat.com/using-cbh-over-satellite-to-bridge-the-digital-divide-in-mexico/

complement to terrestrial networks, NGSO systems can help close connectivity gaps while reducing costs associated with deploying new broadband infrastructure, especially in areas where traditional terrestrial solutions are expensive or impractical.[8] For mobile network operators (MNOs), this could significantly lower the cost of expanding broadband coverage to the entire ASEAN population by at least $15 billion (or $1 billion annually assuming a 15 year build-out period).

Universal and meaningful Internet access is the foundation of regional digital development. Adding NGSO systems to the region's connectivity mix, alongside policies to encourage usage, could unleash transformative economic impact through enhancing Internet coverage and usage across Southeast Asia and unlocking significant new growth opportunities.

Our study estimates that progress toward improved Internet coverage and usage is expected to unlock $47.8 billion worth of annual economic benefits, with the potential to create up to 3.8 million jobs for the ASEAN region.[9] These benefits can be achieved by promoting Internet coverage and usage through three key user groups: *unserved users* (i.e., those who live in areas not covered by any type of Internet network); *unconnected users* (i.e., those who live in coverage areas but do not use the Internet), and; *under-connected users* (i.e., those who are connected and use the Internet but in a constrained manner).

NGSO-enabled connectivity can also support ASEAN in addressing key growth challenges including (i) reducing trade and logistics costs to drive regional trade growth; and (ii) mitigating the economic impact of natural disasters.[10] NGSO systems enable the use of Internet of Things (IoT) devices for improved vehicle and cargo tracking and real-time monitoring across entire road journeys, leading to potential road logistics savings of $33.6 billion by 2030. Additionally, connectivity enabled by NGSO systems would allow early warning systems to be enhanced, mitigating the impact of natural disasters and facilitating $9.3 billion worth of cost savings by preventing infrastructure damage.



[8] Barasa, H., Ruiters, E., & Humphrey, T. (2024). *Bridging the digital divide in Africa: The promising role of LEO satellites.* Tony Blair Institute for Global Change. Available at: https://assets.ctfassets.net/75ila1cntaeh/yileuHTXuHmJpJaooZBOI/18651f2afd1252931b36c16a7ffc60a3/6C99uWYjbk2WrS58kxBHpF--152217122024

[9] Internet coverage is defined as the share of the population geographically within range of a network. Internet usage is defined as the share of the population that actually goes online. Internet access combines both coverage and usage, reflecting the proportion of people who both have network connectivity and choose to use it. In this report, Internet access always refers to efforts to improve both coverage and usage among the population.

[10] The benefits of addressing the two challenges to growth can only be unlocked with regulatory support, and would require relevant regulatory changes to enable these land-based mobility applications, as well as policies that drive technology adoption. The analyses do not include Myanmar.

Targeted regional collaboration and domestic action are critical to harnessing the benefits of NGSO systems for regional connectivity. Finding the right mix of connectivity technologies will depend, inevitably, on steps taken at the national level, but also on regional action that expands countries' options. That means preserving national sovereignty while giving countries access to the broadband capacity they need to stay competitive in the digital economy. Against that backdrop, this report sets out the following recommendations to support the development and deployment of NGSO systems through regional collaboration and domestic policy action by AMS governments:

1. Develop cross-border satellite regulatory frameworks that support innovation and deployment. Satellite regulation is governed by international frameworks and agreements, as well as national authorities, but NGSO systems create cross-border complexities due to their constant movement across jurisdictions. ASEAN can reduce regulatory fragmentation and support innovation by adopting harmonized regional approaches.

2. Modernize interference rules. Current interference rules, such as technical limits governing Equivalent Power Flux Density (epfd) were developed decades ago and do not reflect advances in NGSO technology. Modernizing these limits based on technical evidence could support the adoption of NGSO systems across ASEAN and help the region reap the benefits they can bring to the connectivity mix, while protecting the legacy satellite systems.

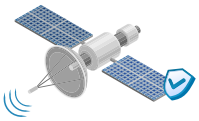
3. Support sufficient spectrum availability and access for LEO services. As NGSO systems expand, spectrum access will become a key bottleneck. ASEAN regulators need to play a more active role in shaping global policy frameworks and spectrum rules, so they reflect the latest advances in satellite technology and support a robust spectrum pipeline that keeps costs down across the region.

4. Promote digital adoption for businesses and individuals. ASEAN governments are already advancing Micro, Small, and Medium Enterprise (MSME) digitalization and workforce development through national roadmaps and programs that build digital skills and support business transformation. Continued investment, including in AI, emerging technologies, and upskilling, alongside regional knowledge sharing, will ensure broader and more effective digital adoption.

5. Create a safe and secure online environment. As Internet usage grows, ASEAN governments must strengthen cybersecurity and combat scams through user education and coordinated enforcement efforts. Strong public-private collaboration is essential to responding effectively to cybercrime and protecting users.

Growth through connectivity: Supporting ASEAN's vision with non-geostationary satellite systems

1 At least $15 billion in infrastructure deployment costs saved by NGSO systems



$15 billion

at least in cost savings for backhaul infrastructure from deploying NGSO systems to complement terrestrial infrastructure – equivalent to saving 19% of total deployment costs of fiber-to-the-X (FTTx)

2 Improved Internet coverage and usage could unlock $47.8 billion in annual economic benefits and potentially create up to 3.8 million jobs

- Expanding coverage for ***unserved users***
- Broadening Internet usage through increased affordability for ***unconnected users***
- Deepening intensity of usage through improved speeds for ***under-connected users***

$7.2 billion worth of economic benefits from expanding Internet coverage

+

$40.6 billion worth of economic benefits from promoting Internet usage

47.8 billion

total economic benefits created for users

3 Addressing key challenges to growth

$ 9.3 billion

saved by mitigating the impact of natural disasters through deploying a more expansive network of early warning systems and real-time tracking of natural disasters

$ 33.6 billion

potential cost savings in logistics from enabling the use of Internet of Things (IoT) devices for improved vehicle and cargo tracking and real-time monitoring supported by levers to drive adoption

4 Targeted governmental actions are needed to promote NGSO systems

Reducing barriers of adoption

- Develop cross-border satellite regulatory frameworks that support innovation and deployment
- Modernize interference rules
- Support sufficient spectrum availability and access of LEO services

Broadening usage

- Promote digital adoption for businesses and individuals
- Create a safe and secure online environment

1. Enabling ASEAN's growth vision: the role of affordable and reliable Internet

1.1. Digital connectivity is an integral part of ASEAN's growth vision

ACV 2045 adopted in 2025 sets out a growth vision for the next two decades that calls for the creation of a connected digital community underpinned by advanced digital services with a view to bringing the greatest benefit to ASEAN and its populations.[11] Building on this vision, the ASEAN Digital Masterplan 2030 (ADM 2030), launched in January 2026, provides a roadmap for ASEAN's digital development over the next five years. It identifies reliable digital infrastructure as the foundation of economic and societal transformation and emphasizes the urgent need to ensure that connectivity is available, affordable, and accessible across the whole region, including in areas which are currently unserved or underserved.[12]

ASEAN stands to gain significantly from improved digital infrastructure and Internet connectivity. Affordable and reliable Internet connectivity supports the flow of knowledge and data across borders that creates new business opportunities, fosters innovation, and enables the use of technologies that strengthen productivity. It drives financial inclusion through access to digital banking services, enables access to new training and job opportunities, and creates value for remote communities and vulnerable groups. The International Telecommunication Union (ITU) estimates that a 10% increase in mobile broadband penetration is associated with a 0.51% increase in gross domestic product (GDP) per capita in the Asia Pacific region.[13]

In ASEAN, where MSMEs form the backbone of the economy, with over 70 million MSMEs equivalent to 97% of all businesses and employing 85% of the labor force, improved digital connectivity allows small businesses to strengthen productivity and expand market access.[14] In particular, the use of digital platforms, enabled by reliable and affordable Internet connectivity, allows MSMEs to reach new customer bases and drive cross-border trade and e-commerce in the region, supporting the ASEAN Digital Economy Framework Agreement (DEFA)'s efforts to accelerate ASEAN's transformation into a leading digital economy.

[11] ASEAN Secretariat (2025), ASEAN Community Vision 2045: "Resilient, Innovative, Dynamic, and People-Centred ASEAN". Available at: https://asean.org/wp-content/uploads/2025/05/05.-ASEAN-Community-Vision-2045_adopted.pdf

[12] ASEAN Secretariat (2026), *ASEAN Digital Masterplan 2030*. Available at: https://asean.org/wp-content/uploads/2026/01/ADM-2030.pdf

[13] International Communication Union (2020), *How broadband, digitization and ICT regulation impact the global economy. Global Econometric Modelling*. Available at: https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-EF.BDR-2020-PDF-E.pdf

[14] ASEAN Secretariat (n.d.), Economic Community: Resilient and Inclusive ASEAN – Overview. Available at: https://asean.org/our-communities/economic-community/resilient-and-inclusive-asean/development-of-micro-small-and-medium-enterprises-in-asean-msme/

1.2. A "connectivity divide" persists in the region

Despite the efforts of AMS governments to drive connectivity and digital transformation, a "connectivity divide" persists between the region's urban centers and its rural, landlocked, or archipelagic regions. Even as artificial intelligence (AI) and other emerging technologies spread rapidly through metropolitan hubs, nearly half of Southeast Asia's population resides in rural zones where communities often face limited or non-existent networks (in Cambodia and Lao PDR, where rural residents account for approximately 60% of the population, this divide is particularly pressing[15]).

> **"Nearly half of Southeast Asia's population resides in rural zones where communities often face limited or non-existent Internet access"**

Extending coverage to these underserved areas presents significant technical and financial hurdles. The archipelagic geography of countries such as Indonesia creates high costs for building and maintaining terrestrial infrastructure. Building cell towers and laying inter-island backhaul links across small, dispersed islands of low population density is highly unprofitable for many commercial terrestrial players, leaving these island communities isolated from high-density digital infrastructure.[16] Furthermore, the feasibility of reaching end-users is heavily dictated by the reach of the core network. The length of a country's backbone network influences how much backhaul (middle-mile) and access (last-mile) infrastructure must be built. In certain AMS—such as Thailand, Lao PDR, Myanmar, and Indonesia—backbone network coverage is relatively low, with only around a third or less of their populations within 10 km of a transmission node in 2020.[17] Consequently, greater investment is needed to build long-distance fiber or wireless backhaul networks to reach end users, creating a severe barrier to extending coverage in sparsely populated areas of low commercial interest.

As an effect of these challenges, fixed broadband costs remain prohibitively high— exceeding 10% of gross national income (GNI) per capita in Cambodia, far above the Broadband Commission's recommended 2% affordability threshold.[18] This has contributed to a heavy reliance on mobile networks (103.7 active mobile-broadband subscriptions per 100 people) and corresponding low fixed broadband penetration (9.5 fixed broadband subscriptions per 100 people in 2022).[19]

These challenges underscore the urgent need to diversify the regional connectivity mix as alternative technologies are needed to provide affordable and widespread coverage to the entire ASEAN population. The ADM 2030 recognizes this and envisions a hybrid approach that integrates terrestrial networks and low Earth orbit (LEO) satellite connectivity to diversify connectivity paths.[20]

[15] World Bank (n.d.), "Rural population (% of total population)." Available at: https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS

[16] Asian Development Bank (2025), "The Other Half of the Internet: Closing Asia's Digital Gap". Available at: https://blogs.adb.org/blog/other-half-internet-closing-asia-s-digital-gap

[17] Organization for Economic Co-operation and Development (2023), *Extending Broadband Connectivity in Southeast Asia.* Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/12/extending-broadband-connectivity-in-southeast-asia_74819f28/b8920f6d-en.pdf

[18] Sources include Organization for Economic Co-operation and Development (2023), *Extending Broadband Connectivity in Southeast Asia.* Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/12/extending-broadband-connectivity-in-southeast-asia_74819f28/b8920f6d-en.pdf; Broadband Commission (n.d.), "2025 Broadband Advocacy Target 2". Available at: https://www.broadbandcommission.org/advocacy-targets/2-affordability/

[19] Organization for Economic Co-operation and Development (2023), *Extending Broadband Connectivity in Southeast Asia*. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/12/extending-broadband-connectivity-in-southeast-asia_74819f28/b8920f6d-en.pdf

[20] ASEAN Secretariat (2026), *ASEAN Digital Masterplan 2030*. Available at: https://asean.org/wp-content/uploads/2026/01/ADM-2030.pdf

1.3. Advancements in satellite technology can help address ASEAN's connectivity gaps

Advancements in NGSO systems, especially LEO constellations, could help address gaps that terrestrial networks have not been able to solve and become an important part of ASEAN's connectivity mix in creating a more digitally connected region.

Modern NGSO systems, particularly high-throughput satellite (HTS) and LEO constellations, provide extensive coverage with a significantly smaller infrastructure requirement than traditional terrestrial networks.[21] Unlike fiber or wireless networks, which require extensive civil engineering and often struggle to reach inland or mountainous locations, NGSO systems rely on localized user terminals and gateway stations.[22] This makes them the most technically feasible, and often the only practical, option for providing high-speed broadband to ASEAN's highly remote or topographically challenging terrains.[23]

Besides being able to penetrate geographically challenging terrains, NGSO systems are becoming increasingly economical. The rise of "Managed Network-As-A-Service" offerings and the expanded supply of HTS networks have significantly lowered the cost of satellite connectivity, such as for backhaul. Crucially, NGSO systems bypass the massive capital expenditure associated with trenching and cable laying for fiber deployment and also the building of cell towers. While costs of deploying terrestrial infrastructure increase exponentially in sparsely populated areas,[24] NGSO deployment costs are far less sensitive to population density.

This makes NGSO systems an attractive option for rural and remote Southeast Asian regions where terrestrial infrastructure is prohibitively expensive. **Box 1** provides an overview of advancements in NGSO systems and the potential benefits they could bring in enabling widespread and affordable digital connectivity.

[21] African Telecommunications Union. (2024). Evaluating the impact of satellite communication on achieving sustainable development goals in Africa: Opportunities, barriers, and future pathways (Version 3). Available at: https://atuuat.africa/wp-content/uploads/2024/07/V3-Empowering-Africa-SDGs-and-Satellite-Connectivity.pdf

[22] Bamford, R., Hutchinson, G., & Macon-Cooney, B. (2021). The progressive case for universal Internet access: How to close the digital divide by 2030. Tony Blair Institute for Global Change. Available at: https://assets.ctfassets.net/75ila1cntaeh/5EwsYtqgYOXh8SjCkcKNGj/653ea680f47be555757553d652885f7e/The-Progressive-Case-for-Universal-Internet-Access-How-to-Close-the-Digital-Divide-by-2030.pdf

[23] Sources include: Wyles, L. (2024). Satellite is an increasingly cost-effective means for MNOs to reach remote mobile customers. Analysys Mason. Available at: https://www.analysysmason.com/research/content/articles/remote-satellite-viability-nsi039/; and Preciado, E. (2022). Using CBH over satellite to bridge the digital divide in Mexico. Gilat Satellite Networks. Available at: https://www.gilat.com/using-cbh-over-satellite-to-bridge-the-digital-divide-in-mexico/

[24] Bokun, S., Ohlsson, A., Daly, A., Palerm, L., Jones, O., Kiritharan, N., & Wyles, L. (2025). LEO satellite broadband: A cost-effective option for rural areas of Europe. Analysys Mason. Available at: https://www.analysysmason.com/consulting/reports/leo-satellite-broadband-europe/

Box 1: Advancements in NGSO systems

Satellites have supported global connectivity since the 1960s. These have primarily relied on geostationary (GEO) satellites, which orbit at 36,000 kilometers above the Earth's equator.[25] These are efficient for broadcasting, weather forecasting and radio, due to being fixed above a certain point on the earth, but suffer from high latency due to their extreme distance from Earth, limiting their effectiveness in meeting the needs of time-sensitive applications that involve real-time data transmission and high-speed processing, or those requiring the smallest or lowest power consumption user devices such as IoT. [26]

However, increased demand and falling deployment costs for NGSO systems, particularly LEO constellations, have strengthened the potential of LEO satellites to support the growth of more communications applications.[27] The primary advantage of NGSO systems lies in their proximity to Earth. Orbiting between 200 and 2,000 kilometers, these satellites significantly reduce signal travel time, offering latency levels comparable to terrestrial fiber networks. This capability enables time-sensitive connectivity applications, like video conferencing, which were previously unfeasible via satellite.

Advancements such as inter-satellite laser links and high-throughput antennas are helping to provide signals that are significantly faster, have reduced latency, can provide enhanced resilience, and require fewer ground stations compared to current satellites. These innovations allow NGSO constellations to deliver fiber-like speeds to smaller user terminals, making them a scalable solution for closing connectivity gaps in underserved regions.[28]

1.4. NGSO systems could reduce broadband deployment costs in ASEAN countries by at least $15 billion

By complementing terrestrial networks to bridge the connectivity gap, NGSO systems can reduce costs associated with deploying new broadband infrastructure, especially in areas where traditional terrestrial solutions are expensive or impractical.[29] In broadband deployment, the primary cost driver is the distance from the core network Points of Presence (PoPs), inclusive of the backhaul and last-mile components. MNOs face significant financial barriers when attempting to connect remote communities, with constructing and maintaining backhaul infrastructure forming a substantial portion of the overall cost.

In this context, NGSO systems provide a critical partnership for MNOs. By reducing the cost of backhauling data from remote locations and across challenging topographies, NGSO systems enable a commercially viable proposition to help extend the reach of terrestrial networks. For example, in Australia, Amazon Leo signed an agreement with national broadband provider NBN Co to bring satellite Internet to more than 300,000 eligible customers in the country's rural regions.[30] The partnership will overcome the unique connectivity challenges in Australia's vast geography that

[25] Outlined by the ITU (2023), "WRS-22: Regulation of satellites in Earth's orbit." Available at: https://www.itu.int/hub/2023/01/satellite-regulation-leo-geo-wrs/

[26] Tony Blair Institute for Global Change (2024), Bridging the Digital Divide in Africa: The Promising Role of LEO Satellites. Available at: https://assets.ctfassets.net/75ila1cntaeh/yileuHTXuHmJpJaooZBOI/18651f2afd1252931b36c16a7ffc60a3/6C99uWYjbk2WrS58kxBHpF--152217122024

[27] BCG (2024), "Regulating the Next Generation of Satellites". Available at: https://www.bcg.com/publications/2024/regulating-the-next-generation-of-satellites

[28] BCG (2024), "Regulating the Next Generation of Satellites". Available at: https://www.bcg.com/publications/2024/regulating-the-next-generation-of-satellites

[29] Barasa, H., Ruiters, E., & Humphrey, T. (2024). Bridging the digital divide in Africa: The promising role of LEO satellites. Tony Blair Institute for Global Change. Available at: https://assets.ctfassets.net/75ila1cntaeh/yileuHTXuHmJpJaooZBOI/18651f2afd1252931b36c16a7ffc60a3/6C99uWYjbk2WrS58kxBHpF--152217122024

[30] Amazon (2025). Project Kuiper partners with NBN Co to bring low Earth orbit satellite broadband to rural Australia. Available at: https://www.aboutamazon.com.au/news/innovation/project-kuiper-partners-with-nbn-co-to-bring-low-earth-orbit-satellite-broadband-to-rural-australia

traditional infrastructure cannot overcome and enable those in rural and remote areas to participate in the digital economy with improved access to remote work opportunities, online education as well as telehealth services.

In Southeast Asia, harnessing NGSOs for backhaul could significantly lower the cost for MNOs to expand broadband coverage to the entire ASEAN population. Our estimates suggest that using NGSO systems for backhaul offers potential savings of **at least $15 billion** for MNOs.[31] Based on a conservative 15-year build-out period,[32] these savings equate to approximately $1 billion annually.[33]

[31] The analysis does not include Myanmar. For more details, please refer to Box A1 in the Appendix of this report.

[32] Others such as Oughton (2022) have used 10-year assessment periods, but this study uses a more conservative duration of 15 years to account for both consumer affordability and commercial feasibility considerations.

[33] To quantify the savings impact, we estimate the proportion of the ASEAN population in rural or challenging terrains where broadband coverage and access is currently hindered by logistical and financial feasibility considerations for building out backhaul. The per-user cost advantage of leveraging NGSO systems in place of fiber backhaul to connect to these remote communities is then estimated.

2. NGSO systems: unlocking digital development and new growth areas

Universal and meaningful Internet access is the foundation of regional digital development, which the ITU defines as enabling all individuals and businesses to access affordable connectivity that is good enough for an enriching and productive digital experience.[34] Adding NGSO systems to the region's connectivity mix, alongside policies to encourage usage, could unleash transformative economic impact through enhancing Internet coverage and usage across the ASEAN region and unlocking significant new growth opportunities.

2.1. Improved Internet coverage and usage could unlock $47.8 billion worth of economic benefits per year for ASEAN and potentially create up to 3.8 million jobs

Over the past decade, the region has made good progress in bringing more communities online: the Internet penetration rate increased from 63% in 2020 to 82% in 2024 (above the global average of 71%).[35] Despite such progress, however, coverage and quality gaps persist, and around 150 million adults in the region still lack access to digital technologies, particularly in rural and remote areas.[36]

"Around 150 million adults across Southeast Asia, around a third of the population, continue to lack access to digital technologies"

In addition, coverage alone is not sufficient if users do not (or cannot) use the Internet meaningfully. Globally, the usage gap is far larger than the coverage gap: GSMA estimates that 38% of the global population lives within mobile broadband coverage but does not use mobile Internet.[37] In Southeast Asia, barriers such as affordability and limited digital skills contribute to digital exclusion, reinforcing that adoption can lag even when networks exist.[38]

With continued headroom to broaden coverage and deepen meaningful usage, significant value is yet to be unlocked. This study estimates the impact of a future where ASEAN achieves full Internet coverage and improved usage across three user groups: unserved, unconnected, and under-connected.

For each group, progress in coverage, affordability, and quality can generate significant economic and social benefits (Exhibit 1). Overall, we estimate that this progress is expected to unlock $47.8 billion in economic benefits annually, equivalent to 1.1% of ASEAN's 2025 GDP, and potentially create up to 3.8 million jobs.[39]

[34] As defined by the International Telecommunication Union (ITU)'s (2022) Achieving universal and meaningful digital connectivity report. Available at: https://www.itu.int/itu-d/meetings/statistics/wp-content/uploads/sites/8/2022/04/UniversalMeaningfulDigitalConnectivityTargets2030_BackgroundPaper.pdf

[35] Sources include: ASEAN (2021), "ASEAN Statistical Yearbook 2021". Available at: https://www.aseanstats.org/wp-content/uploads/2021/12/ASYB_2021_All_Final.pdf; ASEAN (2025), "ASEAN Statistical Highlights 2025". Available at: https://www.aseanstats.org/wp-content/uploads/2025/10/ASH2025.pdf; and World Bank (2024), "Individuals using the Internet (% of population)". Available at: https://data.worldbank.org/indicator/IT.NET.USER.ZS

[36] World Economic Forum (2022), Bridging Southeast Asia's digital divide to drive financial inclusion. Available at: https://www.weforum.org/stories/2022/05/bridging-southeast-asia-digital-divide-driving-financial-inclusion/

[37] GSMA (2024), The State of Mobile Internet Connectivity 2025. Available at: https://www.gsma.com/somic/

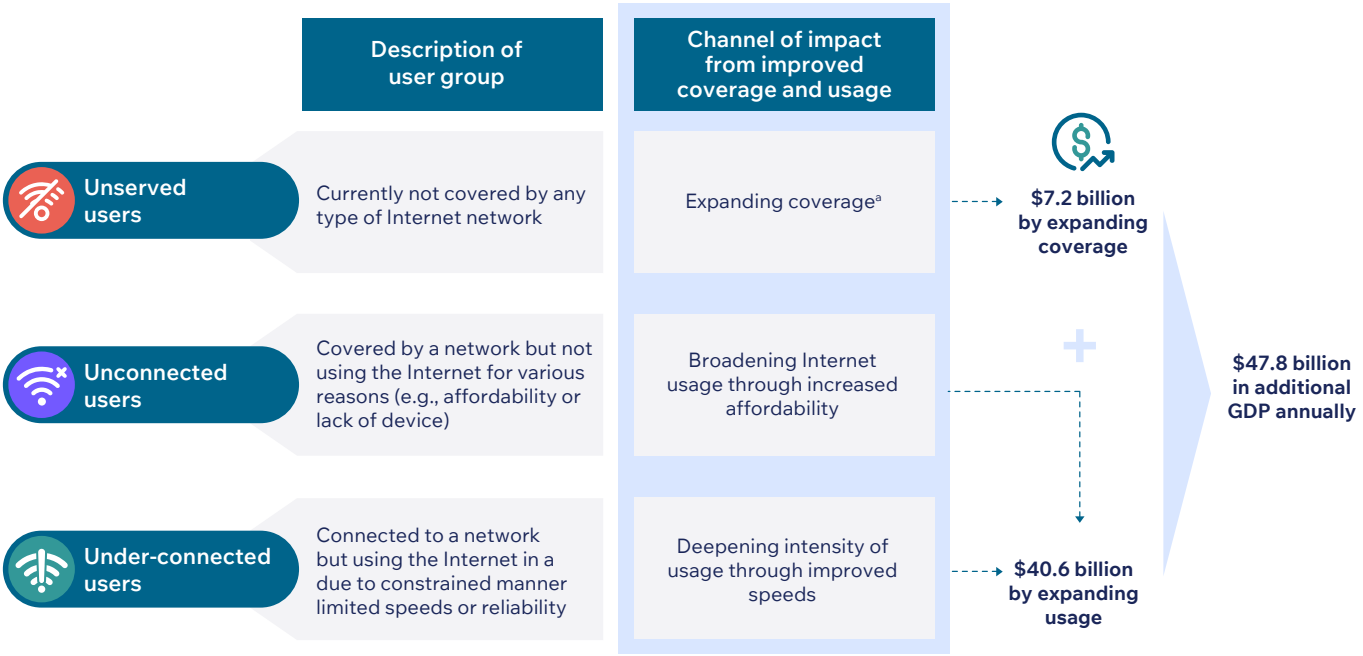
[38] Organization for Economic Co-operation and Development (2023), Extending Broadband Connectivity in Southeast Asia. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/12/extending-broadband-connectivity-in-southeast-asia_74819f28/b8920f6d-en.pdf

[39] The jobs supported are computed using GDP per employed worker for each individual member state as the measure of labor productivity.

Exhibit 1

Improved Internet coverage and usage could create up to $47.8 billion worth of economic benefits per year for ASEAN economies through three channels

How improved coverage and usage can impact ASEAN economies for three different groups of users and the channels of impact



Notes:

a. For the purposes of this analysis, we assume Internet network coverage is expanded to cover the entire ASEAN population to outline the scale of potential impact.
b. Myanmar is excluded from the analysis

2.2. The economic impact is realized through three distinct but complementary channels

(i) **Expanding coverage for unserved users to access digital services.** *This refers to people living in areas currently not covered by any Internet network.*

While the region has made substantial progress in expanding coverage, last-mile gaps persist in hard-to-serve geographies, including archipelagic routes, mountainous areas, and remote border provinces, where terrestrial rollout is costly and backhaul is limited.

Expanding coverage in these areas could bring the remaining unserved users online and widen access to essential digital services, with tangible improvements in daily life.

In Indonesia, for example, while major backbone initiatives have improved inter-island links, many small towns still lack sufficient backhaul and terrestrial connectivity, making commercial deployment challenging in less dense areas.[40] **Box 2** highlights how NGSO systems could help close these gaps across a range of geographies and allow users to leverage a range of digital services, including financial and banking services.

[40] Organization for Economic Co-operation and Development (2023), Extending Broadband Connectivity in Southeast Asia. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/12/extending-broadband-connectivity-in-southeast-asia_74819f28/b8920f6d-en.pdf

Box 2: Growing interest in the use of alternative technologies to support digital access and financial inclusion in the Philippines

In 2022, the Bangko Sentral ng Pilipinas (BSP), together with the Philippine Space Agency (PhilSA) and the Department of Science and Technology Advanced Science and Technology Institute (DOST-ASTI) piloted satellite-based Internet deployment at rural bank sites (where installation of additional terrestrial networks to boost connectivity was less feasible) with the objective of improving last-mile connectivity in underserved communities.[41]

The pilot included a locally-developed Weather and Performance Monitoring System equipped with a network performance monitoring device to track network performance (e.g., latency and throughput) against weather conditions such as rain, temperature, humidity, and pressure, with the objective of evaluating the performance and reliability of the satellite Internet service under local weather conditions to support more reliable access for banks and users.

Around a third of municipalities in the Philippines were considered unbanked and lacking access to financial inclusion services in 2022. The BSP therefore noted their belief in the capability of satellite technology to enhance connectivity in rural areas and expand the capacity of banks to provide digital financial services, particularly in unserved and underserved areas.

(ii) **Broadening Internet usage to unconnected users who face barriers.** *This includes people living in areas where some level of network coverage is available, but who are not using the Internet due to a lack of devices, limited affordability, or digital illiteracy.*

Even where coverage exists, many households remain unconnected because of the unavailability of affordable Internet access and/or devices. These constraints are often more apparent outside major cities, where incomes are lower and service quality can be less consistent.

A study by the Economic Research Institute for ASEAN and East Asia (ERIA) suggests that the price of 1GB of mobile data (relative to income) is far higher in several AMS (e.g., Cambodia, Lao PDR, the Philippines, Viet Nam) than in Singapore or Malaysia, which have higher gross national income per capita.[42] Mobile Internet can be especially expensive in the countryside partly due to gaps in rural network build-out.

Alongside lowering the recurring cost of data, increasing smartphone access and strengthening digital skills are essential to converting "coverage" into "usage", especially for MSMEs and informal workers who could benefit from basic tools like messaging, online banking, e-commerce storefronts, and digital payments. **Box 3** provides an example of how the Vietnamese government sought to support access to online learning through the provision of Internet-enabled devices in the wake of the COVID-19 pandemic.

[41] Philippine Space Agency (2022), "PhilSA, DOST-ASTI, BSP kick off financial inclusion partnership through satellite tech". Available at: https://philsa.gov.ph/news/philsa-dost-asti-bsp-kick-off-financial-inclusion-partnership-through-satellite-tech/

[42] Economic Research Institute for ASEAN and East Asia (2020), "Improving Digital Connectivity for E-commerce: A Policy Framework and Empirical Note." E-commerce Connectivity in ASEAN. Available at: https://www.eria.org/uploads/media/E-commerce-Connectivity-in-ASEAN/6_Chapter-2_Improving-Digital-Connectivity-for-E-commerce_A-Policy-Framework-and-Empirical-Note.pdf

Box 3: Supporting access to online learning through Internet-enabled devices for disadvantaged students[43]

Through a program called "Internet Connection and Computers for Students", the Vietnamese government provided support for students who are unable to afford Internet devices to carry out online learning, which had become prevalent in the wake of the COVID-19 pandemic. The program aimed to equip up to one million disadvantaged students with electronic devices for online learning so that all students will have access to online learning programs by the end of 2021.

The program sought to ensure greater inclusion in education and support disadvantaged students in benefitting from innovative teaching and learning methods to contribute to Viet Nam's transformation into a digital society. It received strong support from the private sector as well as local unions through donations of electronic devices to schools and courses for parents to support their children in understanding and navigating online learning.

(ii) **Deepening intensity of Internet usage for under-connected users.** *This includes those who are connected to a network and using the Internet today in a constrained manner due to low connectivity speeds or a lack of access to reliable Internet.*

For those who are already connected to and using the Internet, there are benefits to be gained from deepening the intensity of usage as broadband services become more affordable and the quality improves. However, limited availability of relevant local content, concerns around safety and security, and more importantly, the lack of reliable and affordable connectivity contributes to underuse.

For example, power outages and fiber cuts are among key causes of connectivity disruptions in Cambodia, illustrating why quality access can remain a challenge for the region.[44]

With more affordable, higher-quality, and more reliable broadband, users can unlock growth by moving from basic tasks toward higher-value digital activities (e.g., frequent video collaboration, cloud adoption, data analytics, AI-enabled workflows). For businesses, more intensive usage enables a transition from basic online presence to full digital transformation, including adopting cloud-based enterprise software, using data analytics to inform decisions, and optimizing supply chains. **Box 4** illustrates how reliable and high-speed connectivity has expanded healthcare services in hard-to-reach communities in Indonesia.

[43] OpenGov Asia (2021), Vietnam launches 'Internet Connection and Computers for Students' programme. Available at: https://archive.opengovasia.com/2021/09/28/vietnam-launches-internet-connection-and-computers-for-students-programme/

[44] Organization for Economic Co-operation and Development (2023), Extending Broadband Connectivity in Southeast Asia. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/12/extending-broadband-connectivity-in-southeast-asia_74819f28/b8920f6d-en.pdf

Box 4: Providing high-speed wireless connectivity to strengthen last-mile health services in Indonesia

In Indonesia's archipelagic geography, many remote primary care facilities still lack reliable and fast Internet access, limiting timely reporting and the delivery of healthcare services. Roughly 2,700 of more than 10,000 clinics in Indonesia still do not have Internet access.[45]

To improve last mile connectivity, an NGSO-based satellite Internet service was piloted at three health centers in May 2024, two in Bali and one on Aru Island, Maluku.[46] One key use case was the real-time input of health data into Aplikasi Sehat IndonesiaKu (ASIK), a national tool used to collect, monitor, and track Indonesians' health data.[47]

For instance, in Aru Island, data entry was highly manual. Teams had to travel at least two hours by speedboat from urban areas to gather data from primary care facilities.[48] The adoption of NGSO connectivity provided clinics with high-speed Internet of up to 269 Mbps, enabling healthcare workers to update and monitor patients' data in near real-time. This has been transformational: local healthcare workers now have the information they need to respond faster to issues in the community.

2.3. NGSO-enabled connectivity can drive new growth frontiers

Beyond the economy-wide gains that come with higher broadband coverage and usage, more affordable and reliable connectivity from adding NGSO systems to the connectivity mix could also speed up the adoption of technologies that address some of ASEAN's most pressing barriers to growth. These include (i) technologies that can address barriers to regional trade and catalyze trade growth, as well as (ii) technologies that mitigate the impact of natural disasters and improve disaster management and response.[49]

AMS can save up to $33.6 billion in logistics costs and drive intra-regional trade growth through IoT deployment powered by NGSOs

Trade is a major engine of growth for ASEAN: in 2024 total merchandise trade reached $3.84 trillion, equivalent to 98.3% of ASEAN GDP, underscoring the region's reliance on the efficient cross-border movement of goods.[50] Yet intra-ASEAN trade remains relatively muted. Its share of total goods trade was 21.4% in 2024 and has stayed in the low-20% range for much of the past two decades.[51] A key constraint for trade growth in ASEAN is high logistics and trade costs, which reduce the competitiveness of supply chains and dampen the gains from trade. In some AMS, logistics costs can reach as high as 23% of GDP, compared to a global average of 10–12%.[52] These elevated costs are often

"In some AMS, logistics costs can reach as high as 23% of GDP, compared to a global average of 10–12%"

[45] WSLS (2024), Elon Musk launches Starlink satellite internet service in Indonesia, world's largest archipelago. Available at: https://www.wsls.com/business/2024/05/19/elon-musk-arrives-in-indonesias-bali-to-launch-starlink-satellite-internet-service/

[46] Reuters (2024), Musk, Indonesian health minister, launch Starlink for health sector. Available at: https://www.reuters.com/technology/musk-arrives-indonesias-bali-planned-starlink-launch-2024-05-19/

[47] ASIK (n.d.), Apa itu ASIK? Available at: https://asiksupport-stg.dto.kemkes.go.id/asiksupport-stg/informasi-umum/apa-itu-asik

[48] Sources include: Kemenkes (2024), The Ministry of Health Begins Starlink Internet Trials in Three Healthcare Facilities, Here Are the Results. Available at: https://kemkes.go.id/id/%20kemenkes-mulai-uji-coba-internet-starlink-di-3-fasyankes-ini-hasilnya; and Ministry of Health (2024), The Long Road to Equal Internet Access in Community Health Centers Across Indonesia. Available at: https://medium.com/%40dtokemkes/jalan-panjang-mengejar-pemerataan-akses-internet-di-puskesmas-seluruh-indonesia-6569f5e53aed

[49] The benefits of addressing the two challenges to growth can only be unlocked with regulatory support, and would require relevant regulatory changes to enable these land-based mobility applications, as well as policies that drive technology adoption. The analyses do not include Myanmar.

[50] ASEAN (2025), ASEAN Statistical Highlights 2025. Available at: https://www.aseanstats.org/wp-content/uploads/2025/10/ASH2025.pdf

[51] ASEAN (2024), ASEAN Statistical Brief. Available at: https://www.aseanstats.org/wp-content/uploads/2024/05/ASB-202405-03.pdf

[52] Jakarta Post (2024), "Driving economic growth to 8 percent by reducing land logistics cost". Available at: https://www.thejakartapost.com/front-row/2024/12/13/driving-economic-growth-to-8-percent-by-reducing-land-logistics-cost.html; and Organization for Economic Co-operation and Development (2021), OECD Competitiveness Assessment Reviews. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2021/05/oecd-competition-assessment-reviews-logistics-sector-in-indonesia_acc8194d/e0186eb7-en.pdf

linked to gaps in infrastructure quality, limited end-to-end route visibility, fragmented logistics markets, and delays across multi-modal corridors—challenges that are especially acute where supply chains traverse archipelagic routes, mountainous terrain, or long rural stretches.

IoT technologies provide a potential solution to address trade barriers in the region through real-time asset tracking that can reduce costs by 5% to 30%, primarily by reducing delays, improving coordination, and preventing cargo losses.[53] However, logistics IoT relies on a heterogeneous connectivity stack and requires reliable connectivity across the full journey, which is not currently available in ASEAN. Road freight and maritime feeder connections frequently pass through coverage gaps where visibility is lost.

NGSO-enabled connectivity can complement existing networks to provide more continuous coverage across hard-to-reach areas. With improved connectivity, real-time monitoring becomes feasible across entire journeys. For AMS, this could translate into **logistics savings of $33.6 billion** per year, which can be channeled into scaling business operations, increasing productivity, and driving growth.[54] More importantly, these efficiency gains can support stronger intra-ASEAN trade by lowering trade costs, improving delivery reliability, and strengthening the viability of regional sourcing networks.

Improving disaster management and response can mitigate $9.3 billion in infrastructure damage

Southeast Asia is one of the most disaster-prone regions globally. In the WorldRiskIndex 2025, five AMS (out of 11) ranked within the top 30 countries worldwide for disaster risk: the Philippines (1st), Indonesia (3rd), Myanmar (6th), Viet Nam (13th), and Thailand (24th).[55] A key driver is the region's exposure to climate-related events. Southeast Asia has one of the world's longest coastlines (around 234,000 km), and an estimated 77% of the population lives in coastal areas, where major cities, ports, and economic activity are concentrated.[56]

"In the WorldRiskIndex 2025, five ASEAN countries (out of 11) ranked within the top 30 countries worldwide for disaster risk"

Past losses have been substantial. Between 2009 and 2020, weather-related disasters resulted in 33,325 deaths, around 222 million people affected, and an estimated $97.3 billion in economic losses across ASEAN. This has taken a toll on economic development, with estimates indicating that such events have caused between 0.47% to 0.87% in GDP losses for member states.[57] As climate change accelerates, risks are expected to intensify further. For instance, a study estimates that annual flooded areas across Asia could increase between 1.4 to 1.8 times by 2050, with economic damages increasing up to six times, reaching $143.7–$197.8 billion.[58] Southeast Asia is projected to account for the largest share of these damages, up to 41.4% of the economic damages in Asia.

[53] Macaulay, J., Buckalew, L., & Chung, G. (2015), Internet of Things in logistics: A collaborative report by DHL and Cisco on implications and use cases for the logistics industry. Available at: https://www.dhl.com/content/dam/dhl/global/core/documents/pdf/glo-core-internet-of-things-trend-report.pdf

[54] A detailed explanation of the methodology is in the Appendix. This analysis does not include Myanmar.

[55] Bündnis Entwicklung Hilft (2025), "The WorldRiskReport." Available at: https://weltrisikobericht.de/worldriskreport/#iLightbox[288aa5ec5d928286428]/0

[56] ASEAN Secretariat (2021), ASEAN State of Climate Change Report: Current Status and outlook of the ASEAN region – Toward the ASEAN climate vision 20250. Available at: https://asean.org/wp-content/uploads/2021/10/ASCCR-e-publication-Correction_8-June.pdf

[57] ASEAN Secretariat (2021), ASEAN State of Climate Change Report: Current Status and outlook of the ASEAN region – Toward the ASEAN climate vision 20250. Available at: https://asean.org/wp-content/uploads/2021/10/ASCCR-e-publication-Correction_8-June.pdf

[58] Monioudi et. al (2025), Impact of sea level rise and adaptation across Asia and the Pacific. Available at: https://www.nature.com/articles/s41598-025-11517-6

The deployment of NGSO satellites could mitigate the impact of natural disasters in Southeast Asia by enabling early detection and better forecasting. While GEO satellites offer continuous coverage of large areas, making them ideal for tracking slow-moving disasters like cyclones and monitoring weather patterns over extended periods, NGSO satellites can provide frequent revisits and high-resolution imagery that enable the rapid detection and monitoring of evolving disasters like wildfires, flash floods, and earthquakes. The low latency of NGSO satellites also ensures fast communication, allowing quicker emergency responses.

In remote areas lacking terrestrial connectivity, NGSO-enabled connectivity can facilitate monitoring and data transmission for disaster prevention. With continuous, reliable connectivity across remote and rural regions, governments and agencies can deploy a more expansive network of early warning systems with IoT and remote sensing technologies. According to the World Meteorological Organization, timely warnings can reduce disaster-related losses by 20%, prevent $13 billion in asset losses annually, and generate well-being gains equivalent to a $22 billion increase in global income.[59]

By strengthening early warning systems, governments and response agencies can better plan and coordinate actions when a disaster happens. This study estimates that better and earlier detection enabled by NGSO systems can mitigate up to **$9.3 billion in infrastructure damage** brought about by natural disasters in ASEAN each year.[60] These benefits become even more critical during extreme weather events, which can cause significantly higher economic impact than the average disaster.

Beyond the benefits of NGSO-enabled connectivity, **Box 5** highlights a further role that NGSO satellites can play in responding to crises, by restoring communications and sustaining coordination.

Box 5: Role of NGSO satellites in strengthening in-crisis response

NGSO satellites can support resilient communication during and after disasters. When disasters hit areas with terrestrial infrastructure, including fiber-optic cables, towers, and data centers, NGSO systems can serve as a critical failover if that infrastructure is damaged, ensuring uninterrupted back-up connectivity. This allows first responders to coordinate rescue efforts and affected residents to contact loved ones even when local grids are down. Recent deployments in ASEAN illustrate these benefits:

Malaysia (Sabah): Floods in Paitan in February 2026 submerged telecommunications towers and cut off villages from communication networks. Authorities mobilized temporary NGSO connectivity to restore essential links for response teams and enabled aid delivery.[61] The terminals' portability supported rapid deployment in the field, including operations without mains electricity (such as via vehicle power), with connectivity also extended to security agencies working in hard-to-reach areas.

Philippines: After Severe Tropical Storm Opong (2025) disrupted communications in Masbate, the Department of Information and Communications Technology (DICT) deployed NGSO terminals to restore connectivity at critical sites, supporting emergency coordination and continuity of health services.[62]

Even when terrestrial networks remain operational, NGSO systems can mitigate network congestion by offloading traffic during critical surges.

[59] Liu, E., Kull, D., & Chaponda, M. (2024). The triple dividends of early warning systems and climate services. World Meteorological Organization. Available at: https://wmo.int/media/magazine-article/triple-dividends-of-early-warning-systems-and-climate-services

[60] A detailed explanation of the methodology is in the Appendix. This analysis does not include Myanmar.

[61] Bernama (2026), "Villages cut off by floods to receive Starlink – James Ratib". Available at: https://www.bernama.com/en/news.php/crime_courts/world/news.php?id=2526134

[62] Sources include: Philippine News Agency (2025), "DICT chief to provide more Starlink equipment in storm-hit Masbate". Available at: https://www.pna.gov.ph/articles/1259759; and Tesery (2025), "Starlink makes a difference in Philippine province ravaged by typhoon". Available at: https://www.tesery.com/blogs/news/starlink-makes-a-difference-for-philippine-province-ravaged-by-typhoon

3. Realizing gains: regional collaboration and policy action

NGSO systems provide a viable complement to terrestrial networks, helping bridge current connectivity gaps in Southeast Asia while improving affordability and expanding coverage as part of the region's broader connectivity mix. Universal and meaningful Internet access is key to growing ASEAN's digital economy and unlocking growth opportunities in new areas such as AI and generative AI. Wider access to affordable, reliable Internet can also unlock technologies that address key challenges faced by the region, such as the high cost of logistics and the impact of natural disasters, driving the region's socio-economic development.

To harness the potential benefits of NGSO systems in the region, it is critical for ASEAN governments to collaborate closely with each other and the international community to support the development and deployment of NGSO systems, as well as undertake domestic policy actions to drive increased digital usage in a safe and secure manner.

3.1. Reducing barriers of adoption through regional collaboration

Regional collaboration to modernize and update licensing frameworks, as well as rules governing NGSO systems, can reduce barriers to adoption and support ASEAN economies in harnessing gains. Specific areas in which ASEAN could strengthen collaboration include the following:

1. Develop cross-border satellite regulatory frameworks that support innovation and deployment

Satellite regulation across borders is currently managed through a hybrid system of international treaties, specialized UN agencies, and national regulatory authorities. While the ITU Radio Regulations affirm national sovereignty over the radio spectrum used by satellite Internet, applying that sovereignty to NGSO systems is more complex, since their satellites move rapidly and continuously across multiple national jurisdictions each day.[63] Licensing requirements and technical rules for NGSO systems therefore need to be designed in ways that support cross-border coordination. Without that, ASEAN risks regulatory fragmentation that could slow deployment and limit innovation.

[63] Tech Policy Press (2025), Global Fight Over Who Governs Communications Satellites Heats Up. Available at: https://www.techpolicy.press/global-fight-over-who-governs-communications-satellites-heats-up/

At the regional level, there is scope for ASEAN to explore harmonized approaches to new satellite technologies and support quicker market access. This has nonetheless been achieved in other parts of the world, even those where sovereignty remains a preoccupation. For instance, the European Conference of Postal and Telecommunications Administrations (CEPT) facilitates the harmonization of European satellite services by developing regional frameworks through CEPT Decisions, which establish coordinated technical and regulatory measures to promote efficient spectrum management and cross-border interoperability. In Latin America, the Inter-American Telecommunication Commission (CITEL) adopted a blanket-licensing framework in 2024 to streamline approvals for fixed-satellite service (FSS) earth stations in the region.[64] Regulators in ASEAN could consider similar approaches or measures to provide greater regulatory certainty and reduce administrative barriers for satellite operators as it works towards strengthening regional digital connectivity.[65]

2. Modernize interference rules

Equivalent Power Flux Density (epfd) rules are international technical limits designed to facilitate coexistence between conventional GSO and newer NGSO satellite systems. These rules are defined by the ITU under the ITU Radio Regulations and adopted globally, including by ASEAN countries. The current rules, developed and adopted when satellites were far less advanced, do not reflect major advances in satellite technology.[66] Today's NGSO systems features a completely different design than those of over 25 years ago, for example, they utilize narrow dynamic beams to allow for significant spectrum reuse and sharing that increases capacity and drives down cost of service.

Yet, NGSO systems continue to be limited, despite studies demonstrating that relaxing epfd limits does not affect the operation of most GSO systems.[67] A strong regional push to encourage the global community (in this case the ITU) to consider the modernization of interference limits based on robust assessments would support the development and proliferation of satellite-based networks by relaxing stringent operational constraints, leading to system capacity increases and potential cost reductions by NGSO satellite systems.[68] This would in turn support ASEAN's ability to reap the benefits of NGSO connectivity.

3. Support sufficient spectrum availability and access for LEO services

As NGSO systems become more widely deployed, limited access to spectrum will become a major constraint on expanding capacity, resulting in reduced service quality for end users and constrained innovation. To realize the full potential of NGSO systems as part of the connectivity mix needed to close the digital divide, regulators must ensure sufficient access to spectrum and modernize coordination and coexistence mechanisms.[69]

Specifically, ASEAN's regulators need to become actively involved in contributing to work on ensuring that global policy frameworks and spectrum regulations consider the latest innovations in satellite technology and support a robust spectrum pipeline that limits costs for the region. This could include the adoption of frameworks that allow higher power and more extensive spectrum access for LEOs in shared bands, developing modernized interference protection frameworks and mechanisms for coordinated sharing, and allocating more bands for satellite use.[70]

At the same time, regulatory authorities should prioritize the efficient management of spectrum resources, including through collaboration on best practices for setting relevant fees (including fees for earth stations, landing rights, and spectrum) to ensure that they are aligned with actual spectrum use and are set at a level that can incentivize service deployment in rural or less connected areas where the benefits of NGSOs could be most critical.

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[64] Inter-American Telecommunication Commission. (2024). Recommendation PCC.II/REC.69 (XLIII-24): Guidance for blanket licensing regimes for fixed-satellite service earth stations. Available at: https://www.oas.org/citelevents/en/Documents/DocumentsFile/2804

[65] Manggala (2025), "ASEAN's strategic leap toward 6G integrated sensing and communication". Available at: https://govinsider.asia/intl-en/article/aseans-strategic-leap-toward-6g-integrated-sensing-and-communication

[66] Furchtgott-Roth, H (2023). The economic benefits of updating regulations that unnecessarily limit non-geostationary satellite orbit systems: Part II (SSRN Scholarly Paper No. 4649941). Social Science Research Network. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4649941

[67] Federal Communications Commission (2024). DA 24-376A1: Order granting modification of Kuiper Systems LLC's non-geostationary orbit fixed-satellite service authorization. Available at: https://docs.fcc.gov/public/attachments/DA-24-376A1.pdf

[68] Furchtgott-Roth, H (2023). The economic benefits of updating regulations that unnecessarily limit non-geostationary satellite orbit systems: Part II (SSRN Scholarly Paper No. 4649941). Social Science Research Network. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4649941

[69] Calabrese et. al (2025). Low Earth Orbit satellites: Policies to promote spectrum sharing, foster competition, and close digital divides: A report of the LEO Policy Working Group. International Center for Law & Economics. https://laweconcenter.org/resources/low-earth-orbit-satellites-policies-to-promote-spectrum-sharing-foster-competition-and-close-digital-divides-a-report-of-the-leo-policy-working-group/

[70] Asia-Pacific Economic Cooperation (APEC) (2025), Fostering Connectivity: The LEO Satellite Opportunities in APEC. Available at: https://www.apec.org/publications/2025/08/fostering-connectivity--the-leo-satellite-opportunities-in-apec

3.2. Broadening usage through national policies and initiatives

The inclusion of NGSO systems in the connectivity mix must work in tandem with national policies and initiatives to broaden Internet use, so the benefits of more reliable and affordable connectivity are fully realized. Potential priority actions for AMS governments include the following:

1. Promote digital adoption for businesses and individuals. To ensure that the benefits of digital adoption are fully harnessed, support is needed to enable businesses, particularly MSMEs to adopt digital tools and train workers. Across ASEAN, governments have rolled out plans and roadmaps to support MSME digitalization and workforce development.

For example, the Roadmap for Digital Skills Development in Cambodia 2024–2035 provides a pathway for building digital human capital that can respond to the needs of the industry and government, and support Cambodia's digital transformation. It gives guidance for educational institutions to prepare new curricular materials for digital technology skills in line with labor market needs. It also supports students and workers in identifying and addressing their digital training needs.[71] In Viet Nam, the SMEdx program was launched in 2021 to support MSMEs in their digital transformation journey. The program curates potential digital transformation solutions that MSMEs can apply to their operations, bridging knowledge gaps around how to embark on a digitalization process. The program was expanded and reformed in 2023 to provide an ecosystem of digital platforms to support enterprises in integrating, connecting, and sharing data.[72]

ASEAN countries must continue to invest in digital adoption initiatives and update them to meet changing needs, such as the adoption of AI and generative AI technologies. Even as these initiatives are pursued at the domestic level, there are opportunities for knowledge sharing and exchange across AMS to ensure that ASEAN as a whole benefits from greater utilization of digital technologies

2. Create a safe and secure online environment. As Internet usage increases, users are also increasingly exposed to cybersecurity threats and online scams and fraud. ASEAN governments must therefore work with connectivity partners, including space-based partners, to educate users, strengthen cybersecurity, and reduce cybercrime and fraud.

One example is Malaysia's National Scam Response Center (NSRC) that has been established as an operational center to coordinate rapid response to online financial fraud. The NSRC is a collaboration between the National Anti-Financial Crime Centre (NFCC), the Royal Malaysian Police (PDRM), Bank Negara Malaysia (BNM), and the Malaysian Communications and Multimedia Commission (MCMC), as well as financial institutions and the telecommunications industry. It is therefore able to bring together a range of resources and expertise to combat financial fraud more quickly and effectively.[73]

In Singapore, the Infocomm Media Development Authority (IMDA) and Amazon worked together under the national Digital for Life movement to help advance Singaporeans' essential digital skills, including safe online shopping and GenAI, through the organization of community workshops, such as those that promote essential digital skills for vulnerable and underprivileged communities.[74] Amazon Singapore also plays a key role in the Global Anti-Scam Alliance's Singapore Chapter that works across industries to help protect Singapore consumers against bad actors.[75]

Strong collaboration between the public and private sectors is critical to help ASEAN governments respond to emerging cybersecurity and cybercrime threats, and governments should work closely with responsible private sector players.

[71] Khmer Times (2024), "Cambodia Launches Digital Skills Roadmap for 2024–2035." Available at: https://www.khmertimeskh.com/501468093/cambodia-launches-digital-skills-roadmap-for-2024-2035/

[72] Ministry of Science and Technology (Vietnam) (2023), Digital platforms to support enterprises' move to digitization. Available at: https://english.mst.gov.vn/digital-platforms-to-support-enterprises-move-to-digitization-197157549.htm

[73] National Anti-Financial Crime Centre (NFCC) Malaysia (n.d.), About NSRC. Available at: https://nfcc.jpm.gov.my/index.php/en/about-nsrc

[74] Amazon (2024), IMDA and Amazon Announce Strategic Collaboration to promote digital inclusion and safe online shopping under Digital for Life movement. Available at: https://press.aboutamazon.com/sg/customer-trust/2024/6/imda-and-amazon-announce-strategic-collaboration-to-promote-digital-inclusion-and-safe-online-shopping-under-digital-for-life-movement

[75] Global Anti-Scam Alliance (n.d.), Singapore Chapter. Available at: https://www.gasa.org/chapters/singapore

Appendix: Methodology

Box A1: Approach to estimating savings in enhancing the ASEAN region's Internet connectivity from using NGSO systems for backhaul

Cost savings are estimated by calculating the number of unconnected users addressable via NGSO satellites, multiplied by the reduction in backhaul infrastructure deployment cost per user from leveraging NGSO systems relative to fiber backhaul, net of the costs of obtaining NGSO solutions over their useful life.

Using global benchmarks,[76] we assume NGSO networks can reach 16% of the ASEAN population. This figure is then adjusted by country based on rural density and terrain, without considering satellite capacity constraints, yielding an NGSO-addressable share ranging from 0% (Singapore) to 25.1% (Timor-Leste), or a sum of 100.2 million users across the region. Obtaining fiber-to-the-home (FTTH) deployment capex ranges of $300–$700 per subscriber,[77] adjusting for household size and share of populations living in rural areas,[78] and assuming that 39% of the average per-user cost is attributed to fiber backhaul, we estimate an average fiber backhaul cost of $242–$518 per user across ASEAN member states.

Assuming that the NGSO solution is provided at cost (that is, the initial NGSO CAPEX of $175/user[79] and spread out over its assumed useful life of 10 years) and applying a discount rate of 7%, we arrive at a renting cost of $125 per user, excluding terminals. We assume terminals are priced at $130 each by 2030[80] and that each serves 4 users, resulting in a total NGSO CAPEX of $158 per user. No user acquisition is assumed for countries with FTTH costs per user that are below this NGSO threshold.

Taken together, leveraging NGSO systems for backhaul is expected to yield $15.0 billion (equivalent to 0.4% of ASEAN 2025 GDP) in backhaul infrastructure investment cost savings, or $1 billion annually over 15 years. The analysis excludes Myanmar.

[76] Sources include: Analysys Mason (2025). LEO satellite broadband: A cost-effective option for rural areas of Europe. Analysys Mason. Available at: https://www.analysysmason.com/consulting/reports/leo-satellite-broadband-europe/; and World Bank, (2019). Connecting Africa through broadband: A strategy for doubling connectivity by 2021 and reaching universal access by 2030. Available at: https://documents1.worldbank.org/curated/en/131521594177485720/pdf/Connecting-Africa-Through-Broadband-A-Strategy-for-Doubling-Connectivity-by-2021-and-Reaching-Universal-Access-by-2030.pdf

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Box A2: Approach to estimating the aggregate GDP impact of improved broadband coverage and usage

For the purposes of this study, we assume that improved broadband coverage and usage is brought about by expanding telecommunication networks through integrating NGSO constellations into current infrastructure. As explained in Chapter 1, integrating NGSO constellations into current terrestrial infrastructure networks could reduce costs and extend coverage for mobile network operators (MNOs). This will enable more affordable data plans and improved network performance, specifically, lower latency and higher speeds. These enhancements will expand broadband coverage and usage to promote digital and financial inclusion, support digitally driven enterprise growth (e.g., e-commerce), boosting productivity in key sectors such as mining and agriculture, and lowering barriers to trade and transactions.

We estimate the economic impact by referencing established empirical relationships between Internet traffic growth and economic growth from literature. Broadband traffic expansion occurs in newly covered areas (Channel 1, or for "unserved" users) and existing covered areas (Channels 2 and 3, or for "unconnected" or "under-connected" users).

In newly covered areas, NGSO networks are assumed to expand Internet coverage to reach 16% of the unserved population, based on global benchmarks.[81] This figure is adjusted for each country based on rural density, terrain, current usage gaps, and future population growth. As a result, we project 82.7 million additional users will be connected through NGSO-enabled connectivity by 2030. In existing areas, NGSO-enabled backhaul is assumed to reduce data plan prices by 10% in 2030.[82] Using established price-elasticities for mobile broadband penetration, we estimate that 36.4 million additional users will be connected in areas with existing coverage.[83]

For both newly covered and existing areas, we assume broadband usage will reach 58GB per user per month in 2030, leveraging regional forecasts.[84]

Combining user growth and usage-per-user increases, we estimate a 233% increase in total broadband traffic between 2025 and 2030. Drawing on empirical studies, we apply an estimated 0.5% increase in GDP-per-capita for every 100% increase in Internet traffic.[85] Applying this to our traffic growth estimate yields a projected $47.8 billion increase in GDP in 2030, equivalent to 1.1% of 2025 GDP. Using GDP per employed worker, we estimate that the forecasted GDP increase will potentially create up to 3.8 million jobs across ASEAN.[86]

[81] Sources include: Analysys Mason (2025), LEO satellite broadband: A cost-effective option for rural areas of Europe. Analysys Mason. Available at: https://www.analysysmason.com/consulting/reports/leo-satellite-broadband-europe/; and World Bank (2025), Rural population (% of total population). Available at: https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS

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Box A3: Approach to estimating cost savings from real-time asset tracking

Four components made up the cost saving estimate: logistics costs, GDP growth rates, IoT adoption rates, and percentage of cost savings enabled by real-time tracking through IoT.

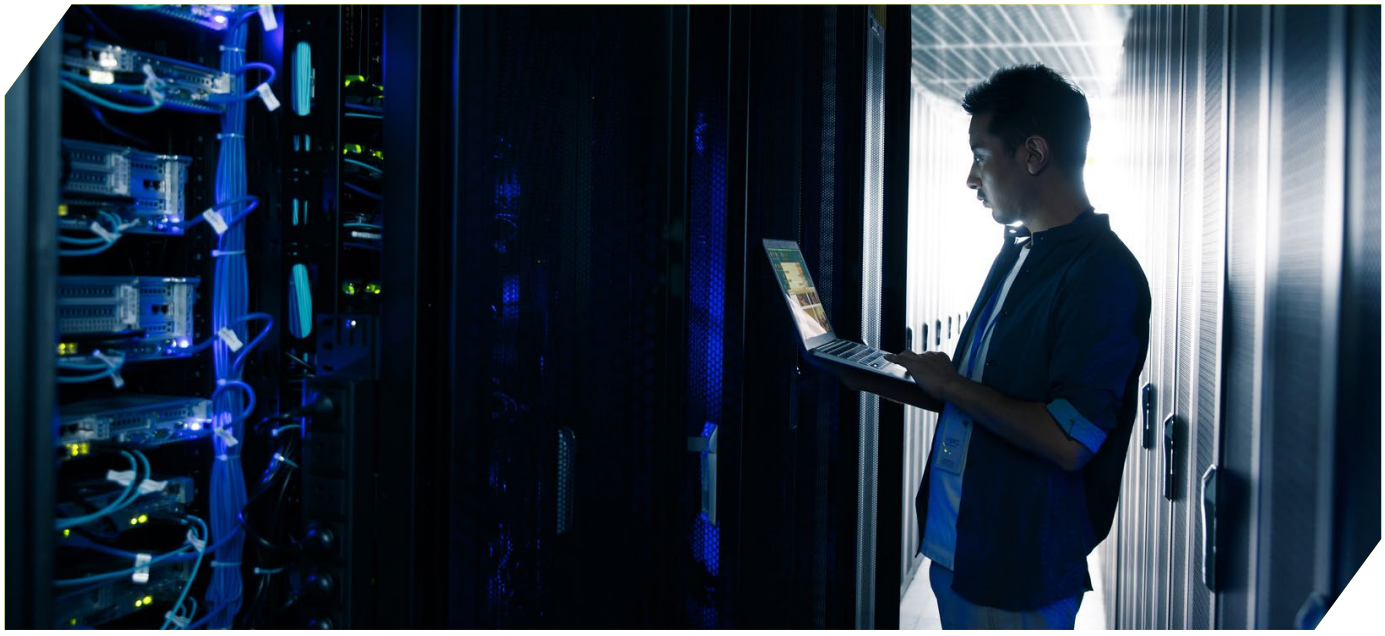
We first estimate logistics costs in 2030 by multiplying the logistics cost as a share of GDP with the GDP of economies. Based on historical changes between 2010 and 2020, we estimate that average logistics costs will range from 7% to 23.5% of GDP in 2030.[87] We then project each country's 2030 GDP using projected annual growth rates of 4.3% to 8.8%.[88] This approach assumes that as ASEAN economies grow, trade between countries will grow in tandem, resulting in a proportional increase in logistics costs.

Next, we estimate the IoT adoption rates, using the historical adoption rates of cloud computing as a proxy. This ranges from 11.4% to 36.0%.[89]

As cloud computing and IoT are advanced technologies, the assumption is that countries with higher adoption of cloud computing will also exhibit greater willingness to adopt IoT.

Lastly, we estimated the average percent cost savings on logistics enabled by real-time tracking through IoT as 16.3%. This relies on inputs from literature review and industry studies which are then averaged.[90]

By multiplying the projected logistics costs, adoption rate of IoT, and the average logistics cost savings enabled by real-time tracking through IoT, we estimate the cumulative logistics costs saving in 2030 to be $ 33.6 billion.



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Box A4: Approach to estimating infrastructure damage mitigated from improved disaster management and response

We first estimated the expected infrastructure damage by natural disasters in 2030. To do this, we used historical growth rates in both the frequency and average impact of natural disasters in the region.[91]

For 2030, we project the frequency of natural disasters to range from 0 to 21 events per country; and average infrastructure damage per disaster to range from $11 million to $576 million.

Next, we estimated how much enhanced early warning systems and improved disaster response could reduce these impacts.[92] Based on literature reviews and industry studies, we applied an average reduction rate of 39% for infrastructure damage to estimate that these measures could mitigate about $9.3 billion in infrastructure damage in 2030.

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Access Partnership

accesspartnership.com

Follow us

Our offices

Europe

London

The Tower, Buckingham Green
Buckingham Gate
London, SW1E 6AS
United Kingdom

+44 20 3143 4900
london@accesspartnership.com

Brussels

8th Floor, Silversquare Europe
Square de Meeûs 35
B-1000 Brussels
Belgium

brussels@accesspartnership.com

North America

Washington DC

1300 Connecticut Avenue NW,
Suite 250
Washington, DC 20036
USA

+1 202 503 1570
washingtondc@accesspartnership.com

Asia

Singapore

12 Marina View
#11-20, Asia Square Tower 2
Singapore 018961

+65 8323 7855
singapore@accesspartnership.com

Jakarta

Revenue Tower 21st Floor
Unit 104 SCBD Lot 13, Jl. Jend. Sudirman
Kav. 52-53
Provinsi DKI Jakarta, 12190
Jakarta, Indonesia

+62 21 5020 0949

Kuala Lumpur

Common Ground Q Sentral
Level 39, Unit 39-02 (East Wing), 2A,
Jalan Stesen Sentral 2, Kuala Lumpur
Sentral, 50470
Kuala Lumpur, Malaysia

Bangkok

188 Spring Tower
11th Floor, Unit 106, Phayathai Road
Thung Phayathai, Ratchathewi,
10400Bangkok, Thailand

+ 66 (2)-8216148

Hanoi

19th floor, Tower 1
Capital Place Building
No 29 Lieu Giai Street
Ngoc Khanh Ward, Ba Dinh Diítrict
Hanoi, Vietnam

Manila

CG8ROCKWELL Level 21, 8 Rockwell,
Hidalgo Dr., Rockwell Center, Bgy.
Poblacion, 1210
Makati City, Metro Manila
Philippines

Middle East and Africa

Abu Dhabi

Al Wahda City Tower, 20th Floor
Hazaa Bin Zayed The First Street
PO Box 127432
Abu Dhabi, UAE

abudhabi@accesspartnership.com

Johannesburg

119 Witch-Hazel Avenue
Highveld Technopark
Johannesburg
Gauteng, South Africa