

DEVELOPMENT AND USE OF ARTIFICIAL INTELLIGENCE IN LATIN AMERICA AND THE CARIBBEAN

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Executive Summary

The rapid adoption of artificial intelligence (AI), particularly generative AI, has fundamentally reshaped the global technological and economic landscape. For Latin America and the Caribbean (LAC), AI represents a transformative opportunity, with potential to add an estimated 5.6 percent to regional GDP by 2030 (Muschett and Opp, 2024). However, realizing this potential requires a robust rethinking of information and communication technology (ICT) infrastructure priorities. While connectivity remains foundational, governments must now address the unprecedented demand for infrastructure capable of supporting data generation, storage, and processing.

This study provides a comprehensive roadmap for LAC countries, identifying the infrastructure and cross-cutting considerations necessary to support AI and emerging technologies. The findings underscore the need for investment in high-speed networks, data storage and processing, edge computing, and cloud capabilities, alongside strategic frameworks for financing, sustainability, and cybersecurity. Importantly, the report emphasizes that nations do not need to develop all infrastructure locally; leveraging infrastructure-as-a-service (IaaS) models can accelerate technology adoption while reducing initial capital requirements.

Governments face the dual challenge of addressing this demand within a constrained global energy transition and an evolving geopolitical landscape defined by technological sovereignty and strategic autonomy. By prioritizing key areas and fostering regional collaboration, LAC nations can position themselves at the forefront of the digital economy, driving inclusive and sustainable growth.

Key Messages

1. **Understanding Infrastructure Needs for AI and Other Emerging Technologies**

Governments in the LAC region must prioritize investments in critical infrastructures, including high-speed data transport, data storage and generation, and advanced data-processing capabilities. Tailoring these infrastructures to national priorities—such as education, health, or public safety—will enable countries to maximize the benefits of AI. Clear assessment frameworks are essential for aligning infrastructure with strategic goals.

2. **Cross-Cutting Priorities for Holistic Development**

Investing in human capital, environmental sustainability, and cybersecurity is crucial to support a robust technological ecosystem. Without addressing these foundational

areas, even the most advanced infrastructure cannot deliver sustainable outcomes. Collaborative efforts between public and private sectors are vital to ensuring these priorities are met.

3. **Actionable Roadmaps for Every Country Type**

Countries at varying levels of development—small islands, low-income nations, and emerging economies—must adopt differentiated strategies based on their capacities. Short-term priorities should focus on expanding connectivity and establishing digital readiness, while long-term strategies should emphasize innovation hubs and cross-border collaborations to foster shared growth.

4. **Public-Private Partnerships for Scalable Solutions**

Developing advanced infrastructures, such as edge data centers and cloud ecosystems, requires significant investments. Public-private partnerships (PPPs) can bridge financial gaps and accelerate deployment timelines, particularly in urban centers and industrial zones where the impact will be most immediate.

5. **Data Sovereignty and Regional Collaboration**

Governments should balance their ambitions for technology independence with the advantages of shared infrastructures, such as regional data hubs. This approach not only reduces individual investment costs but also enhances security, scalability, and interoperability for regional growth.

6. **Environmental Sustainability as a Core Pillar**

With rising energy demands for AI and digital technologies, governments must embed sustainability into infrastructure planning. Policies should incentivize renewable energy integration into data centers and mandate energy-efficient standards to mitigate environmental impact.

7. **Cybersecurity and Data Governance as Non-Negotiables**

The exponential growth in digital ecosystems necessitates robust cybersecurity frameworks. Governments must implement zero-trust architectures, enforce compliance audits, and build regional alliances to ensure resilience against emerging cyberthreats.

8. **Accessible Knowledge and Infrastructure Sharing**

Countries unable to develop their own infrastructures can still harness AI and emerging technologies through IaaS models. Regional and global partnerships should facilitate access to cloud solutions and advanced computing resources, ensuring no nation is left behind.

9. **Equitable Financing Mechanisms**

Governments must adopt innovative financing models to ensure inclusivity in digital transformations. Options include multilateral funding mechanisms, technology levies, and green bonds that align economic growth with sustainability goals.

10. **Monitoring and Evaluation for Continuous Improvement**

Periodic reviews of infrastructure performance and societal impacts are essential to ensure progress aligns with strategic objectives. Indicators should measure both technological development and social outcomes, fostering transparency and accountability.

This report highlights the urgency of building a sustainable and inclusive digital future for LAC. By aligning national policies with global technological trends, fostering international partnerships, and leveraging regional strengths, governments can accelerate the adoption of AI and other emerging technologies. The resulting transformation has the potential to enhance public services, encourage innovation, and strengthen economic resilience across the region.

Introduction

Context and Relevance of ICT Infrastructure for AI and Other Emerging Technologies

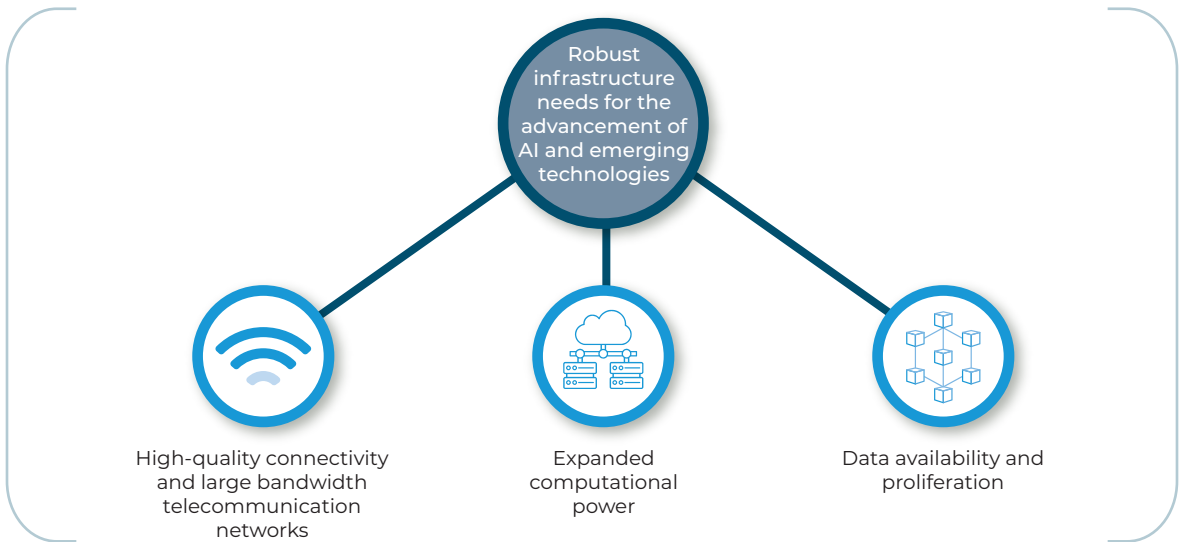
The global economy stands at an inflection point driven by the unprecedented convergence of artificial intelligence (AI)¹ and other emerging technologies such as autonomous vehicles, additive manufacturing, 3D printing, Internet of Things (IoT), advanced materials, and blockchain requiring robust information and communication technology (ICT) infrastructures. Robust ICT infrastructures² are essential for the advancement of AI and emerging technologies to foster growth, innovation, and social development. They highlight the importance of a strong technological foundation for driving innovation in AI and related fields. Key components of this infrastructure include (see Figure 1):

- High-quality connectivity and large bandwidth telecommunication networks: Reliable and fast internet connections and 5G are crucial for accessing and processing vast amounts of data. This ensures efficient data transfer and accessibility to information in real time.
- Expanded computational power: Powerful computing resources, such as high-performance computers and cloud computing, are needed to handle complex AI algorithms and large datasets. This enables complex calculations and processing of large datasets, essential for AI and machine learning (ML).
- Data availability and proliferation: The availability of diverse and abundant data is essential for training AI models and extracting valuable insights. This fuels the development of national AI models and algorithms.

¹ For a brief description of the different types of AI, see Biswal (2025).

² “Robust ICT infrastructure” means the availability of high-quality connectivity and large bandwidth telecommunication networks, the expansion of computation power from single access to ubiquitous use, and the proliferation of zillions of bytes of data generated and stored in a wide range of repositories and the web to drastically increase the capability, availability, growth, and impact of AI and emerging technologies.

FIGURE 1
COMPONENTS OF ROBUST ICT INFRASTRUCTURE



Source: Authors' elaboration.

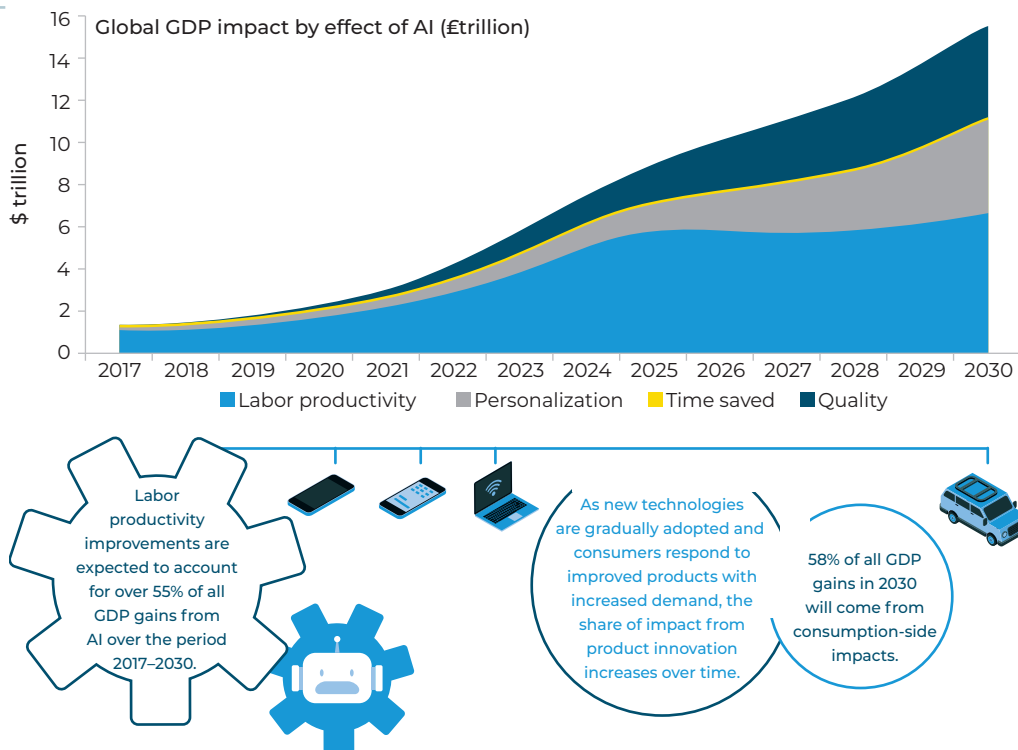
By investing in these areas, a nation can significantly enhance the capabilities, accessibility, growth, and impact of AI and emerging technologies, leading to transformative advancements across various industries and sectors.

This transformation is reshaping competitive dynamics across industries and creating new opportunities for value creation. PwC (2017) indicates that organizations and countries that successfully harness these technologies could capture up to US\$15–20 trillion in annual economic value by 2030 (see Figure 2).

The Technology Convergence Paradigm

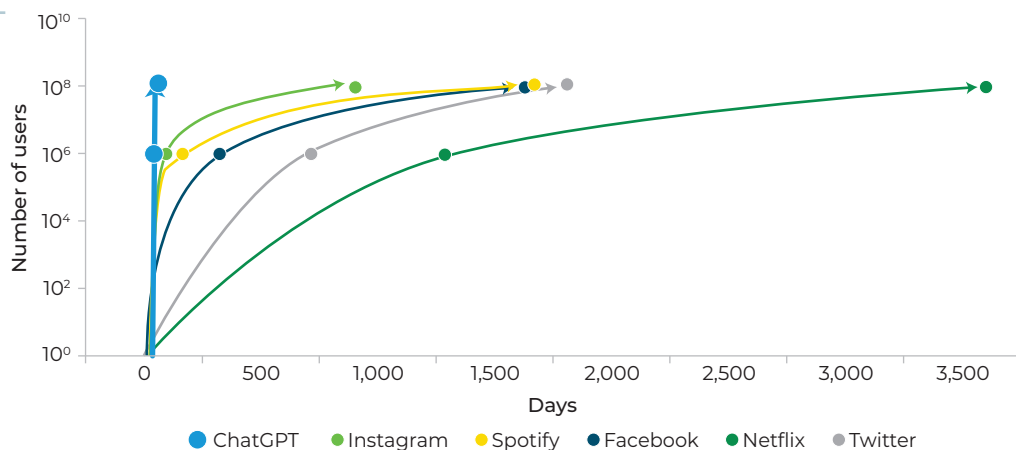
The current technological revolution is fundamentally different from previous industrial transformations due to three key factors. First, the speed of adoption has accelerated dramatically: While electricity took 46 years to reach 50 million users worldwide, internet achieved the same penetration in seven years and ChatGPT's generative AI took only two months to reach double this number (100 million) (Desjardins, 2018; Ebert, 2023) (see Figure 3). Second, the scale of impact is unprecedented: Solutions driven by AI and other emerging technologies, based on ubiquitous computing and telecommunications network infrastructures, are simultaneously transforming multiple sectors, including healthcare, manufacturing, financial services, and public administration. Third, the depth of change is more profound than in previous transformations, reshaping fundamental society, business, and operating models across all sectors rather than affecting specific industry verticals.

FIGURE 2
GLOBAL ECONOMIC VALUE CREATION POTENTIAL FROM
AI AND EMERGING TECHNOLOGIES, 2024–2030



Source: PwC (2017).

FIGURE 3
NUMBER OF DAYS TO 1 MILLION AND 100 MILLION USERS



Source: Hailey (2023).

Strategic Technology Drivers

“Artificial Intelligence (AI) is machine-displayed intelligence that simulates human behavior or thinking and can be trained to solve specific problems. AI is a combination of Machine Learning techniques and Deep Learning. Types of Artificial Intelligence models are trained using vast volumes of data and can make intelligent decisions.”

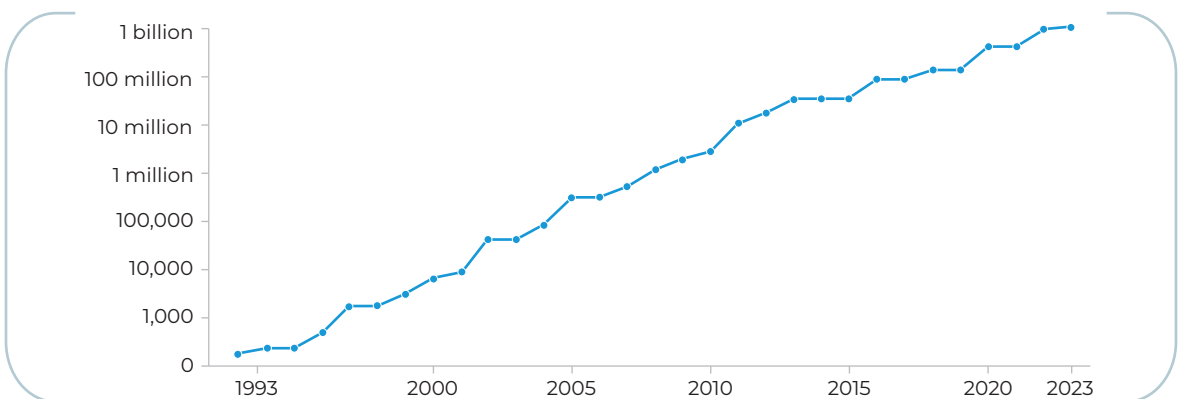
— Biswal (2025)

The progression of AI capabilities has exceeded most early predictions. Current AI systems process and analyze humongous amounts of unstructured data, generate human-like text and creative content, optimize complex systems in real time, and enable predictive decision making across organizations. This evolution is particularly significant for Latin America and the Caribbean (LAC), where AI adoption could potentially add 5.4 percent to regional GDP by 2030 (Muschett and Opp, 2024).

The exponential growth in computing capabilities has created new possibilities for AI deployment (see Figure 4). Specialized AI processors have improved performance by 1,000x in 10 years (Merritt, 2023). Edge computing now enables real-time processing at the point of need, fundamentally changing how organizations can deploy AI solutions.

The proliferation of connected devices and digital systems has created unprecedented access to data. Global data creation is projected to reach between 175 and 181 zettabytes (ZB) by 2025, with IoT devices expected to generate 73.1 ZB of data (Reinsel et al., 2018; Kumar, 2025). The deployment of 5G networks further enables real-time data processing and analysis, creating new possibilities for AI applications.

FIGURE 4
COMPUTATIONAL CAPACITY OF THE FASTEST SUPERCOMPUTERS



Source: Roser et al. (2023).

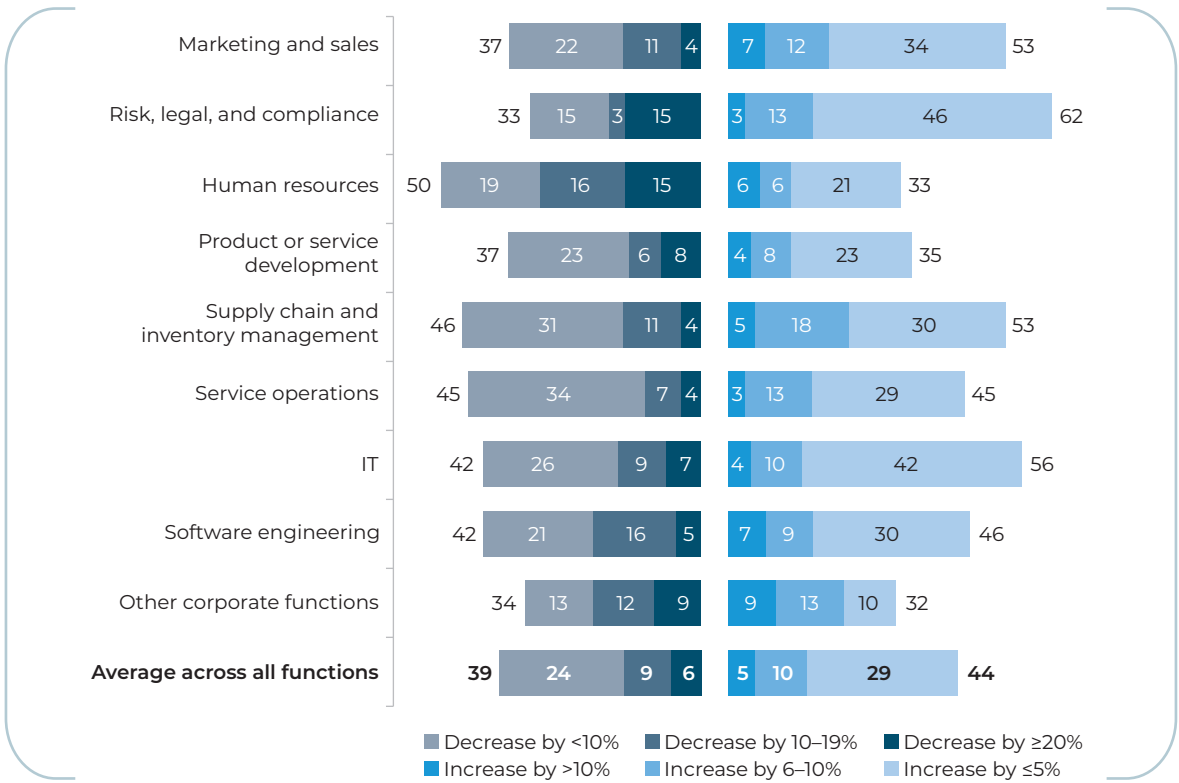
Note: The number of floating-point operations carried out per second by the fastest supercomputer in any given year. This is expressed in gigaFLOPS, equivalent to 10^9 floating-point operations per second. A floating-point operation (FLOP) is a type of computer operation. One FLOP represents a single arithmetic operation involving floating-point numbers, such as addition, subtraction, multiplication, or division.

Market Impact and Value Creation

The use of AI reveals significant value creation. According to a study by McKinsey & Company, organizations are achieving 35–39 percent reductions in costs and 44–58 percent increases in revenue through AI implementation (Singla et al., 2024). Organizations most often see meaningful cost reductions from generative AI use in human resources and revenue increases in supply chain management (see Figure 5). Use of analytical AI most often yields cost reductions in service operations and revenue increases in marketing and sales (see Figure 6).

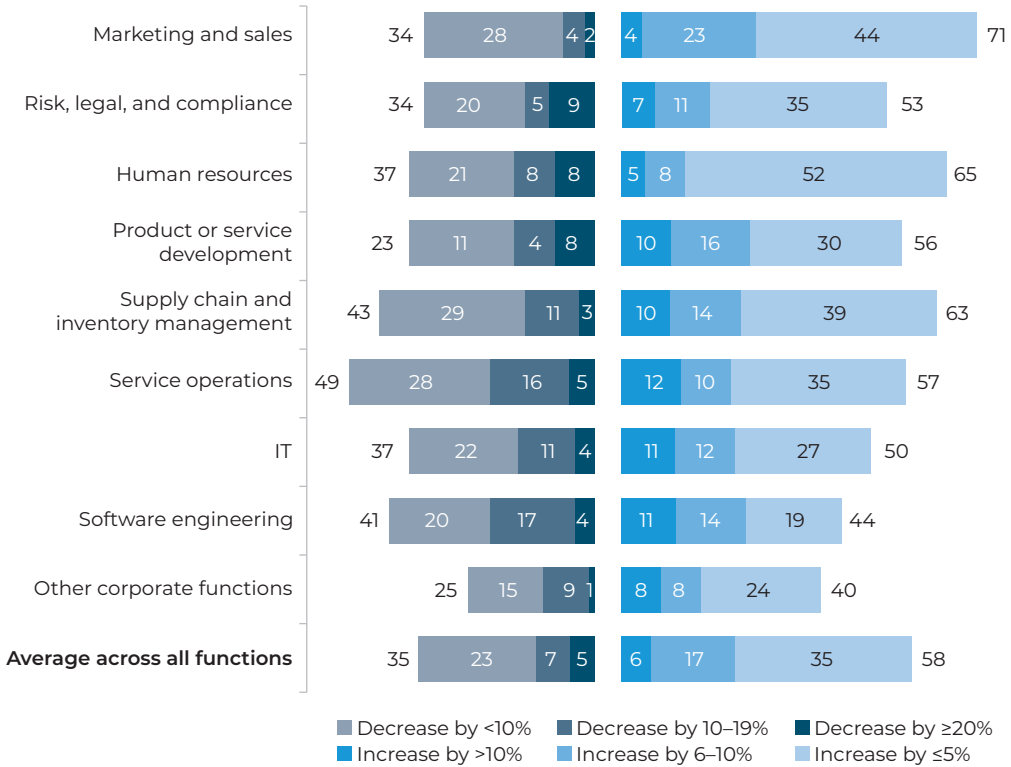
Boston Consulting Group’s 2023 Global Innovation Survey (BCG, 2023) revealed that companies deploying AI achieved a fivefold increase in idea generation, alongside notable improvements in idea validation and incubation. Organizations that combine AI with other advanced technologies, such as IoT and robotics, see a 26 percent boost in impact for each additional technology adopted. Key applications of AI include identifying market trends, optimizing project portfolios, and uncovering

FIGURE 5
COST REDUCTIONS AND REVENUE INCREASES FROM USE OF GENERATIVE AI



Source: Singla et al. (2024).

FIGURE 6
COST REDUCTIONS AND REVENUE INCREASES
FROM USE OF ANALYTICAL AI



Source: Singla et al. (2024).

external innovation opportunities. While 83 percent of companies have implemented AI to some extent, sectors like medtech, chemicals, and pharmaceuticals demonstrate the highest success rates in leveraging AI for research and development (R&D). For example, 51 percent of medtech firms report significant impact from using AI to analyze market trends.

According to Biswal (2025), the top 24 AI applications in 2025 will be: e-commerce, education, lifestyle, navigation systems, robotics, natural language processing, computer vision, face recognition, human resources management, healthcare, agriculture, gaming, autonomous vehicles, social media, marketing, chatbots, finance, astronomy, data security, travel and transport, automotive industry, generative AI, ML, and entertainment.

Strategic Implications for Latin America and the Caribbean

The LAC region has unique opportunities in leveraging these technologies, including the potential to leapfrog traditional development stages, access global markets through

FIGURE 7 CHALLENGES AND OPPORTUNITIES: PATHWAY FOR DEVELOPMENT, USE, AND ADOPTION OF AI AND EMERGING TECHNOLOGIES FOR LATIN AMERICA AND THE CARIBBEAN



Source: Authors' elaboration.

digital platforms, address historical inefficiencies, and create new high-value employment opportunities. However, significant challenges must be addressed, including infrastructure gaps, limited availability of specialized talent, outdated regulatory frameworks, and investment constraints. Figure 7 contrasts challenges with opportunities that must be addressed to get ready for the adoption, use, and development of emerging technologies such as AI. Section 5 of this report presents a number of successful AI use cases in LAC.

Implementation Priorities

Successful technology adoption requires focused attention on several key areas. Digital infrastructure development must prioritize high-speed low-latency connectivity, cloud computing capabilities, data center capacity, edge computing networks, and advanced computing infrastructure. Talent and capacity-building programs need to address technical skills development, digital literacy, innovation ecosystem development, and international collaboration.

For AI and other emerging technologies, regulatory frameworks require modernization to address data protection, specific governance, cross-border data flows, cybersecurity standards, and international cooperation. Investment and innovative funding mechanisms must be strengthened through public-private partnerships (PPPs), technology investment incentives, and R&D support programs. The development of robust ecosystems requires attention to innovation hubs, industry-academia collaboration, international technology partnerships, and support systems for micro, small, and medium-sized enterprises (MSMEs) and startups.

Looking Ahead

The period between 2025 and 2030 will be critical for LAC. Organizations and countries that move decisively to embrace these technologies and their associated infrastructures will likely emerge as leaders in the digital economy. Success will require strategic investment in high-impact infrastructure projects, scalable technology platforms, and sustainable funding models. Capacity-building efforts must accelerate digital skills development, foster innovation ecosystems, and strengthen international partnerships. Policy modernization needs to focus on updating regulatory frameworks, developing AI governance standards, and enabling cross-border collaboration.

The transformation driven by AI and other emerging technologies represents both an opportunity and an imperative for LAC. Success will require coordinated action across public and private sectors, with a clear focus on building the necessary infrastructure, capabilities, talent, and frameworks for the digital age. The decisions made and actions taken between 2025 and 2030 will likely determine the region's competitive position for decades to come (Biswal, 2025).

Objectives and Scope of This Study

The study's central objective is to deliver actionable insights and recommendations for developing competitive regional digital infrastructure in LAC that enables the adoption of emerging technologies, with particular emphasis on AI implementation. This infrastructure must support advanced computing applications while ensuring sustainability, security, and regional integration.

This study aims to evaluate and analyze the infrastructure requirements for the effective development and implementation of AI and other emerging technologies across LAC countries. This study aims to provide a comprehensive overview of the technological, human capital, and investment requirements needed to drive AI development, adoption, and use in the region, with a particular focus on its application in the public sector.

The scope of this paper is specifically focused on infrastructure requirements, excluding content-related aspects. While responsibility, ethics, and cybersecurity are important considerations in AI development, they are only addressed in this study as they directly relate to infrastructure requirements and specifications.

This study establishes a foundation for understanding AI and emerging technologies infrastructure requirements and guides decision makers in formulating effective strategies to accelerate AI development and adoption across the region. By addressing both

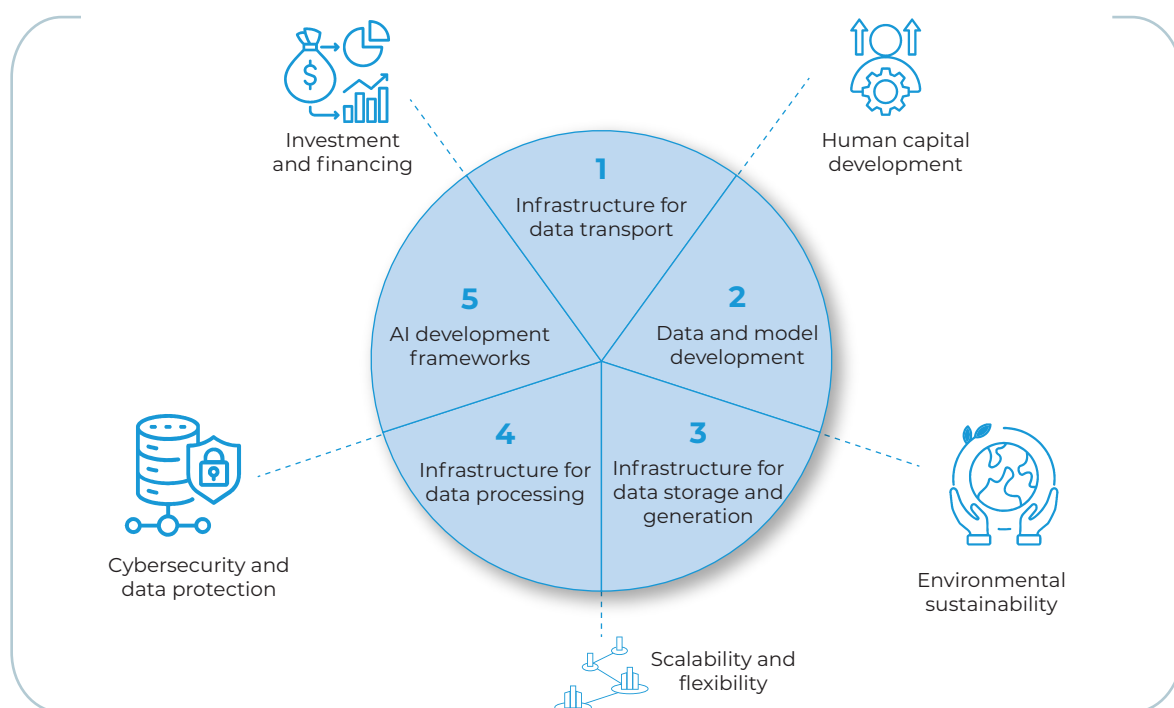
technical aspects and socioeconomic implications, the study will help position LAC at the forefront of the AI revolution, fostering inclusive and sustainable growth.

Document Structure

This document is divided into seven sections that are self-contained to reduce the reader's need to jump back and forth among the different sections.

- Section 1: Introduction explains the importance for governments to invest in robust infrastructure for the development and use of AI and other emerging technologies. It also describes the context and relevance of AI as well as the objective, deliverables and outcomes, key considerations, scope, and expected impact of this document.
- Section 2: Conceptual Framework for AI Data Technologies and Advanced Digital Infrastructure presents the AI ecosystem and key components with an overview of hardware and software, network and connectivity, data storage, and data-processing requirements. The section ends with an overview of technological evolution and global trends.
- Section 3: Infrastructure Needs for AI Development delves in detail into the five must-have infrastructure elements for AI development: data generation, data storage, data processing, data transport, and development frameworks (see Figure 8).

FIGURE 8
INFRASTRUCTURE NEEDS AND CROSS-CUTTING CONSIDERATIONS FOR AI DEVELOPMENT



Source: Authors' elaboration.

- Section 4: Cross-Cutting Considerations for AI Infrastructure examines other important transversal non-infrastructure requirements for successful AI development, including investment and finance, human capital development, environmental sustainability, scalability and flexibility, and cybersecurity and data protection.
- Section 5: AI Use Cases in the Public Sector in Latin America and the Caribbean presents examples of successful use cases of AI in health, education, environment, public/national security, public administration, economy, and mobility and transport systems.
- Section 6: Roadmap for Implementation describes a step-by-step roadmap to successful adoption of AI and other emerging technologies in LAC.
- Section 7: Conclusions and Future Perspective summarizes each section of this report and provides future perspectives.

Deliverables and Outcomes

This report will produce comprehensive policy recommendations covering infrastructure development, technology adoption, regional integration, sustainability guidelines, and investment prioritization. Additionally, it will provide an implementation roadmap outlining short-term priorities, medium-term developments, and long-term vision, complete with specific investment requirements and implementation milestones.

Key Considerations

Sustainability stands as a crucial consideration in our analysis. We will provide an overview of energy efficiency requirements, carbon footprint reduction strategies, and renewable energy integration possibilities. The study will assess environmental impact and provide recommendations for green technology adoption across the infrastructure spectrum.

Regional integration represents another critical aspect of the analysis, which will examine cross-border infrastructure needs and opportunities for shared resource optimization. Recommendations will address regional standards alignment and explore collaborative development opportunities, including technology transfer mechanisms.

Economic Impact Assessment

The study includes an analysis of economic implications, including investment requirements and potential economic benefits. It will assess job creation potential and industry development opportunities, with a particular focus on enhancing regional competitiveness through advanced infrastructure for AI development and use.

Expected Impact

This study aims to equip governments in the LAC region with a clear understanding of the infrastructure required to support AI and other emerging technologies. By providing an analysis of existing capabilities and future needs, this document will serve as a strategic guide for policymakers to make informed decisions about the development of critical ICT and digital infrastructure.

The report's roadmap will offer actionable steps tailored to the region's diverse contexts, outlining the specific actions, investments, and partnerships necessary to advance AI adoption effectively. It will aid in prioritizing initiatives that address the unique challenges faced by LAC countries while ensuring alignment with global trends in technology and sustainability. Ultimately, this document is designed to foster informed planning and coordinated action, enabling governments to build resilient and future-ready infrastructure that supports their technological and economic aspirations.

Framework for AI Data Technologies and Advanced Digital Infrastructure

The development and implementation of high-impact artificial intelligence (AI) data and telecommunications infrastructure requires a sophisticated understanding of the complex ecosystem of stakeholders, technologies, and regulatory frameworks that shape its evolution conceptual framework (see Figure 9) for understanding these relationships and their implications for AI infrastructure development in Latin America and the Caribbean (LAC).

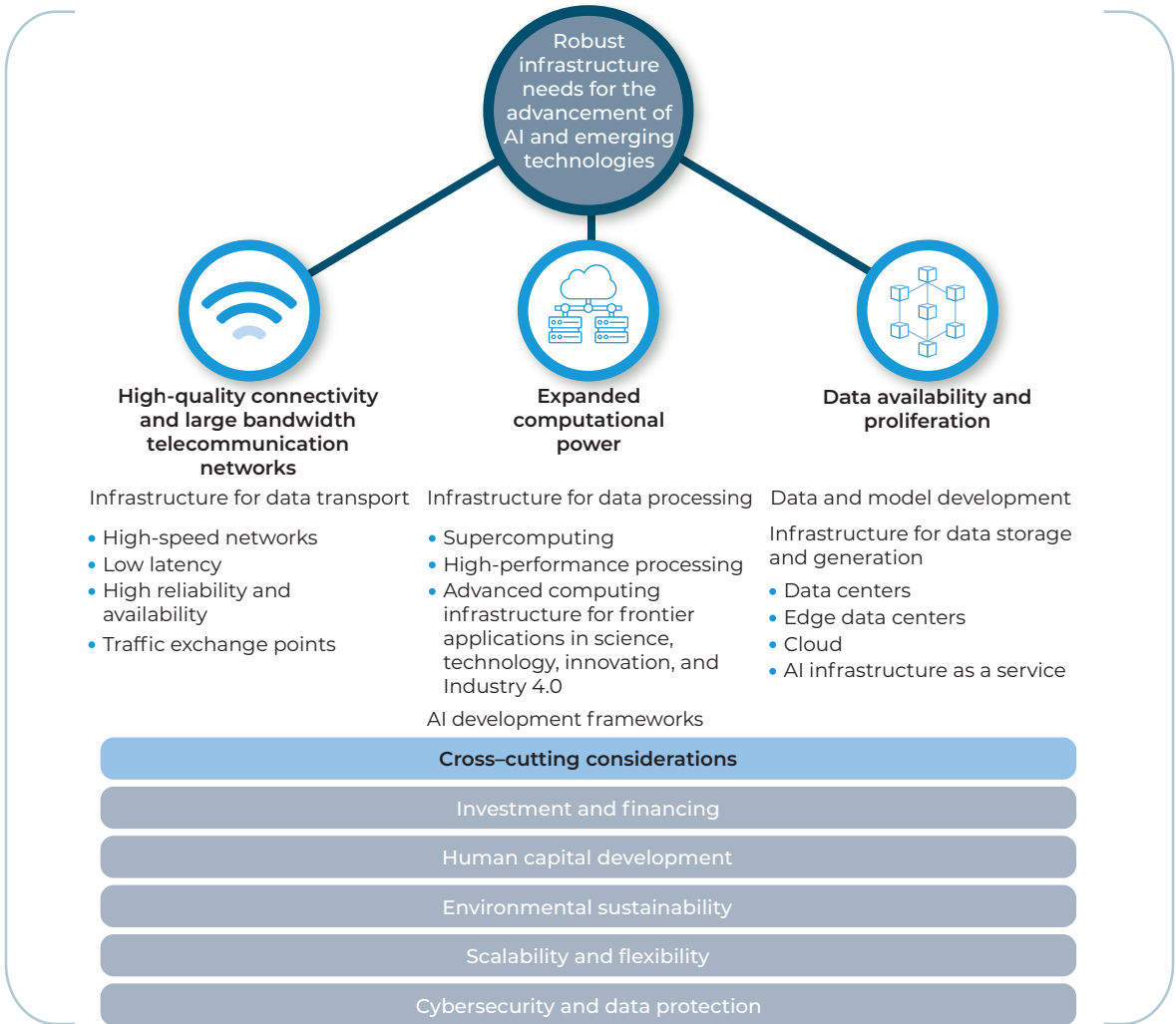
Why Governments Must Invest in Infrastructure for AI and Other Emerging Technologies

“Governments worldwide recognize the strategic potential of digital technologies and data to enhance responsiveness to evolving needs; promote open, transparent, and collaborative policy approaches; and support a more inclusive design and delivery of public services and policies. Policymakers also acknowledge that digital technologies strengthen public sector resilience, ensuring continuity of essential services even under extreme circumstances, [underscoring] the need for a flexible and future-oriented approach to capture the benefits of the digital transformation while mitigating its potential risks in the current global context.”

— OECD and IDB (2023)

The imperative for government investment in advanced technological infrastructure has never been more critical. Countries leading in digital infrastructure development outperform their peers in economic growth, innovation, and social development.

FIGURE 9
COMPREHENSIVE INFRASTRUCTURE ECOSYSTEM FRAMEWORK



Source: Authors' elaboration.

This section examines the compelling reasons why governments must take a proactive role in developing and maintaining next-generation infrastructure.

Economic Growth and National Competitiveness

Investing in digital infrastructure and transformation is a proven driver of economic growth and national competitiveness. According to the Global Digitalization Index (GDI) 2024, every U.S. dollar invested in digital transformation generates a return of US\$8.30 in the digital economy, underscoring the multiplier effect of such investments (Huawei, 2024). Nations with more advanced information and communication technology (ICT)

infrastructure consistently experience greater economic benefits due to improved productivity, job creation, and industrial efficiency.

The impact of digital transformation varies significantly based on a country's digital maturity. Countries classified as Frontrunners, with advanced digital infrastructure and policies, derive 5.4 times more economic value for each point of improvement in their GDI score compared to Starters, which are in the early stages of digital development (Huawei, 2024). This disparity highlights the importance of targeted investments and strategic policies to maximize returns on digital infrastructure. For example, Frontrunners leverage their robust connectivity and advanced technologies to enhance industrial productivity and decision making, while Starters benefit primarily from foundational improvements such as increased broadband penetration.

According to Katz et al. (2022), the ripple effects of digitalization extend to employment, with a 10 percent increase in digitalization projected to generate a 2.4 percent rise in employment, equivalent to more than 6.5 million new formal jobs in the Americas. Moreover, digital transformation significantly boosts productivity. A 10 percent increase in digitalization can raise total factor productivity by 5.7 percent in the LAC region. This enhancement positions digital transformation not only as a tool for economic growth but also as a mechanism to reduce regional disparities and foster equitable development.

The linkage between infrastructure investment and economic growth manifests through multiple channels. First, digital infrastructure acts as a catalyst for innovation and entrepreneurship, creating new business opportunities and fostering the development of high-value industries. Second, robust technological infrastructure attracts foreign direct investment (FDI), with countries with advanced digital capabilities capturing more technology-focused FDI than their peers (Arthur D. Little, 2021).

Strategic Independence and National Security

Government investment in technological infrastructure plays a crucial role in maintaining strategic independence and ensuring national security. In an era of increasing digital threats and technological competition, countries must develop and control critical infrastructure to protect national interests and ensure operational resilience. This imperative has become more complex as nations pursue “technology sovereignty” and “strategic autonomy”—concepts that reflect a policy's capacity to act independently in an intensifying global, technology-based competition.

The interdependent and multinational nature of contemporary technological innovation presents unique challenges, particularly in critical sectors like semiconductors and rare earth minerals, where supply chain vulnerabilities have become apparent. To address these challenges, governments are implementing three distinct but complementary policy interventions: (i) protection measures (such as export controls and investment screening), (ii) promotion measures (to strengthen domestic capabilities), and (iii) projection measures (including international alliances and technical standards). While these measures aim to reduce dependencies and vulnerabilities, they must be balanced against the benefits of international collaboration, especially when addressing global challenges like climate change. This has become particularly relevant as economic and security policy

agendas increasingly converge, potentially disrupting existing technology ecosystems while attempting to safeguard national interests (OECD, 2023b).

Social Development and Public Service Delivery

Digital infrastructure enables transformative improvements in public service delivery. Investments in digital health could prevent nearly 7 million severe health episodes and hospital admissions, significantly alleviating pressure on healthcare systems (WHO, 2024). Educational institutions with robust digital capabilities, including AI, can enhance the effectiveness and quality of education by personalizing learning, making it more inclusive and potentially more equitable (OECD, 2023a). According to the Programme for International Student Assessment (PISA) 2022 study, students who spent up to an hour a day learning with digital devices outperformed their peers who did not by 14 points, even after accounting for socioeconomic status (OECD, 2023c).

Digital inclusion, driven by strategic infrastructure investments, generates significant social benefits. According to a World Bank report (Aranda-Jan and Qasim, 2023), access to digital technology can expand economic and social opportunities, particularly for historically underserved groups such as women, rural communities, and people with disabilities. Gaps in access to digital technology deepen inequalities and have considerable social and economic costs, including an estimated “US\$1 trillion loss in GDP due to the digital exclusion of women” (Aranda-Jan and Qasim, 2023, 5). This impact is especially critical in developing regions, where digital access can dramatically transform education and economic opportunities (Aranda-Jan and Qasim, 2023).

Environmental Sustainability and Climate Change

Government investment in advanced infrastructure is pivotal for achieving environmental sustainability goals. According to Elfrink (2012), implementing smart city solutions can lead to around a 50 percent reduction in energy consumption over a decade, an 80 percent improvement in water usage efficiency, and a 20 percent decrease in traffic congestion. This aligns with the principles outlined in the COP29 Declaration on Green Digital Action, which emphasizes the transformative role of digital infrastructure and technologies in advancing global sustainability goals and fostering green innovation (COP29, 2024).

The integration of environmental monitoring and management systems, supported by advanced infrastructure, significantly enhances responses to environmental challenges. Pollution Management and Environmental Health: Annual Report 2020 (World Bank, 2020) highlights the impact of implementing air quality monitoring systems; in Egypt, for example, such systems enabled the identification of approximately 12,600 annual deaths and more than 60,000 disability-adjusted life years in Greater Cairo. These insights have been instrumental in designing more effective air quality management plans, underscoring the critical role of advanced monitoring infrastructure in addressing environmental issues. The ITU’s Green Digital Action initiative further reinforces this by advocating for the deployment of advanced digital systems to monitor and manage environmental resources effectively, ensuring a sustainable and resilient future (ITU, 2024).

Economic Risk Mitigation

Government investment in technological infrastructure serves as a decisive economic risk mitigation strategy. Countries with advanced digital infrastructure demonstrated better economic resilience during the COVID-19 pandemic, maintaining higher levels of economic activity and recovering more quickly than those with less developed ICT infrastructure (Kim et al., 2022).

Furthermore, robust ICT infrastructure significantly enhances the effectiveness of responses to natural disasters and emergencies. The ITU report *Utilizing Telecommunications/Information and Communication Technologies for Disaster Risk Reduction and Management* (ITU, 2021) highlights that advanced ICT systems, such as early-warning systems and real-time data-sharing platforms, play a crucial role in reducing disaster impacts by enabling timely responses and better resource coordination. Similarly, the study *ICT-Enabled Approach for Humanitarian Disaster Management* (Ghadge, 2023) identifies how tools like geographic information systems (GIS) and unmanned aerial vehicles (UAVs) have accelerated disaster response times and improved relief outcomes since the early 2000s. These technologies ensure faster communication and efficient allocation of resources during crises, underscoring the critical role of advanced infrastructure in disaster management.

Innovation Ecosystem Development

Government infrastructure investment plays a pivotal role in fostering innovation ecosystems. According to the findings in *ICT-Enabled Social Innovation: Evidence & Prospective* (Misuraca et al., 2017), regions with robust ICT infrastructure experience enhanced collaboration between public, private, and not-for-profit sectors. These partnerships enable the co-creation of innovative solutions and the integration of services not only for micro, small, and medium-sized enterprises (MSMEs), but in particular they attract more startups and stimulate entrepreneurial activities. Furthermore, ICT-enabled ecosystems often achieve higher efficiency and productivity in service delivery, contributing to a conducive environment for innovation. This dynamic accelerates technological advancements and economic growth over time, reinforcing a cycle of sustained innovation and regional competitiveness.

Regional Competitiveness

In the context of LAC, government infrastructure investment is critical for maintaining regional competitiveness. According to the Inter-American Development Bank (IDB) report *Financing Infrastructure in Latin America and the Caribbean: How, How Much, and by Whom?* (Serebrisky et al., 2015), infrastructure investment significantly contributes to economic growth by increasing productivity, diversifying productive structures, and facilitating FDI. Empirical research cited in the report shows that an additional 1 percent of GDP invested in infrastructure can lead to a 2.5 percent increase in economic output in Brazil, 1.8 percent in Argentina, and 1.3 percent in Mexico within three years. This highlights the positive impact of robust ICT infrastructure on capturing regional economic growth and attracting FDI inflows, enabling leading countries in the region to outperform their peers.

BOX 1**GUANAJUATO AS AN INNOVATION HUB: A CASE STUDY**

Guanajuato, Mexico, has positioned itself as a regional leader in innovation and entrepreneurship through its strategic implementation of the *Mentefactura* policy.^a This unique approach leverages the collective knowledge, creativity, and skills of its population to develop sustainable solutions that drive socioeconomic development. The state has built an ecosystem comprising 8 innovation and technology parks, 20 business incubators, 5 technology transfer offices, 8 research centers, and more than 1,200 national researchers. This robust network fosters collaboration among academics, entrepreneurs, public officials, and investors to promote a culture of innovation.

Central to Guanajuato's success is its *Ruta de la Innovación y Emprendimiento* (Innovation and Entrepreneurship Roadmap), a structured framework that guides ideas from concept to market. Through spaces like community hubs, innovation gyms, incubators, and technological parks, creative ideas are nurtured, formalized, and commercialized. Moreover, initiatives such as Capital Startup Capital provide angel investment opportunities, ensuring financial backing for promising projects. This integrated ecosystem empowers local talent and enhances the state's competitiveness on a global scale.

The impact of these efforts is evident in Guanajuato's national rankings, where it stands second in patent applications and innovation (Centro México Digital, 2024a). By combining advanced infrastructure, strategic investment, and a strong emphasis on human capital, Guanajuato has become a beacon for regional development and a model for other regions aiming to establish themselves as innovation hubs.

^a See <https://www.valledelamentefactura.com/>.

Future-Proofing National Economies

Perhaps most importantly, government ICT infrastructure investment plays a vital role in future-proofing national economies against technological disruptions. OECD (2024) highlights that advanced digital infrastructure, alongside complementary assets such as skills and digital capabilities, is essential for enabling firms to adopt and integrate transformative technologies like AI. This foundation allows countries with robust ICT systems to maintain higher adaptation rates to new technologies and enhance workforce transition capabilities, positioning them for sustained competitiveness in the digital economy.

Long-Term Cost Benefits

While the initial investment requirements for advanced ICT infrastructure development are notably high, the long-term returns are meaningful and substantial. According to the ITU's report *How Broadband, Digitization, and ICT Regulation Impact the Global Economy* (ITU, 2020), every 10 percent increase in digitization leads to a 2.62 percent increase in labor productivity and a 2.28 percent increase in total factor productivity, demonstrating the substantial economic benefits of investing in ICT infrastructure. Moreover, an increase of 1 percent in the Digital Ecosystem Development Index correlates with a 0.13 percent growth in GDP per capita, further emphasizing the transformative impact of strategic investments in ICT infrastructure.

Recommendations for Implementation

Successful government infrastructure investment requires a comprehensive approach encompassing several key elements. First, clear strategic planning must align infrastructure development with national economic and social objectives. Second, effective governance frameworks must ensure efficient resource allocation and project execution. Third, robust monitoring and evaluation systems must track implementation progress and measure outcomes.

Based on this report's analysis, it is recommended that governments in LAC prioritize infrastructure investment through:

- Development of comprehensive national infrastructure strategies aligned with economic and social development goals.
- Establishment of dedicated funding mechanisms for infrastructure development, including public-private partnership (PPP) frameworks.
- Creation of robust governance structures to ensure effective implementation and monitoring of infrastructure projects.
- Implementation of skills development programs to ensure workforce readiness for advanced infrastructure planning, design, and operation.
- Development of regional cooperation frameworks to maximize infrastructure investment efficiency and effectiveness.

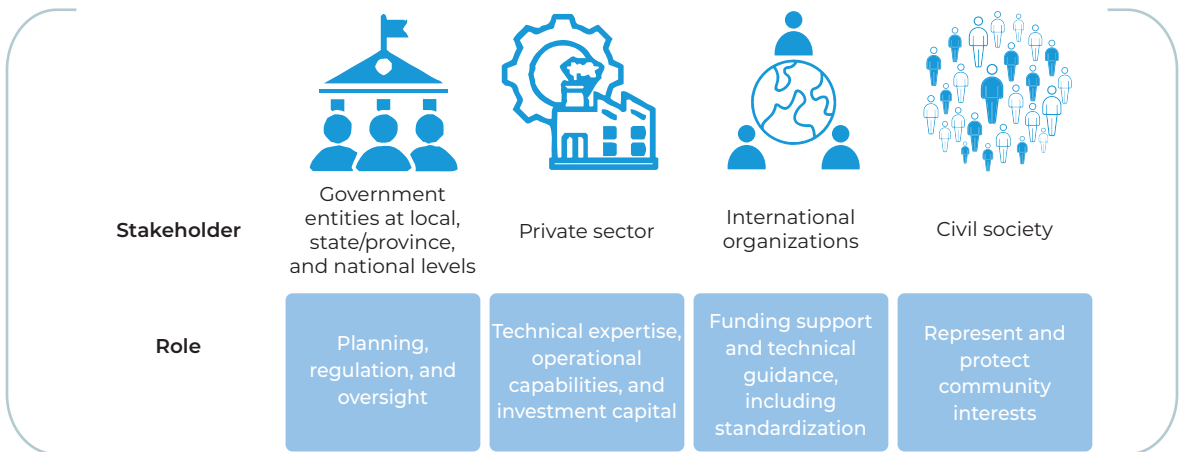
The imperative for government investment in technological infrastructure is clear and compelling. Countries that fail to make these investments risk falling behind in global competitiveness, economic development, and social progress. The opportunity cost of delayed investment grows exponentially as technological advancement accelerates, making immediate action essential for long-term national success.

Ecosystem Architecture

Data and telecommunications infrastructure in the AI era operates within a complex ecosystem of interconnected stakeholders and systems. At its core, this ecosystem comprises four fundamental layers: physical infrastructure, network operations, service delivery, and governance frameworks. Each layer involves different stakeholders and requires specific considerations for successful implementation. These layers involve other associated layers such as energy, water, and waste management that are essential for the operation of such systems.

The physical infrastructure layer encompasses data centers, telecommunications networks, software, and devices. The network operations layer manages the routing, switching, and optimization of data flows across this physical infrastructure. The service delivery layer enables the provision of specific services and applications to end users. The governance framework layer oversees the entire system, ensuring security, reliability, and regulatory compliance.

FIGURE 10
AI INFRASTRUCTURE DEVELOPMENT STAKEHOLDERS



Source: Authors' elaboration.

Stakeholder Integration

Successful AI infrastructure development requires effective coordination among multiple stakeholders (see Figure 10.). Government entities at local, state/province, and national levels play crucial roles in planning, regulation, and oversight. Private sector organizations contribute with technical expertise, operational capabilities, and investment capital. International organizations provide funding support and technical guidance, including standardization. Civil society organizations ensure community interests are represented and protected.

Countries achieving the most successful infrastructure deployments have established formal mechanisms for stakeholder coordination. These mechanisms typically include regular consultation processes, clear decision-making frameworks, and transparent accountability systems.

Investment Framework

The financing of advanced infrastructure requires a sophisticated approach to investment structuring. Traditional public funding models are increasingly supplemented by innovative financing mechanisms, including PPPs, infrastructure bonds, and international development funding. Successful projects typically employ a mixed funding approach, combining multiple financing sources to optimize risk allocation and return profiles.

Regulatory Considerations

The regulatory framework for data and telecommunications infrastructure must balance multiple competing priorities. Security requirements must be weighed against operational efficiency. Privacy protections must be balanced with data accessibility needs.

Innovation potential must be considered alongside stability requirements. Successful regulatory frameworks demonstrate flexibility while maintaining clear standards and enforcement mechanisms.

Technological Integration

Digital infrastructure must support the integration of multiple emerging technologies. Cloud computing platforms require high-bandwidth, low-latency connections. Internet of Things (IoT) applications demand extensive coverage and reliable connectivity. AI systems need robust data-processing capabilities. The infrastructure framework must accommodate these varied requirements while maintaining scalability for future technological advances.

Implementation Framework

The successful implementation of advanced infrastructure requires a structured approach to project planning and execution. This conceptual framework identifies four critical phases: (i) assessment and planning, (ii) design and engineering, (iii) deployment and testing, and (iv) operations and maintenance. Each phase requires specific expertise and careful attention to both technical and organizational factors.

This conceptual framework provides a foundation for understanding the complex relationships and requirements involved in developing high-impact data and telecommunications infrastructure. It serves as a guide for policymakers and stakeholders in planning and executing infrastructure projects that can drive economic and social development across LAC.

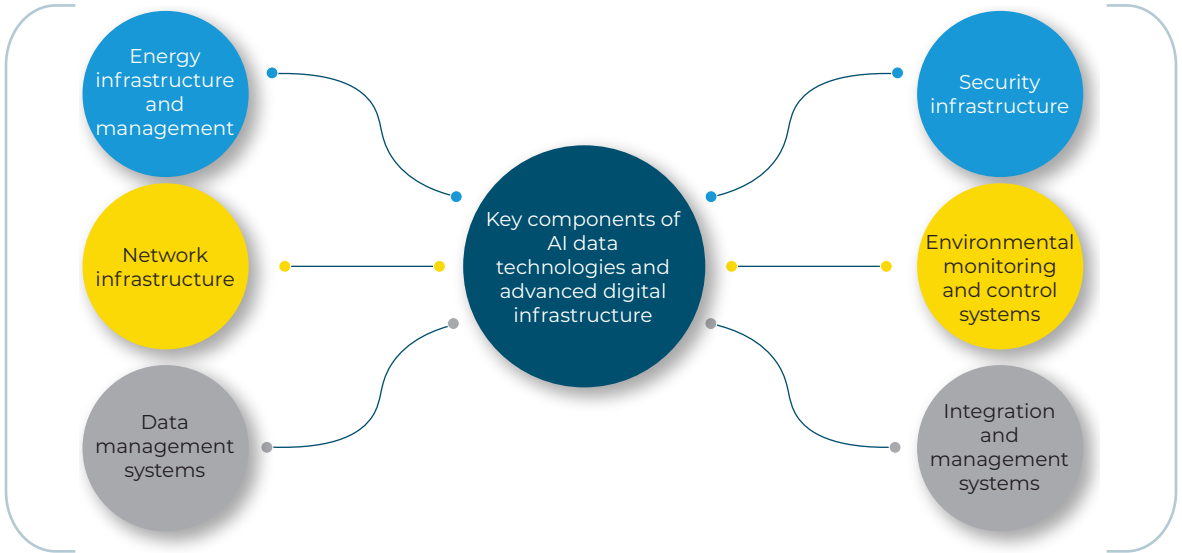
Key Components of AI Data Technologies and Advanced Digital Infrastructure

The development of advanced digital infrastructure for high-impact AI data technologies requires a comprehensive approach that integrates sustainability, efficiency, and resilience. This analysis identifies several critical components that form the foundation of next-generation technology infrastructure (see Figure 11). Understanding these components and their interactions is essential for successful implementation of advanced digital infrastructure across the LAC region (Figure 12 shows the share of renewables in electricity output and total energy supply).

Energy Infrastructure and Management

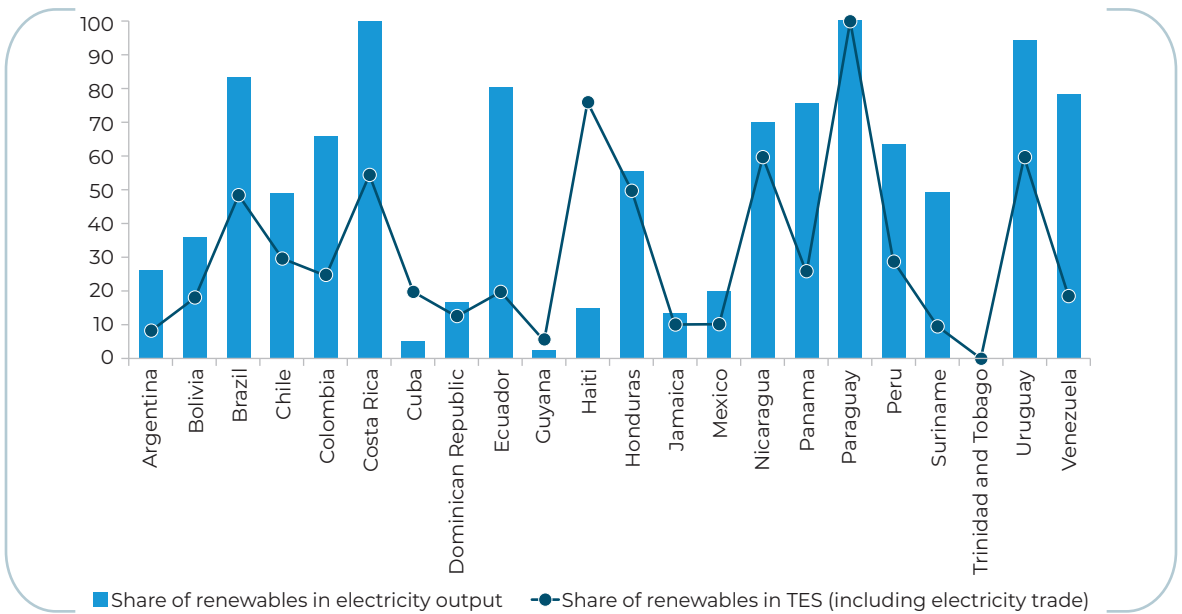
Today's technology infrastructure must be designed with sustainability at its core. Research indicates that organizations implementing sustainable infrastructure achieve 50 percent lower costs and could deliver 28 percent in added value through carbon sequestration, cleaner air and water, better health, and other benefits, compared to traditional approaches (Duque, 2022). This sustainability-first approach encompasses multiple dimensions of infrastructure development and operation.

FIGURE 11
KEY COMPONENTS OF AI DATA TECHNOLOGIES
AND ADVANCED DIGITAL INFRASTRUCTURE



Source: Authors' elaboration.

FIGURE 12
SHARE OF RENEWABLES IN ELECTRICITY
OUTPUT AND TOTAL ENERGY SUPPLY



Source: OECD (n.d.).

BOX 2

THE DIGITAL FOOTPRINT: UNPACKING AI'S ESCALATING ENERGY DEMAND AND CLIMATE IMPACT

The escalating energy demand of AI, particularly large language models (LLMs) and complex machine and deep learning tasks, is a documented reality. As we further integrate AI into our products, reducing emissions may be challenging due to increasing energy demands from the greater intensity of AI computing and the emissions associated with the expected increases in our technical infrastructure investment (Seitz, 2024).

In addition to computational intensity requiring specialized hardware such as graphics processing units (GPUs) and application specific integrated circuits (ASICs), trends in the expansion and model size complexities of LLMs are increasing power consumption exponentially. Furthermore, demand for additional space in data centers requires massive amounts of electricity for servers, cooling systems, and supporting infrastructure.

The International Energy Agency (IEA) has reported that electricity consumption from data centers, AI, and cryptocurrency combined could double by 2026. Data centers are significant drivers of growth in electricity demand in many regions. After globally consuming an estimated 460 terawatt hours (TWh) in 2022, data centers' total electricity consumption could reach more than 1,000 TWh in 2026. This demand is roughly equivalent to the electricity consumption of Japan. Updated regulations and technological improvements, including in efficiency, will be crucial to moderate the surge in energy consumption from data centers (Ericsson and RCR Wireless News, 2024).

The escalating energy consumption of AI matters profoundly due to direct and indirect impacts. Higher electricity consumption by AI translates directly into increased demand for power, leading to more burning of fossil fuel and, consequently, higher greenhouse gas emissions. This exacerbates climate change, contributing to rising global temperatures, extreme weather events, and sea-level rise. This strain on existing energy grids may accelerate the depletion of non-renewable resources if clean energy sources are not prioritized.

Indirectly, it can add environmental footprints caused by (i) rare earth minerals and other finite resources used in the manufacturing of AI hardware, (ii) the exponential increase of data centers leading to accelerating water scarcity, particularly in those regions already facing water stress, and (iii) the rapid pace of technological advancement in AI hardware that leads to frequent upgrades and obsolescence, contributing to a growing e-waste problem.

Reducing negative impacts on higher energy consumption and higher greenhouse gas emissions requires a multipronged approach involving researchers, developers, implementers, policymakers, and consumers.

At present, researchers and developers need to build energy-efficient AI algorithms, hardware, and architectures as well as optimize training techniques. Implementers need to continue to leverage virtualization and cloud consolidation to maximize hardware utilization while renovating cooling technologies in data centers to reduce cost and energy consumption. Policymakers are encouraged to mandate the use of clean energy for those who host AI workloads, invoking strong commitments from cloud providers and corporate users. Altogether, multistakeholders need to discuss and develop standardized methodologies to measure and report energy consumption and carbon footprint of AI models throughout their lifecycle (training, inference, development). Finally, all are called to continue to educate the public, industry professionals, policymakers, and consumers about the environmental impact of AI to drive demand for sustainable solutions and responsible development, implementation, and use.

The foundation of sustainable technology infrastructure lies in its energy systems. Advanced infrastructure requires sophisticated power management systems that integrate renewable energy sources, smart grid technologies, and advanced storage solutions. For example, advanced optimization enables data centers to achieve an annual energy consumption reduction for cooling of between 5 percent and 15 percent (McCinty, 2024).

Today's data centers and network facilities increasingly rely on hybrid power systems that combine solar, wind, and traditional power sources. These systems incorporate advanced energy storage solutions to ensure reliability while maximizing renewable energy utilization. Smart grid integration enables real-time power management and optimization, reducing overall energy consumption.

The computing infrastructure layer must balance performance requirements with energy efficiency. Modern systems increasingly utilize advanced cooling technologies, such as liquid cooling and air-side economization, reducing cooling energy requirements by up to 40 percent (Seitz, 2024). Server virtualization and cloud computing significantly improve resource utilization rates by allowing multiple virtual machines (VMs) to run on a single physical server, maximizing hardware capacity and reducing idle resources. This consolidation leads to better central processing unit (CPU), memory, and storage utilization, ultimately lowering costs and improving overall efficiency. Furthermore, cloud computing, built upon virtualization, enables dynamic resource allocation and scalability, allowing businesses to adjust resources based on demand.

Infrastructure design must consider full life cycle environmental impact. Organizations implementing comprehensive environmental assessment frameworks reduce their carbon footprint by 60–95 percent, according to UNEP (2023).

Network Infrastructure

Network infrastructure represents a critical component of emerging technology systems. The integration of 5G technologies enables new capabilities while requiring careful attention to energy efficiency and resource utilization. AI-driven network management systems can reduce energy consumption; cases vary from a 20 percent to 70 percent reduction (Ericsson and RCR Wireless News, 2024).

Today's network architectures increasingly incorporate edge computing capabilities, reducing data transmission requirements and improving response times. Software-defined networking enables dynamic resource allocation, improving network efficiency.

Data Management Systems

Effective data management infrastructure forms the backbone of emerging technology systems. Today's infrastructure must support real-time data processing while ensuring security and compliance. Organizations implementing advanced data management systems achieve faster processing times and lower costs.

The integration of big data analytics platforms enables real-time optimization of infrastructure operations. For example, machine learning (ML) algorithms can predict

maintenance requirements, increasing equipment uptime by 20 percent (Deloitte Analytics Institute, 2017) and extending equipment life.

Security Infrastructure

Cybersecurity infrastructure must be embedded throughout the technology stack. Today's security systems utilize AI-driven threat detection, zero-trust architectures, and advanced encryption technologies. Organizations implementing comprehensive security infrastructure can reduce security incidents and leaders in resilience can increase response times by 23 percent (Splunk and Oxford Economics, 2024).

Environmental Monitoring and Control Systems

Advanced infrastructure requires sophisticated environmental monitoring systems. These systems integrate IoT sensors, analytics platforms, and control systems to optimize

BOX 3 EMERGING TECHNOLOGY INTEGRATION

The infrastructure must support the integration of multiple emerging technologies.

Digital Twins and Simulation Systems

Infrastructure increasingly incorporates digital twin technologies for real-time monitoring and optimization. These systems enable predictive maintenance, increasing uptime by up to 10 percent to 20 percent and maintenance costs by 5 percent to 10 percent (Fonarov, 2024). In the water management sector, the use of a digital twin model resulted in an impressive 25 percent reduction in leaks (Fonarov, 2024).

AI and Machine Learning

AI infrastructure requirements extend beyond basic computing resources. Organizations must implement specialized processing capabilities, including graphics processing unit (GPU) clusters and AI-optimized networking. Properly designed AI infrastructure may accelerate processing by up to 50 times and reduce costs by 25 percent (Fonarov, 2024).

Robotics and Automation Systems

Infrastructure for robotics and automation requires specialized components for control, communication, and safety systems. Organizations implementing comprehensive robotics infrastructure achieve higher automation rates and lower error rates. For example, according to a study by McKinsey & Company (Didion et al., 2019), thanks to the successful automation of manual and repetitive tasks, operations centers are reducing costs by 30 percent to 60 percent while simultaneously enhancing the quality of their services.

Augmented and Virtual Reality

Augmented reality and virtual reality (AR/VR) infrastructure demands high-bandwidth, low-latency networks and specialized processing capabilities. To enable AR/VR applications in construction or healthcare, which require low latency, 5G infrastructure will be necessary (Cherukuri, 2023).

environmental conditions and resource utilization. For example, Beijing has implemented extensive air quality monitoring systems that have significantly reduced particle material or PM2.5 levels. From 2013 to 2017, the city achieved a 35.6 percent reduction in annual PM2.5 concentrations, surpassing their targets. The reduction in smog levels can be attributed to a combination of emission control measures and advanced monitoring technologies that provide accurate data for policymaking and enforcement (UNEP, 2019).

Integration and Management Systems

Successful infrastructure implementation requires sophisticated integration and management systems. These systems must coordinate multiple technology components while ensuring optimal performance and efficiency. Organizations implementing advanced management systems achieve better resource utilization and lower operational costs. The impact varies across industries; for example, with advanced analytics in asset management, a utility company was able to “unlock savings of 20 to 25 percent in operating expenses and 40 to 60 percent in capital expenditures, which could then flow as savings into the profit-and-loss (P&L) statement or be reinvested to deliver significant reliability improvement” (Asthana et al., 2022).

Implementation Considerations

The successful implementation of emerging technology infrastructure requires attention to several key factors:

Scalability and Flexibility

Infrastructure must be designed for future growth and technology evolution. There are examples where implementing a cloud-ready operating model may enable organizations to decrease deployment times from weeks to hours, significantly increasing delivery frequency and reducing operational costs by 30 percent (Comella-Dorda et al., 2021). These advancements highlight the importance of scalable infrastructure in achieving agility and operational efficiency.

Reliability and Resilience

Infrastructure must maintain high reliability while ensuring resilience to disruptions. Organizations implementing comprehensive resilience frameworks achieve lower downtime and 28 percent faster recovery times (Splunk and Oxford Economics, 2024).

Cost Optimization

Infrastructure design must balance performance requirements with cost considerations. McKinsey & Company (Akella et al., 2009) highlights that significant cost reductions can be achieved by simplifying IT architecture. For instance, a comprehensive review

and rationalization of IT systems, including eliminating duplicate applications and standardizing technologies, has helped companies save tens or even hundreds of millions of dollars while improving operational efficiency and reducing complexity. These measures emphasize the value of integrated approaches in achieving both cost efficiency and high performance in infrastructure design.

Recommendations for Implementation

It is recommended that LAC countries focus on:

- Development of comprehensive infrastructure strategies that integrate sustainability and efficiency requirements.
- Implementation of advanced monitoring and management systems for optimal performance.
- Integration of circular economy principles in infrastructure design and operation.
- Development of robust security frameworks throughout the infrastructure stack.
- Implementation of sophisticated environmental management systems.

The successful implementation of emerging technology infrastructure requires careful attention to these key components and their interactions. Organizations that effectively integrate these elements while maintaining focus on sustainability and efficiency will achieve significant competitive advantages in the evolving technology landscape.

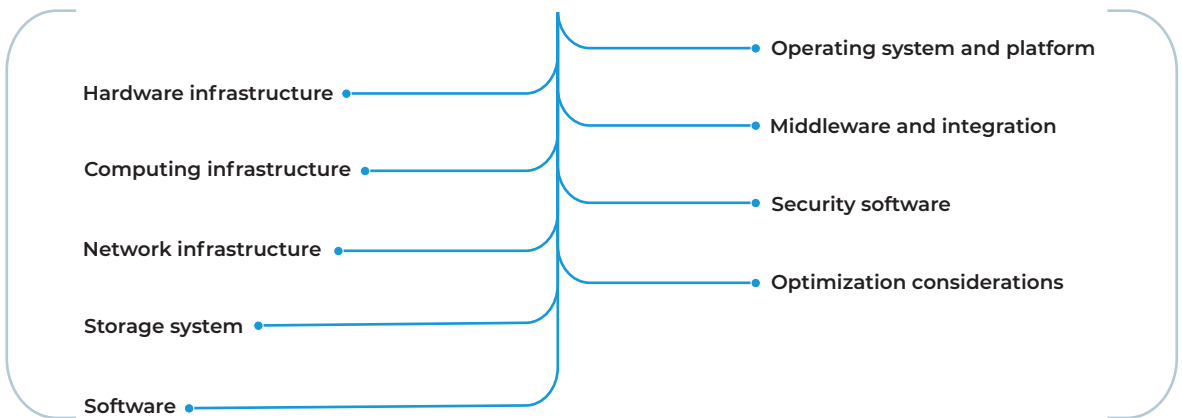
Considerations for Hardware and Software Requirements

The successful implementation of emerging technologies requires careful consideration of hardware and software requirements to ensure effective deployment and sustainable operation. Organizations achieving the highest return on technology investments dedicate significant attention to these foundational elements. The following paragraphs present a quick overview of these hardware and software requirements, some of which are further detailed in Section 3 (see Figure 13).

Hardware Infrastructure

The hardware foundation for emerging technologies must balance performance requirements with practical constraints such as cost, reliability, and maintainability. McKinsey & Company (Deichmann et al., 2022) highlights that simplifying system architecture through modularization and standardization can significantly reduce development and support costs, with some organizations achieving up to a 25 percent reduction. These strategic approaches to hardware selection and system design emphasize the importance of aligning technical choices with both immediate and long-term cost efficiency.

FIGURE 13
HARDWARE AND SOFTWARE REQUIREMENTS CONSIDERATIONS



Source: Authors' elaboration.

Computing Infrastructure

Modern applications require sophisticated computing infrastructure that can handle diverse workloads. High-performance computing (HPC) clusters must support AI and ML applications, while edge computing devices need to process data closer to the source.

Network Infrastructure

Network infrastructure must support high-bandwidth, low-latency applications while maintaining reliability and security. The integration of 5G technologies requires specialized hardware components, including advanced antenna systems and edge computing nodes. According to McKinsey & Company (2022b), 5G infrastructure can achieve 1,000 times higher mobile data volume per area, 100 times the number of connected devices, 10 times longer battery life for low-power massive-machine communications, 50 percent higher bandwidth utilization, and 5 times lower latency.

Storage Systems

Data storage requirements continue to grow exponentially with the adoption and use of emerging technologies. Modern storage systems must balance performance, capacity, and cost considerations.

Software

Software infrastructure must provide flexibility, scalability, and security while enabling rapid deployment of new applications and services. Organizations taking a strategic

approach to software selection generally achieve faster deployment times and lower development costs.

Operating Systems and Platforms

Modern infrastructure requires operating systems that support virtualization, containerization, and cloud-native applications.

Middleware and Integration

Integration software plays a crucial role in connecting diverse systems and applications. Modern middleware must support real-time data processing, event-driven architectures, and microservices deployments. According to McKinsey & Company (Bossert et al., 2015), organizations that adopt DevOps (development operations—a set of practices that combines software development and IT operations to shorten the development life cycle and improve deployment efficiency) and agile integration strategies can reduce the average time from code completion to live production from 89 days to just 15 days, demonstrating a significant acceleration in application development cycles.

Security Software

Security software plays a crucial role in protecting systems and data across multiple layers of the technology stack. Modern solutions integrate AI-driven threat detection, automated response capabilities, and advanced encryption technologies to ensure resilience in the face of cyberattacks (see Figure 14 for examples). Organizations that invest in robust cybersecurity tools and observability solutions recover from cybersecurity-related incidents 23 percent faster on average and reduce downtime significantly, underscoring the importance of comprehensive security strategies (Splunk and Oxford Economics, 2024).

Optimization Considerations

The selection and implementation of hardware and software components must consider several key optimization factors.

Cost Optimization

Infrastructure components must balance performance requirements with cost considerations.

Energy Efficiency

Hardware and software selections significantly impact energy consumption.

Maintenance Requirements

Infrastructure must be designed for efficient maintenance and updates.

Recommendations for Implementation

It is recommended that LAC countries focus on:

- Development of comprehensive hardware and software specifications aligned with specific use case requirements.
- Implementation of scalable architectures that can adapt to evolving technology requirements.
- Integration of energy efficiency considerations in all infrastructure decisions.
- Development of comprehensive maintenance and update strategies.
- Implementation of robust security frameworks across all infrastructure components.

The successful deployment of emerging technologies requires careful attention to these hardware and software requirements. Organizations that effectively address these requirements while maintaining focus on optimization and efficiency will achieve significant advantages in technology implementation and operation.

Networks and Connectivity

Networks and connectivity form the backbone of modern digital infrastructure, enabling the seamless operation and integration of advanced technologies like AI and IoT and the digitalization of various sectors. Healthcare delivery, for example, increasingly depends on robust network infrastructure. Telemedicine applications require high-bandwidth, low-latency connections to enable remote consultations and diagnostic services. This section explores the evolution of network architectures and their critical role in supporting the development and deployment of high-impact applications. From the adoption of 5G and edge computing to the expansion of national research and education networks (NRENs), this section outlines how innovative networking solutions address connectivity challenges, optimize performance, and drive economic growth.

As digital transformation accelerates, the demand for robust, scalable, and secure network infrastructures has never been greater. In this section the role of connectivity in bridging the digital divide, particularly in underserved regions, and the significant economic and societal benefits that come from strategic network investments are also examined. By leveraging advanced connectivity solutions, LAC countries can position themselves at the forefront of the global digital economy.

Network Architecture Evolution

Current network architectures must support increasingly diverse and demanding applications while maintaining reliability and security. Traditional network designs are evolving

to incorporate new technologies and capabilities, including 5G, edge computing, and software-defined networking such as non-terrestrial or satellite networks. Research indicates that organizations implementing advanced network architectures achieve better performance metrics and lower operational costs. According to a study by IDC (Butler and Marden, 2020), companies using advanced networking technologies realized a value of US\$204,600 per year per 100 users, primarily through revenue gains tied to enabling their businesses, as well as ensuring higher productivity for application developers and IT networking teams. The same study found that organizations leveraging advanced network technologies experienced a 21 percent productivity increase for developers.

Connected Society Development

Network infrastructure plays a fundamental role in addressing digital divide challenges. This impact is particularly significant in rural and underserved areas, where improved connectivity can transform economic opportunities.

Economic Development Impact

Network infrastructure serves as a catalyst for economic development. A 1 percent increase in mobile broadband penetration generates a 0.23 percent increase in GDP, while a 1 percent increase in fixed broadband increases GDP by 0.31 percent (Alderete, 2022). This economic advantage compounds over time, creating sustainable development opportunities.

Implementation Requirements

Successful network infrastructure development requires attention to several key factors.

Performance Requirements

Modern networks must deliver high bandwidth and low latency while maintaining reliability.

Security Integration

Network security must be embedded throughout the infrastructure stack.

Scalability Considerations

Network infrastructure must support future growth and evolving requirements.

Recommendations for Implementation

Based on this analysis, it is recommended that countries of the LAC region focus on:

- Development of comprehensive network strategies aligned with economic and social development goals.
- Implementation of advanced security frameworks throughout the network infrastructure.
- Integration of scalability considerations in all network design decisions.
- Development of specialized network capabilities and use of non-terrestrial networks for critical services like healthcare and education in rural areas.
- Implementation of robust monitoring and management systems.

The successful development of network infrastructure requires careful attention to these key factors and their interactions. Organizations and regions that effectively address these requirements while maintaining focus on sustainability and efficiency will achieve significant advantages in digital transformation and social development efforts.

Data Centers and Cloud Computing

Data centers and cloud computing are pillars of digital transformation strategies worldwide, underpinning the deployment of emerging technologies and supporting the expansion of digital ecosystems. These two components collectively ensure that organizations have the computing power, storage capacity, and flexibility necessary to address the growing demands of data-driven applications.

Data centers serve as centralized facilities for data storage, processing, and management. They provide the foundational infrastructure needed to support mission-critical applications, enable digital services, and facilitate real-time analytics. By centralizing resources, data centers offer economies of scale, reducing costs associated with equipment, maintenance, and energy consumption. They also incorporate redundancy measures and disaster recovery protocols to ensure high availability and reliability, which are essential for sectors such as finance, healthcare, and public services.

Since 2015, there has been a shift toward net zero green data centers, which integrate energy-efficient designs, energy conservation through advanced cooling systems, and renewable energy sources. These measures significantly reduce the carbon footprint of data centers while optimizing operational costs.

Evolution and Benefits of Cloud Computing

Cloud computing has emerged as a pivotal solution for organizations seeking scalable and flexible computing resources. Cloud platforms allow organizations to quickly adapt to fluctuating data demands; businesses can respond to spikes or dips in usage, avoiding service interruption (elasticity and on-demand services), without having to invest heavily in physical infrastructure. This on-demand model offers benefits such as reduced time-to-market, lower upfront costs, and seamless scalability, which are particularly valuable in sectors with unpredictable workloads, such as media streaming, e-commerce, and online education.

Furthermore, cloud computing supports various deployment models, including public clouds, private clouds, and hybrid clouds. Public clouds provide shared resources that offer cost efficiency and scalability, while private clouds offer greater control and security for sensitive data. Hybrid clouds combine the best of both, enabling organizations to optimize data storage and processing based on regulatory and operational needs.

Hybrid and Multicloud Strategies

Many organizations are adopting hybrid and multicloud strategies to achieve a balance between flexibility, cost efficiency, and security. Hybrid cloud environments allow data and applications to be seamlessly transferred between on-premises data centers and cloud platforms, facilitating compliance with data sovereignty regulations while providing scalability. Multicloud strategies, on the other hand, involve using multiple cloud providers to avoid vendor lock-in and enhance disaster recovery capabilities.

This hybrid and multicloud approach is particularly relevant in LAC, where varying regulatory frameworks and infrastructural disparities exist across countries. By strategically distributing workloads, organizations can navigate regional regulatory complexities while optimizing performance and costs.

Challenges and Strategic Considerations

Despite their numerous benefits, data centers and cloud computing come with challenges. Data center operations require significant investments in energy-efficient designs and cooling technologies to maintain sustainability. Cloud security remains a major concern, especially with the increasing number of data breaches and cyberthreats. To mitigate these risks, organizations must adopt robust cybersecurity measures and comply with data protection laws. Additionally, the lack of reliable connectivity in remote areas of the LAC region presents a barrier to cloud adoption, necessitating investments in broadband infrastructure.

High-Performance Computing and Advanced Processing

HPC has become a critical asset for organizations and governments aiming to leverage big data, AI, and complex simulations. HPC systems consist of large-scale computing infrastructures capable of processing vast datasets and running intricate models with high accuracy and speed.

HPC is pivotal in sectors such as climate modeling, genomics, and material sciences, where it enables researchers to conduct simulations and analyze massive datasets in a fraction of the time required by conventional computing methods. For instance, climate modeling, which requires analyzing vast datasets of weather patterns, would be unfeasible without HPC systems. Likewise, pharmaceutical companies rely on HPC to simulate drug interactions, thereby accelerating the drug discovery process.

In LAC, strengthening HPC capabilities (regional infrastructure plus human capital) that are already integrated in the Advanced Computing System for Latin America

and the Caribbean (Sistema de Cómputo Avanzado para América Latina y el Caribe, or SCALAC) initiative³ could significantly accelerate the region's innovation in science, engineering, and economic development. HPC centers could serve as shared resources for academia, industry, and government agencies, fostering collaboration and reducing the cost burden for individual organizations by country. These centers should also focus on developing expertise in parallel computing and data analytics to maximize the value of HPC investments.

Integration with Emerging Technologies

The combination of HPC and edge computing is particularly powerful for applications that require real-time data processing, such as smart manufacturing, IoT deployments, and autonomous vehicles. By distributing computing resources across regional HPC facilities and edge nodes, LAC countries can optimize data-processing pipelines, reduce latency, and minimize network congestion.

Additionally, the convergence of HPC with AI is unlocking new possibilities for AI model training and deployment. Modern AI models, particularly those used for deep learning applications, require significant computational power to process large datasets and achieve high precision and accuracy in a short timeframe. Improving LAC countries' access to HPC regional resources can reduce training times for AI models by up to 60 percent and improve their predictive performance.

Sustainability and Efficiency Considerations

Given the significant energy demands of HPC systems, sustainability must be a key consideration. HPC facilities consume large amounts of electricity to power and cool their computing clusters, making energy-efficient designs and cooling technologies essential. Measures such as liquid cooling, air-side economization, and server virtualization can reduce energy consumption by up to 20 percent (Barry, 2023). Moreover, integrating renewable energy sources into HPC facilities can further reduce their environmental impact.

Strategic Investments and Human Capital Development

To successfully implement HPC capabilities, LAC countries must prioritize strategic investments in infrastructure, human capital development, and regional collaboration. LAC governments together with research centers and higher education institutions should establish HPC centers that provide shared resources and offer training programs in parallel computing and data science. This approach will not only build technical capacity but also create a foundation for regional innovation and competitiveness. The use of NRENs and the Latin American Cooperation of Advanced Networks (Cooperación Latino Americana de Redes Avanzadas, or RedCLARA) to interconnect

³ See <https://scalac.redclara.net/en/> and more details on SCALAC in the next subsection.

additional HPC centers to SCALAC will increase the availability of computing power for the LAC region.

Additionally, PPPs can play a crucial role in mobilizing investments for HPC infrastructure. By involving private enterprises, and government agencies as well as academic institutions, these partnerships can ensure that resources are optimally allocated and that research priorities align with regional needs.

National Research and Education Networks

NRENs serve as critical infrastructure components for scientific and educational advancement. These specialized networks provide high-performance connectivity that enables sophisticated and forefront research applications and collaborative learning environments. They “generally serve advanced users with service demands ahead of the public marketplace. As such they are in a position to trial new services and also contribute to the general development of technology via experimentation and contribution to standardisation” (Davies, 2014). “NRENs include a high level of technical expertise and experience serving a more ICT literate [user] base, [therefore,] NRENs [are] potentially natural partners to assist governments with the implementation of” (Davies, 2014) their digital transformation and public policies to implement advanced technology and ICT infrastructure at the national, state/province, and local levels.

In an interview (Flores, 2024), Nelson Simões, ex-president of the Brazilian NREN (Red Nacional de Pesquisa, or RNP), “underscore[d] the value of RNP’s research projects, which fostered experimentation and gave rise to companies and services that today contribute to Brazil’s technological development.” For the future, Simões champions “regional collaboration and the adoption of emerging technologies like artificial intelligence, blockchain, and quantum computing.” He believes that “the role of academic networks is to stay at the forefront, anticipating the impacts of these technologies and exploring how they can benefit education and research” to solve regional needs.

RedCLARA

RedCLARA is the regional research and education network (RREN). RedCLARA’s core purpose is to foster the advancement of research, education, and innovation across LAC by providing and managing a high-capacity regional academic fiber-optic network. It serves as a vital backbone, connecting NRENs within each country and to other regional networks such as GEANT, the European RREN, thereby facilitating seamless collaboration, data exchange, and access to specialized digital resources for universities, research centers, and educational institutions throughout the region and across other regions. By enabling this shared, advanced infrastructure, RedCLARA empowers scientific discovery, strengthens educational capabilities, and promotes digital development, particularly for nations seeking to enhance their connectivity and participate more fully in the global knowledge society.

RedCLARA plays a pivotal role in strengthening digital infrastructure and capabilities across the region. It also actively supports nations lacking robust digital infrastructure, particularly within the Caribbean, encouraging them to join and foster regional development.

Members and potential new members can further leverage RedCLARA's regional collaboration initiatives, which include a blockchain regional infrastructure, the SCALAC project to consolidate a regional HPC infrastructure and services, and the BELLA II project, as well as other scientific and technological infrastructures, all aimed at advancing research and education in the region.

Advanced RRENs and NRENs serve two fundamental purposes:

- To support the work of researchers and academics through the provision of a large-capacity infrastructure for data communication, which enables the fast transfer of large amounts of data, and
- To act as a powerful research tool, by providing a platform over which researchers and innovators can develop and test new network services and technologies.

Advances and innovation in high-speed fiber-optic networks and digital services were developed by technical groups representing different NRENs globally. Researchers, scientists, and engineers participating in the deployment and operation of advanced networks are also crafting new technologies and digital services that will be used in the near future.

SCALAC

SCALAC is the Advanced Computing System for Latin America and the Caribbean. Its main purpose is to organize and integrate strategic infrastructure in the field of HPC, scientific computing, and high productivity computing for LAC (see Figure 15). In essence, SCALAC aims to build and facilitate access to a robust ecosystem for advanced computing, crucial for cutting-edge scientific research and innovation. This involves not only providing the computational resources themselves but also developing highly trained human resources to utilize these high-capacity infrastructures effectively. A key part of its mission is promoting knowledge exchange and community building, exemplified by its strong support for the CARLA conference (High Performance Computing in Latin America).

While RedCLARA provides the high-speed network for research and education, SCALAC works to provide and coordinate the powerful computing resources (supercomputers, specialized clusters) that researchers and educators in the region need to tackle complex problems in climate modeling, bioinformatics, materials science, and more.

SCALAC provides services in infrastructure, platforms, applications, and training as well as consulting for research, development, and innovation using advanced computer technologies. Table 1 lists its members.

SCALAC, working with RedCLARA, ensures that researchers have high-speed, reliable connectivity to HPC resources regardless of their physical location within the connected countries. Beyond academia, SCALAC can facilitate partnerships between research institutions, local industries, and government bodies to develop AI solutions that directly serve public and private sector needs, driving economic and social development.

SCALAC can be a central hub for training researchers, data scientists, and engineers in AI model development, especially focusing on local data and challenges. This includes

TABLE 1
SCALAC MEMBERS

Argentina:

- Universidad de Buenos Aires (UBA)

Brazil:

- Laboratorio Nacional de Computación Científica (LNCC)
- Universidade Federal do Rio Grande do Sul (UFRGS)

Chile:

- Laboratorio Nacional de Computación de Alto Rendimiento (NLHPC)
- Universidad Federal de Santa María (UFSM)

Colombia:

- Centro de Supercomputación y Cálculo Científico de la Universidad Industrial de Santander (SC3UIS)
- Universidad de los Andes (UniAndes)

Costa Rica:

- Colaboratorio Nacional de Computación Avanzada (CNCA)
- Universidad de Costa Rica (UCR)

Ecuador:

- Corporación Ecuatoriana para el Desarrollo de la Investigación y la Academia (CEDIA)

Mexico:

- Corporación Universitaria para el Desarrollo de Internet (CUDI)
- Universidad Nacional Autónoma de México (UNAM)
- Laboratorio de Matemáticas Aplicadas del CINEVESTAV-IPN (ABACUS)
- Centro de Análisis de Datos y Supercómputo de la Universidad de Guadalajara (CADS-UDG)
- Centro México Digital (CMD)

Uruguay:

- Universidad de la República (UDR)

Venezuela:

- Universidad Central de Venezuela (UCV)

International observer agencies from Europe

- Spain
 - BSC-CNS
 - CIEMAT
- France
 - INRIA
 - LIG
 - I3S
- Italy
 - DEMOCRITOSUNILUX

Source: SCALAC (n.d.).

workshops, specialized courses, and access to learning platforms that leverage their HPC resources.

In essence, SCALAC transforms AI from a distant, resource-intensive technology into an accessible tool for regional development. By providing the essential computing power, fostering expertise, and promoting data-driven collaboration, it will be a cornerstone in enabling LAC countries to develop AI solutions that are truly tailored to their unique local challenges and opportunities.

Technological Evolution and Global Trends

The rapid evolution of digital technologies and infrastructure is fundamentally reshaping industries and societies worldwide. This section analyzes the key technological advancements driving this change and identifies global trends that are likely to shape the strategic development of AI infrastructure in LAC. The increasing convergence of emerging technologies such as quantum computing, AI, and 5G networks demands a proactive approach to infrastructure planning and investment.

FIGURE 15
SCALAC HPC CENTERS, SYSTEMS, AND COMMUNITIES



Source: SCALAC (n.d.).

The Rise of Quantum Computing

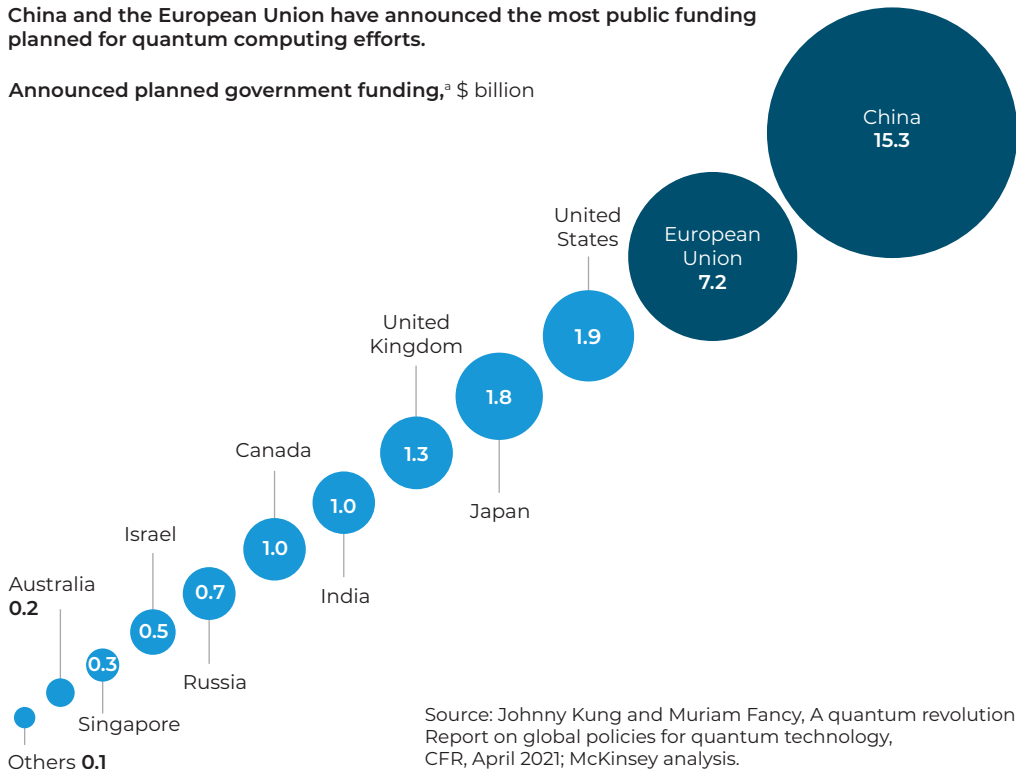
Quantum computing represents one of the most transformative advancements that has taken place since 2015. Unlike classical computing, which relies on binary data processing, quantum computing uses qubits, allowing for massive parallelism and exponential processing power. Although still in its nascent stages, quantum computing has the potential to revolutionize sectors requiring complex simulations and optimization tasks, such as cryptography, drug discovery, and financial modeling. Several leading economies, including the United States and China, have significantly increased their investments in quantum research, with commercial applications expected to mature by 2030 (see Figure 16).

For LAC, laying the groundwork for quantum infrastructure requires strategic planning and regional cooperation. LAC governments together with RedCLARA and SCALAC should prioritize establishing quantum research hubs and partnerships with global leaders to build the necessary expertise and technical capacity. Integrating quantum infrastructure with existing HPC centers can also position the region to capitalize on early-stage quantum innovations.

FIGURE 16 ANNOUNCED PLANNED GOVERNMENTAL FUNDING FOR QUANTUM COMPUTING

China and the European Union have announced the most public funding planned for quantum computing efforts.

Announced planned government funding,^a \$ billion



Source: Johnny Kung and Muriam Fancy, *A quantum revolution: Report on global policies for quantum technology*, CFR, April 2021; McKinsey analysis.

Source: McKinsey & Company (2022a).
a Total historic announced funding; timelines for investment of funding vary by country.

AI and the Growth of Foundation Models

The field of AI has experienced significant progress, particularly with the emergence of foundation models—large-scale ML models that can be fine-tuned for specific applications. These models, such as OpenAI's GPT-4 and Google's Gemini, have showcased impressive capabilities in natural language processing, image recognition, and even multimodal tasks. This trend toward increasingly sophisticated models is creating new opportunities in sectors ranging from healthcare to public administration.

However, these advancements also demand scalable and robust infrastructure, because training large-scale models requires substantial computing power, storage capacity, and energy resources. A critical implication of this trend is the need for dedicated AI infrastructure that includes state-of-the-art data centers, edge computing capabilities, and advanced connectivity solutions. LAC policymakers should consider the strategic deployment of AI-ready infrastructure to foster regional innovation and enhance

digital sovereignty. Again, the partnership with RedCLARA and SCALAC will facilitate the co-creation of regional AI infrastructure to support the region's needs.

5G and the Proliferation of IoT and Edge Computing

The global rollout of 5G networks is enabling faster data transmission, lower latency, and more reliable connections, creating the backbone for the widespread adoption of IoT devices. As 5G becomes more pervasive, industries such as smart manufacturing, autonomous vehicles, and telemedicine are expected to flourish, creating significant economic and social value. The intersection of 5G and edge computing is particularly noteworthy, as it enables real-time data processing closer to the source, reducing the need for continuous transmission to centralized data centers.

For LAC, developing a comprehensive 5G deployment strategy is essential to unlocking the full potential of these technologies. A key focus should be on establishing partnerships between governments, telecom operators, and technology providers to address challenges such as spectrum allocation, regulatory barriers, and connectivity in remote areas. Additionally, investments in edge infrastructure can help reduce network congestion and support latency-sensitive applications like autonomous vehicles and smart city solutions.

The Rise of Decentralized and Distributed Systems

Distributed ledger technologies (DLT), such as blockchain, are becoming increasingly mainstream due to their potential to enhance transparency, security, and efficiency in various applications. From financial services to supply chain management, DLT solutions are reshaping traditional processes by enabling decentralized data management. The adoption of blockchain technology can enhance data security, reduce operational risks, and streamline regulatory compliance, particularly in sectors like finance, healthcare, and public administration.

BOX 4 **OBJECTIVES OF THE COP29 DECLARATION ON GREEN DIGITAL ACTION**

1. Leveraging Digital Technologies and Tools for Climate Action
2. Building Resilient Digital Infrastructure
3. Mitigating Digitalisation's Climate Impact
4. Promoting Digital Inclusion and Literacy
5. Data-Driven Decision-Making
6. Fostering Sustainable Innovation
7. Encouraging Sustainable Consumer Practices
8. Facilitating the Sharing of Best Practices

Source: COP29 (2024).

In 2022, the Latin American and Caribbean Internet Addresses Registry (Registro de Direcciones de Internet para América Latina y Caribe, or LACNIC) and RedCLARA, in collaboration with IDB Lab, launched LACNet, offering the first global blockchain network in enterprise-grade production. This network is based on the protocols and experience of LACChain and orchestrated by LACNet. An international neutral nonprofit association, LACNet allows academic organizations, governments, and companies to join their projects in a blockchain network with the guaranteed level of service they require. This unique blockchain network is open, governed, compliant, and sustainable, with a focus on inclusion (CUDI, 2022).

As LAC countries continue to explore blockchain adoption, strategic considerations should include integrating these solutions with existing digital infrastructure and addressing regulatory and cybersecurity challenges. Establishing regional standards for blockchain adoption and promoting interoperability across borders can further accelerate digital transformation efforts.

Sustainability and the Green Technology Movement

The growing emphasis on environmental sustainability is driving the adoption of green technologies across industries. From energy-efficient data centers to renewables-powered 5G base stations, organizations are increasingly prioritizing sustainable infrastructure solutions to reduce their carbon footprint. Notably, the adoption of smart grid technologies and renewable energy integration in data centers is gaining traction, particularly in Europe and North America. For LAC, investing in green technologies not only aligns with global sustainability goals but also creates new economic opportunities in renewable energy and sustainable innovation.

LAC governments and private sector stakeholders should collaborate to establish green infrastructure standards and incentivize the adoption of energy-efficient technologies. This approach will be crucial in balancing economic growth with environmental responsibility.

Conclusions and Strategic Implications

The evolution of digital technologies presents LAC with unique opportunities to leapfrog traditional development stages and establish itself as a competitive player in the digital economy. However, realizing this potential will require forward-looking infrastructure strategies that prioritize technological integration, sustainability, and regional collaboration. By embracing these trends and building the necessary infrastructure, LAC countries can position themselves at the forefront of the AI revolution, drive economic growth, and enhance the quality of life for their citizens.

Infrastructure Needs for AI Development

The successful development and deployment of artificial intelligence (AI) hinges on robust infrastructure capable of handling its increasing data volumes, processing power requirements, and network complexities. As AI applications continue to evolve, the demand for reliable and scalable infrastructure grows, encompassing data transport, storage, processing, and management. In this context, data transport infrastructure plays a pivotal role in ensuring that AI systems can function efficiently and effectively, enabling everything from real-time analytics to advanced decision-making capabilities.

Infrastructure for the development of AI has become very specialized due to its intrinsic nature: AI infrastructure encompasses the hardware, software, and networking elements that empower organizations to effectively develop, deploy, and manage AI projects. It serves as the backbone of any AI platform, providing the foundation for machine learning (ML) algorithms to process vast amounts of data and generate insights or predictions (Moraitis, 2024). AI infrastructure builds upon many “traditional” data infrastructures, but it requires taking them to extreme levels of power, capacity, and speed. AI infrastructure must respond to five key elements:

- **Data sources:** The basis for all AI-related systems is access to tremendous amounts of information from which AI models are developed and trained. This includes structured databases, unstructured information (e.g., texts, sounds, images) and real-time data generation, among other sources.
- **Storage systems:** All the information from the data sources needs to be stored in very robust systems able to reliably and resiliently handle enormous amounts of data at generally extremely high speeds. AI storage systems need to be scalable. Examples of storage systems are databases, data warehouses, and data lakes hosted on-premises or in the cloud. Furthermore, these storage systems can be located/hosted anywhere in the world, requiring their interconnection to data networks.

- Processing systems: These systems include specialized hardware as well as frameworks, algorithms, and models. Several types of hardware processors, such as graphics processing units (GPUs), have been repurposed for use in AI, but new processors have also been developed specifically to cope with the stringent requirements of AI, like APUs, TPUs, NPU, and VPU,⁴ among others (PRIMO.ai, n.d.). Likewise, on the software side, development frameworks, ML models, feature extraction methods, and data-processing scripts, among others, have been developed. As is the case with storage systems, these processing systems can be located/hosted anywhere in the world, requiring their interconnection to data networks.
- Data networks: Rarely do AI systems operate in closed, self-contained environments. Thus, AI storage and processing systems must be securely connected to, and accessible through, reliable, resilient, and scalable high-speed data communications networks.
- User and device interfaces: By nature, developers, maintainers, users, and data generators (e.g., Internet of Things [IoT] sensors, image and sound capture devices, medical devices) and actuators (e.g., autonomous vehicles, medical devices, emergency systems) need to interact in real time with AI systems through digital devices of all sorts containing software interfaces such as browsers, apps, and APIs.

“AI and Machine Learning (ML) are [becoming] highly regulated areas of innovation and as more and more companies launch applications in the space, it is only becoming even more closely watched. Most of the current regulations governing the sector are around data privacy and security and can cause businesses to incur damaging fines and reputational damage if they’re violated.”

— Flinders and Smalley (2024)

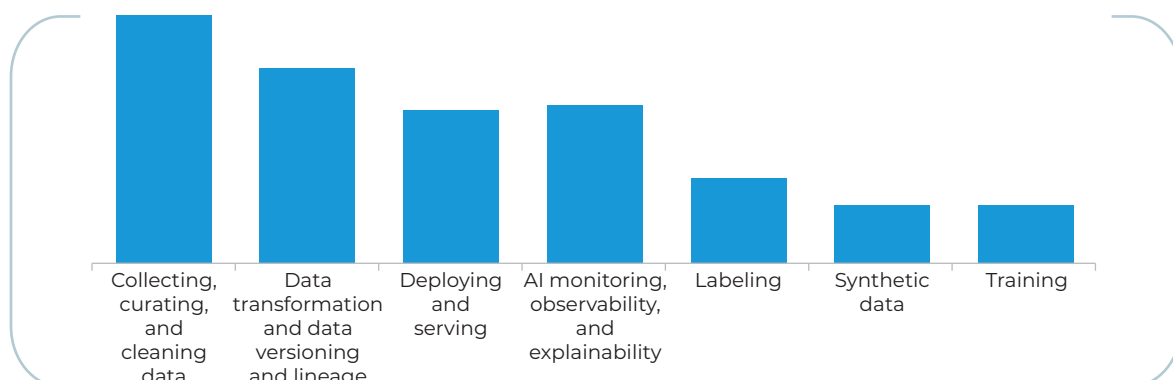
There is a sixth key AI element that, albeit not strictly necessary, is extremely helpful to the AI development process: machine learning operations (MLOps) platforms establish sets of specific practices that guide developers and data scientists through data collection, model training, validation, troubleshooting, optimization, and monitoring of AI tools, applications, and services.

Data and Model Development

The basis for all AI-related systems is access to tremendous amounts of information, from which AI models are developed and trained. As IBM chief technology officer Hillery Hunter said in a 2024 video, “there’s no AI without data” (Hunter, 2024). A 2022 survey by

⁴ APU: accelerated processing unit, a chip that combines CPU and GPU capabilities to improve parallel processing efficiency. TPU: tensor processing unit, a custom-developed chip by Google designed to accelerate machine learning workloads. NPU: neural processing unit, a processor optimized for executing neural network operations, commonly used in edge AI devices. VPU: vision processing unit, a processor specialized for handling computer vision tasks such as image recognition and object detection.

FIGURE 17
BIGGEST CHALLENGES IN PRODUCTIONIZING MODELS



Source: AI Infrastructure Alliance (2022).

the AI Infrastructure Alliance “discovered that the teams surveyed often faced their biggest challenges with collecting and cleaning data, Q[uality]A[ssur]ing and transforming data” (AI Infrastructure Alliance, 2022).

As can be seen in Figure 17, the two biggest challenges in productionizing AI models are those related to data collection and transformation as well as, to a lesser degree, synthetic data and training. Organizations developing AI systems must have a wealth of curated data from which the models will be developed and trained and, just as importantly, must have a solid staff of data scientists and engineers to transform that data for AI systems.

Infrastructure for Data Storage and Generation

The infrastructure for data storage, processing, and generation is the backbone of any AI ecosystem. It enables governments and public and private organizations to collect, store, analyze, and leverage massive datasets, thereby unlocking the full potential of AI-driven solutions. As data becomes the lifeblood of digital transformation, robust infrastructure is required to ensure scalability, security, and efficiency in handling vast amounts of information. This section will explore three critical components of this infrastructure: traditional data centers, edge data centers, and cloud computing.

Investing in these elements is crucial to creating a resilient and agile environment capable of supporting AI applications and facilitating innovation. Each type of infrastructure component has distinct roles and advantages, making them complementary rather than mutually exclusive.

Data Centers

Data centers serve as centralized hubs for data storage and processing, offering a controlled environment to house servers, storage systems, and networking equipment.

These facilities have evolved significantly since the massification of commercial internet in the last decade of the 20th century and the explosion of digital data and services, with advancements focusing on efficiency, scalability, and sustainability. Modern data centers are now crucial for hosting large-scale AI models, supporting real-time analytics, and managing critical applications.

The traditional approach to data centers has shifted toward more efficient and scalable designs, driven by growing demands for data processing and storage. The adoption of advanced cooling technologies and energy-efficient designs is at the forefront of this transformation. Green data centers, which integrate renewable energy sources and intelligent cooling systems, can reduce energy consumption by more than 40 percent (Barlow, 2021). In addition, countries and their public and private organizations are increasingly implementing software-defined data centers (SDDCs), which enhance flexibility by virtualizing all infrastructure layers.

Data centers are not just about storage and processing; they are also crucial for providing reliable and secure environments for critical applications. With the increasing frequency of cyberthreats and data breaches, data centers must implement advanced security measures, including multilayered encryption, zero-trust architectures, and continuous monitoring. For AI, data centers provide the computational and storage resources required for training large-scale ML models. With the rise of big data and AI, modern data centers are designed to handle the storage of massive datasets, ensuring they are secure and readily available for AI algorithms to access and process.

In the AI life cycle, data centers play a crucial role during the training phase, where vast quantities of data are used to “teach” AI models. This requires not only substantial storage capacity but also high-performance servers capable of processing complex computations. As AI systems evolve, the demand for robust, energy-efficient data centers continues to grow, pushing innovations in cooling, power management, and server optimization.

Data centers also act as hubs for cloud-based AI services, where public and private organizations can access AI tools and platforms on demand without needing to invest in their own infrastructure. This cloud-based access democratizes AI capabilities, enabling smaller organizations to leverage AI solutions that would otherwise be out of reach due to cost and infrastructure constraints. Thus, the expansion and modernization of data centers are key to supporting the future of AI development.

In Latin America and the Caribbean (LAC), the growing digital economy has heightened the demand for data centers, creating opportunities for both public and private sector investment. Establishing modern data centers in strategic locations can enhance digital services, drive down latency, and reduce dependence on international data hubs. Proximity to key markets and industries is essential for optimizing data center performance and ensuring reliable connectivity.

However, challenges such as high electricity costs and regulatory barriers need to be addressed. LAC governments should introduce incentives for data center construction, particularly centers that utilize green technologies. For example, tax breaks for companies that invest in renewable energy for data centers could help attract foreign investment and encourage sustainable practices.

Strategic site selection is another critical factor in the success of data centers. Proximity to major economic hubs, network infrastructure, and reliable energy sources are essential to minimize latency and optimize operations. Additionally, integrating these facilities into existing high-speed networks and internet exchange points (IXPs) is crucial for supporting latency-sensitive AI applications, such as real-time analytics and telemedicine.

In LAC, identifying optimal sites for new data centers involves assessing several key factors, including network accessibility, power supply reliability, land availability, and security risks. LAC governments should collaborate with network operators and utility providers to ensure that new data centers are strategically located and supported by robust infrastructure (see Table 2).

TABLE 2
KEY CHALLENGES FOR GOVERNMENTS REGARDING DATA CENTERS

Challenge	Description
Identifying optimal sites	Ensuring data centers are located near economic hubs, reliable networks, and energy sources for maximum efficiency
Network accessibility	Providing high-speed, low-latency connectivity to support real-time and AI-driven applications
Power supply reliability	Guaranteeing a stable and sustainable energy supply, especially for energy-intensive operations
Land availability	Securing suitable land with appropriate zoning and minimal environmental impact
Security risks	Addressing risks such as cyberthreats, physical security, and natural disaster vulnerabilities
Regulatory barriers	Streamlining permitting processes and ensuring compliance with evolving regulations
High electricity costs	Managing operational costs through incentives or renewable energy integration
Environmental sustainability	Promoting green technologies and energy-efficient designs to reduce carbon footprints
Infrastructure integration	Connecting new facilities to existing high-speed networks and IXPs
Investment constraints	Attracting private and public funding for construction and modernization of data centers
Skilled workforce availability	Developing human capital with the technical expertise to operate and manage advanced data centers
Data privacy and compliance	Ensuring data centers meet international standards for privacy and cybersecurity
Latency reduction	Minimizing delays in data transmission by optimizing network architecture and site locations
Disaster preparedness	Implementing robust disaster recovery plans and infrastructure resilience measures

Source: Authors' elaboration.

Edge Data Centers

Edge data centers are smaller facilities distributed across various locations to bring data processing capabilities closer to the source of data generation. Unlike traditional centralized data centers, edge data centers are designed to reduce latency and support real-time decision making for critical applications. Edge data centers play a pivotal role in AI deployment, particularly in latency-sensitive scenarios such as autonomous vehicles, smart cities, and IoT-enabled healthcare systems. In the context of AI, edge data centers reduce the distance data must travel for processing, leading to lower latency and faster decision making.

By processing data at the edge, AI systems can perform critical tasks without relying on a central cloud or large data centers. This decentralization improves response times and reduces the strain on core networks, making edge computing a vital component of AI infrastructure in scenarios where speed and efficiency are paramount. For instance, in smart cities, edge data centers can enable real-time traffic management, while in healthcare they can support real-time patient monitoring.

The rise of AI-driven applications has highlighted the limitations of traditional centralized data centers. Applications such as autonomous vehicles, industrial automation, and augmented reality require real-time data processing, which centralized data centers cannot always provide due to latency constraints. Edge data centers address this challenge by processing data locally, thereby reducing the reliance on long-distance data transmission and improving response times.

As AI applications become more ubiquitous and data generation increases, edge data centers will play an increasingly important role in scaling AI infrastructure. The ability to process data closer to where it is generated not only enhances performance but also alleviates concerns about bandwidth and latency in centralized systems, making edge data centers a critical part of the AI ecosystem.

In LAC, the deployment of edge data centers should be prioritized in densely populated urban centers and key industrial zones. This strategy not only enhances the efficiency of real-time applications but also supports regional economic growth by enabling the development of new digital services and technologies.

One of the key advantages of edge data centers is their ability to enhance data privacy and security by localizing data processing. For industries such as healthcare and finance, where regulatory compliance is critical, edge computing offers a more secure alternative to centralized processing. By reducing the amount of sensitive information transmitted over public networks, countries and their public and private organizations can lower the risk of data breaches and ensure compliance with local regulations.

Additionally, edge data centers contribute to network efficiency by reducing the volume of data that must be sent to central servers. This can significantly alleviate network congestion and lower operational costs. In LAC, where network capacity constraints remain a challenge in certain regions, investing in edge infrastructure can offer a cost-effective solution to expanding digital services.

The successful deployment of edge data centers requires careful planning and strategic placement. Proximity to end users, access to reliable power sources, and integration with high-speed networks are crucial factors to consider. Moreover, efficient management

of edge infrastructure is essential to achieving long-term success. This involves leveraging advanced monitoring tools, implementing automated failover solutions, and optimizing energy consumption.

LAC governments and private enterprises should work together to identify key locations for edge data centers and establish clear guidelines for managing edge infrastructure. Public-private partnerships (PPPs) can play a vital role in driving investments and coordinating deployment efforts across the region.

Cloud

Cloud infrastructure has become an essential element of modern digital ecosystems, providing on-demand computing resources and enabling organizations to scale operations efficiently. The cloud offers a range of services, from infrastructure as a service (IaaS) to software as a service (SaaS), catering to diverse business needs. For AI applications, cloud platforms provide flexibility, scalability, and access to advanced analytics and ML tools.

One of the key advantages of cloud infrastructure is its ability to offer scalable and flexible resources, enabling countries and their public and private organizations to handle fluctuating workloads without significant upfront investment. This is particularly valuable for AI applications, which often require substantial computing power for training and fine-tuning models. By leveraging cloud infrastructure, organizations can access powerful AI tools and frameworks, accelerating innovation and reducing time-to-market.

Moreover, cloud platforms support multicloud and hybrid cloud strategies, which provide organizations with greater flexibility and redundancy. Multicloud strategies involve using multiple cloud providers to avoid vendor lock-in, while hybrid cloud models integrate on-premises data centers with cloud resources. This approach allows organizations to optimize data storage and processing based on specific requirements, such as regulatory compliance and latency reduction.

Cloud platforms play a crucial role in enabling digital transformation, particularly in sectors such as e-commerce, digital media, and fintech. Public and private organizations can rapidly deploy new services, scale resources as needed, and integrate AI-driven capabilities to enhance customer experiences. For example, cloud-based AI services allow organizations to implement recommendation engines, chatbots, and predictive analytics without investing heavily in physical infrastructure.

In LAC, the adoption of cloud solutions is accelerating, driven by the increasing internet penetration and the growing demand for digital services. However, challenges related to data sovereignty, cybersecurity, and connectivity remain. LAC governments must work with cloud providers to establish clear guidelines for data protection and ensure that cloud infrastructure is accessible to businesses of all sizes.

While cloud infrastructure offers significant benefits, it also presents challenges related to security, compliance, and cost management. Organizations must adopt comprehensive security frameworks that include encryption, multifactor authentication, and zero-trust architectures to protect sensitive data. Additionally, regular compliance audits and continuous monitoring are essential to maintaining regulatory compliance and preventing data breaches.

AI infrastructure components are available through both cloud and on-premises solutions. Cloud providers offer greater flexibility, scalability, and cost-effective pay-as-you-go models. However, on-premises infrastructure can provide superior control and enhanced performance for certain specialized workloads. Therefore, the optimal choice depends on a careful evaluation of these trade-offs to determine the best fit for an organization's specific needs.

— Flinders and Smalley (2024)

LAC organizations should prioritize investments in cloud security measures and establish clear governance frameworks to address risks. Collaboration between governments, industry stakeholders, and cloud providers is necessary to create a secure and resilient cloud environment.

Cloud computing and storage offers scalable, flexible resources for storing and processing data, making it an ideal solution for AI workloads. The cloud allows AI developers to access vast amounts of storage and computational power on demand, removing the need for costly hardware investments. This flexibility is particularly beneficial during the AI training phase, where computational requirements can fluctuate significantly depending on the model's complexity and the size of the dataset.

For AI, the cloud also supports collaboration by enabling distributed teams to work together on shared datasets and models. Cloud platforms offer integrated tools for AI development, such as ML frameworks, data analytics, and deployment environments. These services streamline the AI development process, from data preparation to model training and deployment, making the cloud a fundamental part of AI infrastructure.

The cloud's role in AI is further enhanced by its ability to scale resources dynamically. As AI applications grow in complexity, requiring more computing power and storage, cloud platforms can quickly allocate additional resources without disrupting operations. This makes cloud infrastructure an important enabler for AI innovations in industries ranging from healthcare to finance to consumer technology.

“We have ambitious plans to support 600,000 GPUs.”

— Rajesh Nishtala, Meta (At Scale, 2024)

AI Infrastructure as a Service

AI infrastructure as a service (AlaaS) is a cloud-based service offering AI outsourcing for “organizations and businesses looking to implement AI projects without making a substantial investment and negotiating the complexity of traditional hardware installations” (Gcore, 2024). AlaaS enables individuals and businesses to experiment with AI and even take AI to production for large-scale use cases, with low risk and without a large upfront

investment. Because it is easier to start with, it makes it possible to experiment with different public cloud platforms, services, and ML algorithms. Some examples of AlaaS are ML frameworks, APIs, and digital assistants and chatbots. Some of the benefits of AlaaS are sandbox capabilities, CAPEX and OPEX reductions, scalability and flexibility, high performance and speed, security and compliance, and simplified management and maintenance. According to the AI Infrastructure Alliance (2022), “[...] outside of very specialized circumstances, most companies are not building their own architecture from scratch anymore. According to our enterprise survey, only 20 percent of companies built their entire infrastructure in-house, while 45 percent use a mix of in-house and third-party tools, and 31 percent use a mix of third-party tools exclusively.”

Infrastructure for Data Processing

The combination of supercomputing and high-performance computing (HPC) creates a robust infrastructure for AI research and application. As AI models grow in complexity and size—requiring more computational power to achieve higher accuracy—supercomputers and specialized processors become crucial for maintaining the speed and scalability needed for real-world AI deployments. These technologies not only support cutting-edge research but also drive the practical implementation of AI across industries.

Supercomputing

Supercomputing refers to the use of powerful computational systems capable of performing complex calculations at incredibly high speeds, essential for AI applications that

BOX 5 HPC IN PUBLIC SECTOR INITIATIVES

HPC systems are critical for various government applications, especially in areas that require complex simulations and large-scale data processing. One of the primary applications of HPC in the public sector is weather forecasting and disaster management. Governments rely on HPC to analyze vast amounts of meteorological data, model weather patterns, and predict natural disasters such as hurricanes, floods, and earthquakes. This capability enables authorities to respond proactively and mitigate the impact of these events on communities.

Another essential use of HPC is in national security and defense. Governments employ HPC to simulate defense scenarios, analyze intelligence data, and develop strategies for cybersecurity. For instance, military organizations use HPC to model battlefield dynamics, optimize supply chains, and analyze sensor data from surveillance systems. By leveraging HPC, governments can improve their decision-making capabilities and enhance national security.

In the healthcare sector, HPC systems enable the processing and analysis of large-scale genomic data, accelerating research in personalized medicine. Governments and public health organizations can use HPC to model the spread of infectious diseases, predict healthcare resource needs, and optimize vaccination strategies. For example, during the COVID-19 pandemic, HPC was instrumental in modeling the virus's transmission and developing vaccines rapidly.

require intensive data processing. These systems enable AI algorithms, particularly scientific modeling and deep learning models, to process large datasets and perform tasks such as image recognition, natural language processing, and predictive analytics. Supercomputers significantly reduce the time needed to train AI models, making them indispensable for developing cutting-edge AI solutions.

High-Performance Computing

HPC involves the parallel use of hundreds or thousands of advanced processors such as GPUs that are optimized for the parallel processing needs of AI algorithms. Unlike traditional central processing units (CPUs), these specialized processors can handle the vast number of computations required by AI models, particularly during training and inference stages. AI developers rely on high-performance processors to accelerate workloads, enabling faster, more efficient model development.

The architecture of an HPC system is designed to handle intensive computational tasks and large-scale simulations. The core of an HPC system typically includes multicore CPUs, high-performance GPUs, and specialized accelerators. CPUs handle precise numerical calculations, while GPUs provide parallel processing capabilities for running complex simulations efficiently. In certain cases, specialized accelerators like field-programmable gate arrays (FPGAs) or tensor processing units (TPUs) are integrated to further optimize performance for specific workloads.

Strategic investments in HPC infrastructure are essential for enhancing national competitiveness and driving innovation. LAC governments should strengthen the regional

BOX 6 HPC IN INDUSTRY

Industries also benefit significantly from HPC, particularly in sectors such as manufacturing, energy, finance, and automotive. In the manufacturing industry, HPC systems are used for digital twin simulations and predictive maintenance. Digital twins allow manufacturers to create virtual replicas of physical assets and simulate their behavior under various conditions. This enables companies to optimize production processes, reduce downtime, and improve product quality. Predictive maintenance, powered by HPC, helps manufacturers identify equipment failures before they occur, reducing maintenance costs and increasing operational efficiency.

In the automotive industry, HPC plays a crucial role in vehicle design and testing. Automotive companies use HPC to simulate crash tests, optimize aerodynamics, and develop autonomous driving systems. By leveraging HPC, manufacturers can reduce the time and cost associated with physical testing and accelerate the development of safer, more efficient vehicles.

The energy sector also relies on HPC for reservoir simulations and seismic analysis. Oil and gas companies use HPC to model underground reservoirs and optimize drilling operations, increasing resource extraction efficiency. In addition, renewable energy companies employ HPC to analyze wind patterns, optimize turbine placement, and improve power generation from wind farms.

BOX 7 QUANTUM COMPUTING

Quantum computing represents the next frontier in computational innovation, offering unprecedented processing capabilities for optimization, machine learning, and cryptography. Unlike classical computing, which relies on binary bits, quantum computing uses qubits to perform parallel operations, allowing it to tackle complex problems more efficiently. As quantum technology advances, its potential applications in scientific research, logistics, and cybersecurity are becoming increasingly viable.

Quantum computing leverages the principles of quantum mechanics to perform operations that are infeasible for classical computers. Two key features—superposition and entanglement—enable quantum computers to solve certain types of optimization problems exponentially faster than classical systems. For example, quantum algorithms can optimize supply chain logistics, financial portfolios, and energy distribution networks more efficiently than traditional approaches.

Quantum computing poses significant implications for cryptography and cybersecurity. The processing power of quantum computers could potentially break widely used encryption protocols, such as RSA and ECC, by factoring large integers more efficiently than classical algorithms. As a result, LAC governments and organizations must prepare for the advent of post-quantum cryptography to safeguard critical information.

HPC centers of the Advanced Computing System for Latin America and the Caribbean (Sistema de Cómputo Avanzado para América Latina y el Caribe, or SCALAC, see National Research and Education Networks in Section 2) to provide shared resources for academia, industry, and government agencies. These centers can serve as hubs for collaborative research and development, facilitating knowledge transfer and reducing the cost burden for individual organizations. For instance, the Partnership for Advanced Computing in Europe (PRACE) initiative provides a model for establishing regional HPC centers that pool resources and expertise.⁵

PPPs are critical for mobilizing funding and resources for HPC initiatives. By fostering collaboration between research institutions, industry leaders, and technology providers, governments can accelerate the deployment of HPC infrastructure and ensure that research priorities align with national strategic goals. PPPs also facilitate the transfer of advanced HPC technologies to small and medium-sized enterprises (SMEs), enabling them to leverage HPC for product innovation and market expansion.

Advanced Computing Infrastructure for Frontier Applications in Science, Technology, Innovation, and Industry 4.0

Advanced computing infrastructure forms the cornerstone of progress in frontier applications within science, technology, innovation, and Industry 4.0. These infrastructure components, encompassing HPC and emerging quantum computing systems, provide

⁵ <https://prace-ri.eu/>

the necessary processing capabilities to drive innovation, optimize processes, and enable complex simulations. As AI, big data, and ML applications proliferate, these computing infrastructures are becoming indispensable for advancing research, solving industrial challenges, and enhancing decision making.

Investments in this advanced infrastructure are strategic imperatives for governments and organizations seeking to stay at the forefront of technological development. By building capabilities in HPC and quantum computing, LAC countries can better position themselves to capitalize on Industry 4.0 and unlock new opportunities for economic growth and scientific advancement.

LAC countries have the opportunity to build a competitive advantage in quantum computing by investing in research, talent development, and infrastructure. Establishing quantum research hubs and forming partnerships with global leaders can accelerate the region's quantum initiatives. Additionally, governments should provide funding and incentives for universities and research institutions to explore quantum applications in fields such as logistics, finance, and cybersecurity.

Collaboration between public and private stakeholders will be essential for advancing quantum capabilities. By fostering a culture of innovation and investing in specialized training programs, LAC can build the human capital needed to leverage quantum computing effectively.

Infrastructure for Data Transport

Data transport infrastructure forms the backbone of digital transformation efforts. Advanced network architectures play a crucial role in enabling emerging technologies and addressing critical societal challenges. Organizations and regions with superior network infrastructure consistently demonstrate better outcomes across economic and social development metrics.

Data transport infrastructure comprises the physical and digital networks that facilitate the movement of data across devices, data storage and processing centers, and cloud environments. A well-designed data transport infrastructure must ensure high-speed data transmission, low latency, reliability, and availability, while also enabling efficient traffic exchanges.

Data transport infrastructure serves as the backbone for AI-driven systems, connecting dispersed and disparate nodes and enabling real-time data exchange. High-speed networks, low latency, high reliability, and efficient IXPs are crucial to meeting the technical requirements of modern AI applications. By investing in these foundational elements, LAC can establish the groundwork for scalable AI deployment and long-term digital competitiveness.

High-Speed Networks

High-speed networks are fundamental to handling the large datasets required for AI training, real-time streaming, and data-intensive applications. The deployment of fiber-optic infrastructure is particularly important, as it offers superior bandwidth and data transfer

rates compared to other technologies. Additionally, the rollout of 5G networks promises to enhance mobile data speeds and expand connectivity in underserved areas, a critical requirement for the proliferation of IoT and edge-based AI solutions.

High-speed networks are the foundation of AI data transport, enabling the quick transmission of large datasets across multiple locations. Fiber-optic cables, 5G networks, and satellite-based internet services provide the bandwidth necessary to support AI-driven applications that require real-time data access and processing. For AI systems to operate efficiently, whether for training algorithms or deploying AI solutions, these high-speed connections must be reliable, scalable, and secure to meet increasing data demands.

In AI development, the quality of high-speed networks directly influences the speed at which data is transferred between devices, cloud systems, and data centers. AI training, for instance, involves feeding massive datasets into ML algorithms, a process that requires high throughput to minimize delays. As AI adoption expands, networks need to evolve to support edge computing, where real-time decision making happens closer to the user, significantly reducing delays in processing time.

Expanding high-speed network coverage is especially relevant in the LAC region, where disparities in internet access persist between urban, suburban, and rural areas. Governments and telecommunications providers should collaborate to deploy high-capacity fiber-optic networks and establish clear regulatory frameworks for 5G spectrum allocation. This combination of efforts will be instrumental in achieving widespread connectivity and supporting AI adoption across sectors like healthcare, agriculture, and smart cities.

The synergy between high-speed networks and AI will continue to grow, particularly with the rise of 5G technology, which promises faster data rates, increased network capacity, and reduced latency. This advancement will unlock new AI applications, such as augmented reality, connected autonomous systems, and advanced IoT ecosystems, where data-intensive tasks can be processed rapidly and efficiently, further driving AI innovation (Lavallée, 2024).

Low Latency

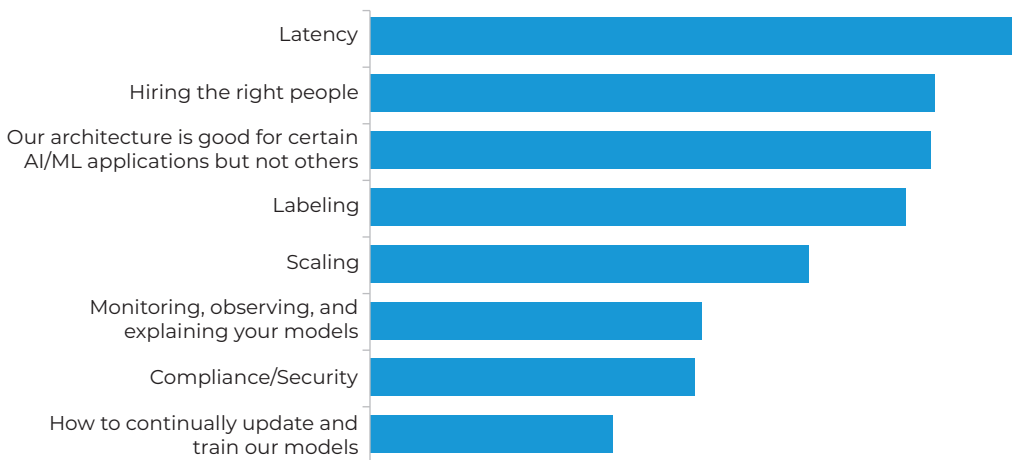
Low latency is critical for AI applications that require real-time processing and decision-making capabilities. Latency, or the delay between a data request and its response, must be minimized to enable efficient operations in latency-sensitive applications. Edge computing plays a crucial role in achieving low latency by bringing processing capabilities closer to the data source.

Low latency is critical for AI applications that depend on real-time decision making. In areas like autonomous driving, robotics, and healthcare, the need for instantaneous data processing means that even milliseconds of delay can have serious implications for performance and safety. Reducing latency in network infrastructure enables AI systems to respond and adapt faster, making them more effective in time-sensitive environments. The AI Infrastructure Alliance's 2022 survey revealed that latency is the most significant challenge when building infrastructure for AI and ML (Figure 18).

“According to a recent analysis from research firm Omdia, monthly AI-enriched network traffic is forecasted to grow at approximately 120 percent (CAGR) from [0.6 exabytes per month in] 2023 to [148 exabytes per month in] 2030 ... This is a lot of additional traffic for global networks to carry going forward.”

— Lavallée (2024)

FIGURE 18
MOST SIGNIFICANT CHALLENGES IN
BUILDING AI/ML INFRASTRUCTURE



Source: AI Infrastructure Alliance (2022).

In AI-powered applications like virtual assistants or customer service bots, low latency is essential for ensuring smooth, interactive experiences. The faster the system can process a request and return an accurate response, the more effective the user experience will be. Low latency also plays a pivotal role in AI-driven predictive maintenance systems, where quick detection of anomalies can prevent costly failures or downtime in industrial settings.

High Reliability and Availability

High reliability and availability are essential for maintaining continuous and secure AI operations. High reliability refers to the error-free consistency and stability of network performance, while high availability ensures that systems remain functional and accessible during peak usage or in the event of disruptions. In sectors like finance, public safety, and healthcare, the uninterrupted operation of AI systems is vital for ensuring safety, security, and efficiency.

Data is the backbone of every AI process, and a reliable network ensures that models receive accurate, complete datasets for training and real-time decision making. Any

network failure can cause data loss or corruption, leading to incorrect AI predictions, faulty outputs, or even system downtime.

Reliability becomes even more crucial in mission-critical AI applications, such as in healthcare, financial markets, or autonomous systems, where consistent data flow is imperative for maintaining accuracy and trust. In these environments, a lapse in network performance could lead to system malfunctions, cause financial losses, or even endanger human lives. As AI systems grow in complexity and scope, ensuring the reliability of the supporting network infrastructure is paramount.

Achieving high reliability and availability requires a combination of redundancy, proactive maintenance, and robust disaster recovery mechanisms. Network architectures should incorporate multiple data pathways and failover solutions to mitigate the risks of service interruptions. AI applications deployed across multiple regions benefit from these redundancies, as they allow for continuous operation despite local network issues. Ultimately, the development of AI depends heavily on the strength and reliability of the underlying network infrastructure. Additionally, leveraging AI-driven predictive maintenance can help network operators detect and address potential issues before they impact service quality. LAC governments and network operators should prioritize investments in redundancy measures and establish clear protocols for crisis management.

Internet Exchange Points

Traffic exchange points, or internet exchange points (IXPs), are critical nodes where different networks connect to exchange data; they are crucial for optimizing data flow and reducing costs associated with long-distance data transmission. By enabling direct exchanges of internet traffic between different service providers, IXPs improve network efficiency, lower latency, and enhance resilience. The presence of well-established IXPs is particularly critical for supporting cloud computing, content delivery, and other high-volume data services that are essential to AI applications.

For AI development, these IXPs play a vital role in enabling efficient data transfer between data centers, cloud providers, and end-user devices. Without these points, data would take longer routes, resulting in higher latency and slower performance, especially in AI applications that require real-time data processing. AI models, particularly those deployed in a distributed architecture, benefit from IXPs because they reduce the time and cost associated with data transfer between networks. By facilitating local interconnection, IXPs enhance the efficiency of AI workloads, enabling faster processing and response times. This is particularly valuable for global AI systems that depend on seamless data flow between different regions to function optimally.

The role of IXPs will become more significant as AI applications continue to scale and require the processing of massive amounts of data across various platforms. Optimizing these points for AI traffic will be critical for ensuring the low-latency, high-bandwidth performance needed for AI-driven solutions like smart cities, autonomous systems, and advanced analytics platforms.

In LAC, the development of regional IXPs can strengthen digital integration and reduce dependency on international data routes. Expanding the number of IXPs and enhancing

their interconnectivity would enable faster and more efficient data exchanges, particularly in cross-border AI collaborations. Governments should incentivize the establishment of new IXPs and foster cooperation between internet service providers, data center operators, and regional stakeholders to optimize data flow and increase network capacity.

AI Development Frameworks

Software frameworks are critical for optimizing the performance of HPC systems and simplifying the development of parallel applications. AI development frameworks can be defined as collections of tools, libraries, and interfaces that help simplify the development and implementation of AI models, thus also significantly reducing the time needed for development. These frameworks handle the intricacies and complexities of low-level operations so developers can focus on the architecture and performance of the models. Although most frameworks can be used to develop most models, each development framework has been constructed with characteristics that, for a certain application, might make one better suited than another. A few of these development frameworks are listed here:

- TensorFlow, an open-source ML framework from Google, is primarily used for deep learning. It efficiently handles complex calculations on different hardware (CPUs, GPUs, and TPUs) using a computation graph model. The framework's Keras API makes it easier to build and test neural networks.
- PyTorch, developed by Facebook's AI research lab, is an ML framework favored for its dynamic computation graph and intuitive eager execution. This design makes it well suited for research and experimentation because it simplifies debugging and coding. PyTorch is also supported by a strong ecosystem of specialized libraries like torchvision, torchtext, and torchaudio for various AI applications.
- Microsoft's Cognitive Toolkit (CNTK) is a deep learning framework recognized for its high performance and scalability, making it well suited for demanding deep learning applications.
- Apache MXNet is a flexible and efficient deep learning framework that supports multiple programming languages.
- Caffe is a deep learning framework primarily known for its speed and modular design, making it a popular choice for image processing applications.

Cross-Cutting Considerations for AI Infrastructure

The rapid evolution of artificial intelligence (AI) is reshaping economies, industries, and societies. While AI adoption offers substantial opportunities, it also brings a set of complex challenges and strategic requirements that must be addressed holistically. These requirements extend beyond the immediate technical infrastructure to encompass broader considerations that will define the long-term success of AI initiatives. Understanding and addressing cross-cutting considerations is essential to ensure that AI development is sustainable, inclusive, and adaptable to changing needs and threats.

This section focuses on five key cross-cutting considerations: investment and financing, human capital development, environmental sustainability, scalability and flexibility, and cybersecurity and data protection. Each of these considerations plays a pivotal role in creating a robust and resilient ecosystem for AI development in Latin America and the Caribbean (LAC). By addressing these factors, LAC governments and organizations can create an enabling environment that fosters innovation, enhances competitiveness, and mitigates risks.

The first consideration, investment and financing, underscores the necessity of strategic funding mechanisms to support large-scale AI infrastructure projects. Securing adequate funding and aligning investments with long-term strategic goals is essential to expanding digital infrastructure, increasing connectivity, and fostering public-private partnerships (PPPs). LAC governments must adopt innovative financing models and collaborate with international funding agencies to mobilize resources effectively.

Equally important is the development of human capital, which acts as the backbone of AI-driven innovation. Building and retaining a skilled workforce with expertise in AI, data science, and emerging technologies is fundamental to sustaining the momentum

of digital transformation. This requires a focus on education, training, and regional collaboration to create an ecosystem where talent thrives and organizations can access the skills they need to succeed.

Environmental sustainability is another crucial factor in AI development. As digital infrastructure expands, the energy consumption and environmental impact of data centers, high-performance computing (HPC) systems, and communication networks must be managed proactively. Sustainable practices and green technologies are not only essential for reducing the carbon footprint but also for aligning AI investments with global sustainability goals and addressing growing concerns about climate change.

To maximize the benefits of AI investments, scalability and flexibility must be integral to infrastructure planning. Rapid technological advancements, evolving regulatory landscapes, and shifting market dynamics demand an adaptable approach to AI infrastructure. Scalable systems that accommodate new technologies and changing requirements will help ensure that investments remain relevant and productive in the long run.

Last, the rise of AI introduces significant cybersecurity and data protection challenges. AI systems rely heavily on large datasets and interconnected networks, making them susceptible to cyberthreats and data breaches. LAC governments and organizations must implement comprehensive cybersecurity frameworks that protect sensitive information, safeguard critical infrastructure, and maintain public trust.

This section delves into each of these cross-cutting considerations and provides strategic recommendations and insights into best practices. By understanding and addressing these key areas, stakeholders can build a robust foundation for AI development that is resilient, inclusive, and forward-looking.

Investment and Financing

The successful deployment of AI infrastructure demands a strategic approach to investment and financing. Given the capital-intensive nature of AI projects, aligning financial resources with long-term development goals is essential for building and maintaining a competitive digital economy. In LAC, AI investments are poised to play a transformative role in enhancing digital connectivity, expanding HPC capabilities, and fostering innovation ecosystems. To achieve these objectives, stakeholders must focus on creating diversified funding mechanisms, establishing effective PPPs, and engaging with international funding bodies to secure financial support for large-scale AI initiatives.

Effective financing mechanisms are essential to accelerate the deployment of AI infrastructure in LAC. Governments should leverage a mix of traditional funding sources, such as public budgets and international development loans, alongside innovative approaches like blended finance and PPPs. For instance, blended finance combines concessional funding from development banks with private sector investment to reduce risk and attract larger capital inflows, especially for high-impact projects like regional data centers. PPPs have been successfully implemented in sectors such as connectivity expansion, with frameworks that can be adapted for AI-related investments (OECD, 2023b). Incorporating financial models that prioritize scalability and

sustainability will ensure that resources are allocated efficiently while maximizing long-term economic benefits.

The Role of Public-Private Partnerships in AI Infrastructure Development

PPPs are pivotal in mobilizing the capital needed to develop AI infrastructure on a regional and national scale. These partnerships combine the financial capabilities of the private sector with the strategic oversight of public institutions, creating a collaborative framework that accelerates digital transformation. LAC governments should focus on establishing clear regulatory frameworks that incentivize private sector participation, such as tax incentives, fast-track approval processes, and subsidies for green infrastructure projects.

The Brazilian Artificial Intelligence Plan (PBIA), a US\$4 billion government-funded plan to develop and deploy AI in Brazil between 2024 and 2028, includes a prime example of a PPP in Brazil between the National Laboratory for Scientific Computing (LNCC), a government-funded research center, and the private company NVIDIA (Ministério da Ciência, Tecnologia e Inovação, 2025). Through this collaboration, NVIDIA has provided advanced hardware and technical expertise to enhance the LNCC's Santos Dumont supercomputer, significantly boosting its capacity for AI and deep learning research. This partnership allows the public institution to maintain cutting-edge technology for scientific research while also helping to train a new generation of skilled AI professionals. This model of cooperation is becoming a blueprint for other similar initiatives across the region; other countries can draw from this model to structure their own collaborative initiatives, ensuring that private investments align with national digital transformation goals.

In Mexico, the state of Querétaro, with its favorable location near major industrial corridors and urban centers, has become a hub for data centers. The big U.S. cloud providers, with approximately US\$10 billion in commitments, have all had cloud regions in Mexico since 2022. Alibaba announced in May 2024 its expansion of cloud offering in Mexico to build a “thriving ecosystem... to foster innovation, collaboration, and sustainable growth across Latin America” (Butler, 2025). Power and water resources have become a critical demand for ongoing collaboration between public agencies and private investment. The ability of Querétaro's government to include new players and initiatives that ensure hyperscale and colocation demands as well as resilient connectivity networks that reduce latency and simplify logistics will determine its long-term position as the digital transformation hub for HPC and AI in Latin America.

International Collaboration and Accessing Multilateral Funding

International collaboration is critical for securing the necessary funding and technical expertise to develop AI infrastructure. Multilateral institutions such as the Inter-American Development Bank (IDB), the World Bank, and regional development banks offer both financial support and advisory services to countries in LAC embarking on digital transformation journeys. Aligning national AI strategies with the broader goals of these institutions can unlock significant funding opportunities for connectivity projects, regional data centers, and research initiatives focused on digital innovation.

Innovative Financing Models for Sustainable Investment

AI infrastructure investments are inherently associated with financial risks, such as market volatility, technological obsolescence, and evolving regulatory landscapes. To address these risks, governments and private investors must adopt innovative financing models that promote sustainability and resilience. Blended finance, impact bonds, and green bonds are promising options for attracting private capital while ensuring that investments remain aligned with social and environmental goals.

Blended finance, which combines concessional funding from public or philanthropic sources with private investment, can help de-risk projects and attract larger investments. For example, the Blended Finance Facility established by the International Development Association (IDA) has supported projects focused on telecommunications infrastructure.⁶ Impact bonds, in contrast, link financial returns to specific social outcomes, such as improving digital literacy or expanding access to technology in marginalized communities. These bonds offer an innovative approach to funding AI infrastructure projects with a focus on achieving social impact.

Mitigating Financial Risks and Ensuring Long-Term Viability

Investments in AI infrastructure are long-term commitments that must be carefully planned to remain viable in a rapidly evolving technological landscape. LAC governments should conduct comprehensive cost-benefit analyses to prioritize infrastructure projects based on their expected economic and social impact. Additionally, adopting a phased approach to implementation, with short-term, medium-term, and long-term milestones, can help mitigate financial risks and enable more adaptive investment strategies.

Furthermore, establishing cross-sectoral investment councils that include representatives from government, industry, academia, and civil society can enhance strategic decision making. These councils can provide oversight, recommend adjustments to funding priorities, and promote accountability in the allocation of resources for AI infrastructure projects.

Human Capital Development

Developing a skilled workforce capable of leveraging and advancing AI technologies is fundamental to achieving sustainable and inclusive digital transformation. Human capital is the backbone of AI innovation, driving the creation, deployment, and optimization of intelligent systems. For LAC, building a talent pipeline that encompasses technical skills, interdisciplinary expertise, and digital literacy is essential to position the region as a competitive player in the global AI landscape.

Enhancing Educational Programs and Digital Literacy

The foundation of AI talent development lies in reimagining educational systems to align with the demands of an increasingly digital economy. LAC governments should prioritize

⁶ <https://ida.worldbank.org/en/financing/ida-private-sector-window/blended-finance-facility-bff>

incorporating AI, data science, and digital literacy into national curricula at both secondary and tertiary levels. This includes not only technical subjects such as computer science and mathematics but also interdisciplinary fields that connect AI with social sciences, responsibility, ethics, and business.

Governments must invest in educational programs that integrate AI-related disciplines—including machine learning (ML), data science, and responsible digital development and use, including ethics—into national curricula. Partnerships between industry and academia can further enhance workforce readiness, providing hands-on training and internships that bridge the gap between theoretical knowledge and practical application. The Organisation for Economic Co-operation and Development (OECD) emphasizes that countries investing in digital skill development achieve higher economic returns because skilled workers drive productivity and innovation (OECD, 2023b). For low- and middle-income countries in LAC, prioritizing technical and vocational education tailored to AI-related fields can create immediate opportunities in information and communication technology (ICT) sectors while building capacity for long-term growth.

Establishing specialized AI-focused research centers at universities can serve as a catalyst for talent development. These centers should facilitate research collaboration, foster partnerships with international institutions, and provide students with hands-on experience in AI projects. Such initiatives would elevate the region's research capabilities and create a skilled workforce that is adept at both theoretical understanding and practical applications. RedCLARA and the NRENs could play an essential role in promoting hands-on experience and global collaboration.

In addition to formal education, lifelong learning and upskilling programs are crucial to reskilling the existing workforce. LAC governments and educational institutions must work together to provide accessible vocational training and certification programs in areas like data analysis, ML, and digital entrepreneurship. This will enable workers in traditional industries to transition to emerging digital roles, thereby reducing the risk of digital exclusion.

Strengthening Industry-Academia Collaboration

Collaboration between academia and industry is essential to bridge the gap between theoretical learning and practical application. Industry-academia partnerships can provide students with valuable internships, collaborative research projects, and exposure to real-world AI challenges. These collaborations also facilitate the development of AI curricula that are closely aligned with industry needs, ensuring that graduates are equipped with relevant and in-demand skills.

A successful example of such collaboration can be seen in Mexico's Hub of Artificial Intelligence (Hub de Inteligencia Artificial) at Tecnológico de Monterrey's campus in Guadalajara. This initiative, developed in partnership with the IDB and the Government of Jalisco, fosters a robust ecosystem of innovation. By hosting mentorship programs, hackathons, and AI innovation challenges, the Hub not only creates a strong talent pipeline but also provides students with hands-on experience in AI applications. Through active involvement of industry leaders, participants gain invaluable insights into solving

real-world business challenges and exploring emerging technologies, driving both economic and social impact (Conecta, 2019).

LAC governments should incentivize industry-academia partnerships by offering grants and tax incentives to companies that invest in training and research initiatives. Additionally, establishing regional AI training centers can help scale up these efforts and ensure widespread access to quality education and training.

Attracting and Retaining Top AI Talent

Attracting and retaining top AI talent is a global challenge that demands competitive strategies. To become a regional AI leader, LAC must focus on creating an environment that attracts both local and international talent. Competitive compensation packages, flexible work arrangements, and clear career progression pathways are essential to retaining skilled professionals. Furthermore, fostering a culture of innovation within organizations can enhance employee engagement and reduce turnover rates.

LAC governments should also introduce policies to facilitate visa and work permit processes for foreign AI experts, encouraging cross-border knowledge exchange. Creating AI research clusters in major cities and positioning them as global hubs for digital innovation can attract top talent and promote regional collaboration. These clusters can serve as incubators for startups, accelerators for entrepreneurship, and centers of excellence in AI research.

Retaining talent also requires a focus on continuous learning and professional development. Companies established in the LAC region should invest in creating training programs, mentorship opportunities, and access to advanced AI resources. By establishing a clear path for career growth, organizations can cultivate loyalty and create a highly skilled, future-ready workforce.

Promoting Regional Collaboration and Knowledge Exchange

Regional collaboration is critical to fostering an AI ecosystem that leverages collective strengths, promotes inclusivity, and drives regional competitiveness. Establishing cross-border AI forums, research networks, and collaborative projects can facilitate knowledge sharing, accelerate research, and scale up innovation efforts. LAC governments should focus on establishing regional AI councils or networks to coordinate initiatives, share best practices, and address common challenges such as digital inclusion, cybersecurity, and sustainability. RedCLARA and NRENS could play a pivotal role in this regional collaboration.

A strategic priority for regional collaboration is the creation of regional AI research centers that focus on key sectors such as healthcare, agriculture, and public administration. These centers can pool resources, data, and expertise to address shared priorities and develop AI solutions tailored to regional needs. The collaborative development of open datasets and AI standards can further enhance interoperability and promote cross-border initiatives. The work of the Pan American Health Organization (PAHO) in the LAC region, and particularly in the Caribbean together with RedCLARA's Health Community, could accelerate this collaborative process related to digital health.

Developing Policies for Responsible, Ethical, and Inclusive AI

Developing a skilled AI workforce must be complemented by policies that promote responsible and ethical AI use and inclusivity. LAC governments should introduce guidelines on the responsible use of AI, focusing on transparency, fairness, and accountability. This includes ensuring that AI systems are designed to mitigate biases, protect privacy, and respect human rights. Moreover, policies should promote gender diversity and inclusion within the AI talent pool, encouraging more women and underrepresented groups to pursue careers in technology.

At a global level, the Global Partnership on AI (GPAI) Responsible AI Working Group has expanded the understanding of responsible AI (RAI) principles with its project Scaling Responsible AI Solutions (SRAIS), which addresses the challenges of adoption and scalability that RAI principles may present when applied in different countries that are at different levels of maturity in developing AI solutions (GPAI, 2023, 2024). At the country level, the think tank Centro México Digital coordinated a dialogue in the beginning of 2024 that resulted in the publication of ten principles (Centro México Digital, 2024b) to guide national AI development, with the input of more than 40 decision makers from the government, industry, academia, and civil society.

LAC countries should focus on creating inclusive digital policies and human-centered principles that address the needs of marginalized communities. This involves expanding access to digital infrastructure, providing training opportunities in underserved areas, and developing AI applications that address local challenges. By taking a proactive approach to inclusivity, governments can ensure that AI development benefits all segments of society.

Environmental Sustainability

As AI infrastructure expands and digital ecosystems grow, the environmental impact of data centers, communication networks, and HPC systems is becoming increasingly significant. Balancing technological advancement with environmental sustainability and the Paris Agreement⁷ is critical for ensuring the long-term viability of AI initiatives and aligning them with global climate goals. Adopting sustainable practices, green technologies, and energy-efficient designs can reduce the carbon footprint of AI infrastructure while enhancing operational efficiency and resilience.

The Environmental Impact of Digital Infrastructure

Data centers and HPC facilities are among the largest consumers of electricity within digital ecosystems. According to the Stanford AI Index (HAI, 2024), data centers account for approximately 1 percent of global electricity consumption, with this figure expected to rise as demand for AI-driven applications increases. In LAC, as data center capacity expands and connectivity improves, governments and private operators must proactively address the environmental challenges associated with these developments.

⁷ https://unfccc.int/sites/default/files/english_paris_agreement.pdf

HPC systems—essential for scientific research, AI model training, and complex simulations—are also energy intensive. Traditional cooling methods and inefficient resource utilization can exacerbate the environmental impact of these systems. As a result, optimizing energy consumption in data centers and HPC facilities is a critical priority for LAC countries pursuing AI infrastructure development. Strengthening the SCALAC initiative will accelerate the adoption of HPC in the LAC region.

Adopting Green Technologies and Energy-Efficient Designs

One of the key strategies for reducing the environmental footprint of AI infrastructure is the adoption of green technologies and energy-efficient designs. LAC governments should encourage the development of green data centers by offering incentives for energy-efficient cooling systems, renewable energy integration, and advanced power management techniques. For instance, liquid cooling and air-side economization are proven methods that can reduce cooling costs by significantly lowering energy consumption.

In addition to technological improvements, data centers should leverage AI and ML algorithms to optimize energy use dynamically. AI-powered energy management systems can analyze historical consumption patterns, predict peak usage periods, and adjust cooling and power distribution in real time. This approach not only improves efficiency but also aligns AI initiatives with sustainability goals.

LAC countries such as Chile have already begun to integrate green technologies into their data center strategies, with renewable energy sources like solar and wind playing a key role (Ministerio de Ciencia, Tecnología, Conocimiento e Innovación [Chile], 2024). Expanding these efforts regionally could position LAC as a leader in sustainable digital infrastructure, offering both environmental and economic benefits.

Renewable Energy Integration for AI Infrastructure

The integration of renewable energy sources into AI infrastructure is a critical component of achieving sustainability. LAC governments should prioritize investments in renewable energy projects that can support data centers, edge facilities, and communication networks. By aligning energy policies with digital strategies, countries can create synergies that accelerate renewable energy adoption while supporting digital transformation.

Partnerships between renewable energy providers and technology companies can also facilitate the transition to green power. For instance, agreements between wind or solar energy firms and data center operators can ensure a stable supply of clean energy for high-demand facilities. These collaborations can serve as blueprints for other regions aiming to achieve a low-carbon digital economy.

In addition, LAC governments should consider implementing renewable energy targets specifically for AI infrastructure projects. Establishing clear guidelines for renewable energy adoption in data centers and HPC facilities can drive investment in green technologies and promote accountability among operators.

Measuring and Monitoring Carbon Emissions

Accurately measuring and monitoring carbon emissions is essential for tracking the progress of sustainability initiatives in AI infrastructure. Establishing standardized frameworks for carbon accounting enables organizations and policymakers to assess the environmental impact of digital projects and identify areas for improvement. AI-powered monitoring systems can provide real-time insights into energy consumption, cooling efficiency, and greenhouse gas emissions, enabling data-driven sustainability strategies.

Regional collaboration is also necessary to develop unified guidelines and reporting standards for carbon emissions in AI infrastructure. By establishing common sustainability benchmarks, LAC countries can promote transparency, share best practices, and enhance regional competitiveness in green technology adoption.

Aligning AI Infrastructure Investments with Global Climate Goals

Finally, aligning AI infrastructure investments with global climate goals, such as the Paris Agreement, is vital for ensuring long-term sustainability. LAC governments should incorporate sustainability criteria into their digital strategies and require AI projects to adhere to environmental standards. This includes setting emissions reduction targets, promoting energy-efficient technologies, and integrating environmental risk assessments into project planning.

LAC countries can also explore opportunities to finance AI projects through green bonds, climate finance, and international funding channels focused on sustainability. By demonstrating a commitment to environmental responsibility, countries can attract investments and position themselves as leaders in green digital transformation.

Scalability and Flexibility

In an era of rapid technological evolution and growing digital demands, scalability and flexibility are fundamental to the effective development and deployment of AI infrastructure. AI systems must be capable of handling increasing data volumes, diverse workloads, and changing application requirements without compromising performance or reliability. For LAC, achieving scalable and flexible AI infrastructure is crucial to driving innovation, enhancing competitiveness, and addressing emerging challenges.

Scalability refers to an infrastructure's ability to grow seamlessly as demands increase, while flexibility pertains to its capacity to adapt to new technologies and evolving requirements. Together, these attributes are key to creating resilient AI systems that can support diverse applications across sectors such as healthcare, education, manufacturing, and public services.

Designing Scalable AI Infrastructure for Growing Demand

The increasing adoption of AI, big data, and digital services is driving unprecedented growth in data generation and processing needs. To meet this demand, LAC governments

and public and private organizations must design scalable infrastructure that can accommodate larger datasets, complex algorithms, and higher user loads. Scalable infrastructure not only allows for the efficient expansion of computing resources but also ensures that investments in AI systems remain relevant and productive over the long term.

A cornerstone of scalable AI infrastructure is the deployment of cloud computing and edge computing architectures. Cloud platforms offer the flexibility to scale computing resources on demand, enabling organizations to handle fluctuating workloads without incurring excessive upfront costs. Meanwhile, edge computing brings processing capabilities closer to data sources, reducing latency and enhancing the performance of time-sensitive applications such as autonomous vehicles and smart cities.

In LAC, expanding cloud infrastructure and establishing regional edge data centers are essential to building scalable digital ecosystems. Governments should prioritize investments in fiber-optic networks, 5G connectivity, and high-performance data centers to support scalable cloud and edge environments.

Embracing Flexible Architectures and Open Standards

Flexibility is equally critical to AI infrastructure, enabling systems to adapt to new technologies, changing regulations, and evolving market needs. LAC governments and public and private organizations must design AI infrastructure with modular architectures that allow for seamless integration of new technologies, such as quantum computing, blockchain, and AI-infrastructure-as-a-service (AIaaS) offerings. This approach minimizes technological obsolescence and ensures that AI investments remain adaptable in the face of future advancements.

Adopting open standards and interoperability protocols is a key strategy for enhancing flexibility. Open standards facilitate the integration of different hardware and software components, enabling organizations to switch vendors, upgrade systems, or integrate third-party solutions without significant disruption. For instance, leveraging open-source AI frameworks like TensorFlow and PyTorch can enable greater flexibility in deploying AI models and customizing solutions.

Furthermore, regulatory flexibility is crucial for fostering innovation. LAC governments should establish adaptable regulatory frameworks that can accommodate emerging AI applications without stifling innovation. This involves adopting a balanced approach to regulations that addresses ethical and security concerns while promoting technological advancement.

Addressing Multitenancy and Hybrid Cloud Strategies

As AI adoption accelerates, organizations increasingly rely on multitenant environments, where multiple users or tenants share infrastructure resources. Multitenancy is crucial for cost efficiency because it allows organizations to pool resources and allocate computing power dynamically based on demand. However, effective management of multitenant environments requires robust security measures, optimized resource allocation, and strong governance frameworks.

Hybrid cloud strategies, which combine on-premises data centers with cloud-based resources, offer an ideal balance between scalability, flexibility, and control. Hybrid clouds enable organizations to manage sensitive data locally while leveraging cloud infrastructure for scalable computing tasks. This model is particularly relevant for sectors such as healthcare, finance, and public administration, where data privacy and compliance are critical considerations.

For LAC governments and enterprises, adopting hybrid cloud strategies can facilitate the integration of legacy systems with modern cloud platforms, creating a unified and flexible digital ecosystem. Additionally, hybrid models provide the agility needed to scale resources rapidly, supporting dynamic business needs and peak demand periods.

Implementing Resilient and Adaptive AI Systems

Scalability and flexibility are not just technical attributes; they are integral to resilience and adaptability in the face of disruptions. AI infrastructure must be designed to withstand external shocks, such as cyberthreats, natural disasters, and economic volatility. This involves implementing redundancy measures, disaster recovery protocols, and proactive monitoring systems that can detect and respond to issues in real time.

AI-powered monitoring systems can provide valuable insights into infrastructure performance, resource utilization, and potential vulnerabilities. These systems use predictive analytics to identify bottlenecks, anticipate failures, and recommend preemptive actions. By integrating AI with infrastructure management, organizations can enhance operational efficiency, maintain uptime, and safeguard critical systems.

In addition to technological resilience, strategic planning and governance frameworks are essential for maintaining flexibility in a changing environment. LAC governments and organizations should establish cross-functional task forces to regularly review infrastructure strategies, assess emerging risks, and update policies to reflect evolving priorities.

Scaling AI Infrastructure for Emerging Markets and Applications

The ability to scale AI infrastructure is crucial for supporting new applications and addressing emerging market opportunities. As LAC continues to digitize, the demand for AI-driven services in sectors such as agriculture, energy, logistics, and education is set to rise. Scalable infrastructure provides the foundation for deploying AI applications that enhance productivity, optimize resource allocation, and improve public service delivery.

For instance, in the agricultural sector, scalable AI systems can enable precision farming techniques that enhance crop yields and reduce waste. In the energy sector, AI-powered analytics can optimize power distribution and increase the efficiency of renewable energy sources. Scaling these solutions requires a robust digital backbone that connects rural and urban areas, ensures reliable connectivity, and supports large-scale data processing.

LAC governments and enterprises must work together to prioritize investments in scalable AI infrastructure that supports regional economic development and addresses

local challenges. By creating flexible and adaptable systems, LAC can leverage AI to achieve sustainable growth and enhance regional competitiveness.

Cybersecurity and Data Protection

As AI becomes increasingly integrated into critical infrastructure, public services, and business operations, the risks associated with cybersecurity and data protection intensify. Robust cybersecurity frameworks and effective data protection measures are crucial for safeguarding AI systems, maintaining public trust, and ensuring compliance with evolving regulations. This section explores the key strategies, best practices, and collaborative initiatives necessary to protect AI infrastructure and mitigate the growing threat landscape.

The Expanding Cyberthreat Landscape in AI Systems

The rapid proliferation of AI applications and digital connectivity has led to an expanded attack surface, exposing critical systems to sophisticated cyberthreats. AI infrastructure relies on large datasets, interconnected networks, and real-time decision-making capabilities, making it vulnerable to a variety of cyberattacks, including data breaches, denial-of-service (DoS) attacks, and adversarial AI manipulations.

In LAC, the risks are heightened by the increasing adoption of digital services in sectors such as healthcare, finance, energy, and public administration. According to the Stanford AI Index (HAI, 2024), the rise of interconnected AI systems in these sectors introduces new vulnerabilities, such as unauthorized access to sensitive data and the manipulation of AI models. Cybercriminals are leveraging AI techniques to automate attacks, identify system weaknesses, and evade traditional detection methods.

LAC governments and organizations must prioritize the development of comprehensive cybersecurity strategies that address the unique risks posed by AI. This includes adopting a proactive approach to threat detection, incident response, and risk mitigation to protect critical infrastructure and maintain public trust.

Implementing AI-Driven Cybersecurity Measures

To effectively defend AI systems, LAC public and private organizations must leverage AI-driven cybersecurity measures that enhance threat detection, response, and resilience. AI-powered monitoring systems can analyze network traffic, identify anomalies, and detect emerging threats in real time. These systems utilize ML algorithms to recognize patterns indicative of cyberattacks, enabling faster and more accurate responses.

Moreover, AI can be employed to automate threat hunting, vulnerability assessments, and security compliance checks. For instance, AI algorithms can scan software code for vulnerabilities, predict potential attack vectors, and recommend remediation actions. By automating routine security tasks, organizations can reduce the burden on human analysts and improve their ability to detect sophisticated threats.

LAC countries should encourage the adoption of AI-driven cybersecurity tools in both public and private sectors. LAC governments can promote these initiatives through

regulatory incentives, funding for cybersecurity research, and partnerships with technology providers.

Strengthening Data Protection Frameworks and Privacy Regulations

Data protection is a critical element of cybersecurity, particularly in the context of AI systems that rely on large datasets. Inadequate data protection measures can expose sensitive information to unauthorized access, data breaches, and privacy violations. To address these risks, LAC countries must strengthen their data protection frameworks and align them with international standards, when appropriate, such as the EU's General Data Protection Regulation (GDPR).⁸

The development of comprehensive data protection laws should prioritize key principles such as transparency, consent, data minimization, and accountability. LAC governments should establish clear guidelines for data collection, processing, and storage, ensuring that AI systems adhere to privacy-by-design principles. Additionally, regular audits and compliance checks are necessary to verify that organizations are meeting data protection standards.

Brazil's General Data Protection Law (LGPD)⁹ serves as a benchmark for the region, providing a legal framework for safeguarding personal data and enforcing accountability. Other LAC countries can draw from this model to create harmonized regulations that promote data security and trust in AI systems.

Promoting Cross-Border Cybersecurity Collaboration

Cyberthreats are inherently transnational, and effective defense requires cross-border collaboration. LAC countries must work together to develop regional cybersecurity frameworks, share threat intelligence, and coordinate incident response efforts. Establishing regional cybersecurity centers can facilitate knowledge exchange, capacity building, and the development of standardized protocols for incident management.

In addition to regional cooperation, governments should engage with international cybersecurity organizations, such as the Global Forum on Cyber Expertise (GFCE) and the Organization of American States (OAS). These organizations provide valuable resources, technical support, and platforms for multilateral collaboration on cybersecurity policy and best practices.

Building a Culture of Cybersecurity Awareness and Education

The human element remains a critical component of cybersecurity, and building a culture of awareness and vigilance is essential to mitigating risks. LAC public and private organizations should invest in regular cybersecurity training for employees, focusing on topics such as phishing prevention, data handling best practices, and incident reporting.

⁸ <https://gdpr-info.eu>

⁹ https://www.planalto.gov.br/ccivil_03/_Ato2015-2018/2018/Lei/L13709.htm

Cybersecurity education should also be incorporated into national digital literacy programs to create a more informed public.

LAC governments can support these efforts by launching awareness campaigns, developing online training modules, and incentivizing organizations to adopt cybersecurity best practices. By fostering a culture of cybersecurity awareness, LAC countries can reduce the risk of human error and enhance the overall security posture of their digital ecosystems.

Conclusions

This section highlights the critical cross-cutting considerations necessary to develop a robust, sustainable, and inclusive AI infrastructure in the LAC region. By addressing these key factors—investment and financing, human capital development, environmental sustainability, scalability and flexibility, and cybersecurity and data protection—LAC governments and organizations can build a strong foundation for digital transformation and ensure that AI initiatives are resilient, adaptive, and forward-looking. Strategic investments, supported by innovative financing models and PPPs, provide the necessary capital to expand digital infrastructure and align AI projects with long-term growth and social impact objectives.

The development of skilled human capital emerges as a central pillar for sustaining AI innovation and competitiveness. Prioritizing education, vocational training, and industry-academia collaboration enables the creation of a dynamic workforce equipped to drive AI adoption across sectors. Equally important is integrating environmental sustainability into AI infrastructure planning. By adopting green technologies, leveraging renewable energy, and aligning investments with global climate goals, stakeholders can reduce the carbon footprint of AI systems while optimizing their operational efficiency. Furthermore, flexible and scalable infrastructure designs, supported by open standards and modular architectures, allow AI systems to adapt to evolving technologies, market demands, and emerging applications.

Cybersecurity and data protection form the backbone of resilient AI infrastructure. With the growing complexity of AI systems and the expanding digital ecosystem, stakeholders must establish robust cybersecurity frameworks, leverage AI-driven security tools, and enforce strong data protection regulations. Regional and international cooperation, alongside a culture of cybersecurity awareness, is crucial to addressing transnational threats and maintaining public trust in AI systems. By effectively integrating these cross-cutting considerations, LAC countries can create a sustainable and competitive AI ecosystem that enhances economic growth, promotes innovation, and improves public services.

AI Use Cases in the Public Sector in Latin America and the Caribbean¹⁰

This section presents selected use cases of artificial intelligence (AI) adoption in the public sector across Latin America and the Caribbean (LAC). The objective is to illustrate the range of applications already underway in the region and to provide concrete examples of how AI can support more efficient, targeted, and responsive public services. These cases highlight the diversity of policy areas where AI is being deployed—such as health, education, environmental management, and security—and offer insights into the enabling infrastructure, data ecosystems, and institutional capacities required for successful implementation.

Health: Improving Outcomes

Connecting the Caribbean to the Pan-American Highway for Digital Health¹¹

- Year: 2024
- Countries: Bahamas, Barbados, Belize, Guyana, Jamaica, Suriname, and Trinidad and Tobago
- Region: The Caribbean
- Leader: Jamaica
- Funding agencies: Pan American Health Organization (PAHO) and Government of Japan
- Technology: N/A

¹⁰ For more examples of AI use cases, see OECD and CAF (2022).

¹¹ Sources consulted: Nelson (2024); Smets and Deyal (2018).

A subregional meeting hosted by the Inter-American Development Bank (IDB) and the PAHO in 2024 set the stage for advancing the Caribbean's vision for digital health transformation. A pivotal outcome was the formal connection of the region to the Pan-American Highway for Digital Health (PH4H), an initiative supported by the Government of Japan and slated for launch in late 2024. The PH4H is designed to improve healthcare delivery, enhance patient outcomes, and strengthen regional health coordination through advanced digital infrastructure.

The Caribbean region is actively integrating its digital health systems into the PH4H network. This effort includes a set of key actions to ensure successful implementation and maximize impact:

- Strengthening digital health infrastructure: Investing in robust IT systems, expanding broadband connectivity, and enhancing data security to support modern healthcare services.
- Promoting interoperability: Developing standardized data formats and protocols to enable seamless cross-border exchange of health information.
- Enhancing telehealth services: Expanding access to telemedicine and remote consultations to serve underserved populations, particularly in rural and remote areas.
- Fostering public-private partnerships (PPPs): Collaborating with governments, healthcare providers, technology firms, and international organizations to accelerate digital health initiatives.

By connecting to the PH4H, Caribbean nations stand to benefit significantly from improved disease surveillance, more efficient healthcare delivery, and enhanced patient care. These advancements will enable healthcare systems to address long-standing challenges, such as fragmented care delivery and limited access to specialized medical services.

Despite significant progress, Caribbean healthcare systems remain heavily focused on treatment rather than prevention and face critical workforce shortages, particularly among nurses. This has exacerbated the impact of non-communicable diseases (NCDs), which are responsible for 7 out of 10 deaths in the region. AI technologies offer a transformative solution, shifting healthcare systems from reactive, treatment-based models to proactive, prevention-focused care.

AI can analyze vast datasets to predict, identify, and monitor NCDs more effectively while reducing treatment costs. For example, AI-assisted diagnoses of NCDs, in conjunction with doctors, have demonstrated accuracy rates as high as 99.5 percent. Virtual nurse assistants powered by AI provide continuous monitoring at significantly lower costs, helping to address labor shortages and improve patient outcomes. These tools enhance relapse predictions and enable round-the-clock care, ensuring more comprehensive support for patients.

By embracing AI and digital health solutions, the Caribbean can overcome systemic challenges, improve health outcomes, and lay the foundation for a resilient and innovative healthcare ecosystem. This initiative exemplifies how strategic collaboration and technological innovation can drive sustainable transformation in public health.

Diabetic Retinopathy Screening with AI¹²

- Year: 2022
- Country: Mexico
- Region: State of Jalisco
- Leader: Ulises Moya, Director of Artificial Intelligence, Government of Jalisco
- Funding agency: Government of Jalisco
- Technology: AI, advanced computing infrastructure, data infrastructure and acquisition equipment, cloud computing

Diabetic retinopathy (DR) is a severe eye condition in which high blood sugar levels damage blood vessels and nerve tissue in the retina. It is the leading cause of blindness among working-age adults. To address this issue, Retina IA, an AI-assisted DR screening test, was implemented in Mexico over eight months. The initiative evaluated more than 1,000 patients with diabetes mellitus free of charge, leading to the diagnosis of nearly 100 cases that were subsequently referred to ophthalmology specialists. This groundbreaking project achieved an image classification accuracy of 96 percent in distinguishing between healthy patients and those with DR, making it the first of its kind in the country.

The AI model was developed by a multidisciplinary team with expertise in neural networks, deep learning, and image processing that worked closely with ophthalmology specialists to validate and refine diagnoses. The system utilized cutting-edge hardware, including eight graphics processing units (GPUs) with 80 GB and 2 TB of RAM each, positioning it as one of the most advanced setups in Latin America. Public and international datasets, such as Messidor 2, were instrumental in training the AI models. Deployment and testing were conducted on AWS and Google Cloud platforms, enabling seamless remote access for physicians and specialists. Devices for capturing fundus (back of the eye) images were essential for generating consistent and reliable data, ensuring the accuracy of the screening process.

The project adhered to strict ethical protocols in data collection and management, fostering trust and acceptance among stakeholders. Effective leadership and cross-government coordination, supported by the Government of Jalisco's General Innovation Coordination Office, facilitated collaboration across multiple government departments. The involvement of international organizations, including the Organisation for Economic Co-operation and Development (OECD) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), strengthened the project's credibility and provided valuable learning opportunities. These efforts positioned Jalisco as a leader in responsible technological innovation and helped establish public policies to promote AI development locally.

Looking ahead, scaling Retina IA to other regions or nationwide will require significant long-term investments in infrastructure, frontier technology adoption, and ongoing personnel training. This initiative demonstrates how AI can revolutionize healthcare delivery,

¹² Source consulted: Gobierno del Estado de Jalisco (2022).

enabling early diagnosis and treatment of DR. Retina IA sets a benchmark for leveraging technology to improve public health outcomes while fostering innovation and international collaboration.

AnemiaApp: Early Detection of Anemia with AI¹³

- Year: 2019
- Country: Peru
- Region: Nationwide
- Leader: Dr. Mirko Zimic, director of the Bioinformatics and Molecular Biology Laboratory (Laboratorio de Bioinformática y Biología Molecular) at Cayetano Heredia University (Universidad Peruana Cayetano Heredia)
- Funding agency: Ministry of Development and Social Inclusion (Ministerio de Desarrollo e Inclusión Social, or MIDIS)
- Technology: AI, mobile app, smartphone camera

Anemia, a condition characterized by insufficient healthy red blood cells or their impaired functionality, poses a significant public health challenge in Peru, where 43.5 percent of children under three are affected. To address this issue, a team developed AnemiaApp, a mobile-based application that provides a non-invasive, quick, and accurate method for detecting anemia in children. This innovative tool is particularly beneficial in remote areas with limited access to high-tech medical facilities.

AnemiaApp operates through a low-cost portable system that leverages a smartphone's camera to capture digital images of the subject's eye. The app analyzes the characteristics of the eye's outer membrane and transmits the images to an automated processing service powered by neural network algorithms. These algorithms determine the subject's hemoglobin level, providing an instant assessment of anemia presence or absence. This streamlined process eliminates the need for invasive blood samples, making it a practical and efficient solution for underserved communities.

The country's Ministry of Development and Social Inclusion recognized the urgent need for accessible diagnostic tools to combat anemia in rural and remote areas. By deploying AnemiaApp, the government has significantly enhanced its capacity to deliver timely and effective healthcare to infants across the country. This initiative ensures continuous monitoring and early diagnosis, helping mitigate the long-term impacts of anemia on child development and public health.

This use case exemplifies the transformative potential of AI-powered mobile applications in improving healthcare delivery, particularly in resource-constrained environments. By integrating advanced technology with public health initiatives, Peru is setting a benchmark for leveraging innovation to address critical health challenges and promote equitable access to medical care.

¹³ Source consulted: Salud Digital (n.d.).

Education: Improving Public Education Systems

Developing Writing Skills with AI¹⁴

- Years: 2018–2020
- Country: Brazil
- Region: State of Espírito Santo
- Leader: Bruno Ferman, Professor of Economics, São Paulo School of Economics
- Funding agency: State Education Department of Espírito Santo
- Technology: AI, embedded online platform, software for grading writing skills

Developing writing skills in education is a time-intensive task, particularly in schools with large class sizes. In Brazil, schools in low- and middle-income areas face significant challenges in providing personalized feedback due to the high student-to-teacher ratio. To address this issue, a sample of 178 public schools, comprising approximately 19,000 high school students, implemented automated writing evaluation (AWE) technology to streamline the grading process and enhance development of writing skills.

AWE uses AI to score and provide comments on essays, enabling teachers to focus on one-on-one tailored assistance for students. The platform also allows students to practice their writing independently and is designed to function effectively even with narrowband internet access, ensuring equitable access to this resource. The initiative included three types of interventions to evaluate the effectiveness of AWE: a combined approach where 55 schools used AWE alongside feedback from human graders, a pure AWE intervention in 55 schools without additional human feedback, and a control group that continued traditional grading methods.

The results were validated using the country's official ENEM exam, a standardized test required for entry into public senior high schools. The program demonstrated measurable improvements in students' writing skills, proving the efficacy of AWE in reducing the burden on teachers while maintaining grading quality. In 2020, these findings led the State Education Department of Espírito Santo to adopt AWE as a public policy for senior high school students, with the potential to benefit approximately 30,000 students annually.

This use case highlights how AI-driven solutions can address resource constraints in education, enabling teachers to provide more personalized support while maintaining rigorous evaluation standards. By integrating AWE into public education systems, Espírito Santo has set an example for how technology can be leveraged to enhance learning outcomes and promote educational equity.

An Algorithm to Combat School Dropout¹⁵

- Year: 2022
- Country: Argentina

¹⁴ Source consulted: J-PAL (n.d.).

¹⁵ Source consulted: Páez (2023).

- Region: Mendoza Province
- Leader: Juan Cruz Perusia, specialist at the Center for the Implementation of Public Policies Promoting Equity and Growth (Centro de Implementación de Políticas Públicas para la Equidad y el Crecimiento, or CIPPEC), in participation with the Innovation and Artificial Intelligence Laboratory (Laboratorio de Innovación e Inteligencia Artificial) at the University of Buenos Aires (Universidad de Buenos Aires)
- Funding agency: US-based Tinker Foundation
- Technology: AI lab

In Argentina, 3 out of 10 secondary school students drop out before completing their education, according to data from the Ministry of Education. To address this issue, the Innovation and Artificial Intelligence Laboratory at the University of Buenos Aires developed an AI-powered dashboard to monitor and reduce dropout rates. This innovative system uses a predictive algorithm, requiring a database with at least two years of historical data—a condition met by public high schools in Mendoza Province.

The dashboard provides schools with actionable insights into the status of their students. Teachers can monitor each class and track individual students using a user-friendly interface. The algorithm evaluates four key variables: academic performance, attendance, family education levels, and any age-grade discrepancies. Based on these metrics, the system assigns a risk level to each student, indicated by a warning light on the dashboard. This allows educators to quickly identify students at risk of dropping out and intervene proactively.

Recognizing that school dropout is not solely tied to socioeconomic factors, the system offers personalized solutions tailored to each student's unique circumstances. For example, the curriculum can be adjusted to accommodate students requiring medical treatment at home, those facing a lack of family support, or those struggling with specific academic subjects. This adaptive approach transforms students from statistics into individual stories, fostering a more inclusive and supportive educational environment.

This project demonstrates the potential of AI to revolutionize education by enabling data-driven interventions that address complex challenges. By equipping schools with precise and actionable information, the system empowers teachers to provide targeted support, ultimately reducing dropout rates and improving educational outcomes across Argentina.

Environment: Supporting Monitoring Capabilities

AI Predictive Model for Air Quality¹⁶

- Year: 2021
- Country: Chile
- Region: Valparaíso Region
- Leaders: Joint effort between the Public Innovation Lab at Adolfo Ibáñez University (GobLab UAI) and the Superintendency of the Environment (Superintendencia del Medio Ambiente de Chile, or SMA)

¹⁶ Source consulted: EmpatIA (n.d.).

- Funding agencies: Superintendency of the Environment and the Public Innovation Lab at Adolfo Ibáñez University
- Technology: AI, Internet of Things (IoT)

A predictive AI model has been developed to monitor and forecast air quality in the cities of Concón, Quintero, and Puchuncaví near Valparaíso, a region frequently affected by high levels of industrial pollution. This PPP initiative aims to enhance the monitoring capabilities of Chile's Environmental Decontamination Plan and enable the Superintendency of the Environment (SMA) to take timely preventive measures, such as issuing public alerts to citizens and coordinating responses with other government bodies.

Currently, the SMA collects extensive data from industrial sources via online sensors, including minute-by-minute measurements of pollutants such as particulate matter (PM), sulfur dioxide (SO₂), and nitrogen oxides (NO_x). These measurements are used to calculate mass emissions and flows over time. However, the SMA previously lacked advanced modeling tools to analyze these datasets in real time and predict air quality trends. This limitation hindered their ability to take preventive action, such as temporarily reducing emissions at specific sources or issuing timely warnings to mitigate the impact of pollution on public health.

The new AI-powered tool, based on machine learning (ML), analyzes patterns in environmental data to generate accurate air quality forecasts. By identifying trends and anomalies, the model supports decision-making processes for Chilean environmental authorities. Preventive measures such as emission reductions and public alerts can now be implemented proactively, minimizing the likelihood and severity of environmental crises.

Successful implementation requires strong coordination among public service institutions to address cross-sectoral challenges. Additionally, technical efforts to prepare and standardize datasets are crucial to ensure the accuracy and reliability of predictions. This initiative represents a significant advancement in leveraging AI to strengthen environmental governance, protect public health, and improve air quality in one of Chile's most industrialized regions.

Security: Improving Public Safety and National Security

AI and Video Surveillance Cameras to Enhance Public Safety¹⁷

- Year: 2024
- Country: Uruguay
- Region: Nationwide
- Leaders: Nicolás Martinelli, Minister of the Interior (Ministro del Interior), Gabriel Lima, Director General of the Ministerial Command (Comando Ministerial), and National Police (Policía Nacional) authorities
- Funding agency: Ministry of the Interior
- Technology: Video cameras, AI

¹⁷ Source consulted: Ministerio del Interior (Uruguay) (2024).

Uruguay's Ministry of the Interior has integrated state-of-the-art technology to enhance public safety and improve crime prevention capabilities. Key advancements include the implementation of a ShotSpotter early gunshot detection system, 3D scanners for forensic investigations, body scanners for prisons, and mobile signal inhibitors to enhance security within correctional facilities. The ministry has also deployed biometric systems for monitoring individuals under alternative sentencing programs, real-time video cameras that transmit data from patrol helicopters to command centers, encrypted police radios, body cameras, and drones equipped with night vision capabilities.

In conjunction with these technological upgrades, project leaders initiated a comprehensive study to analyze criminal behavior patterns. By examining actions taken before, during, and after crimes, the study provided critical insights to software developers tasked with designing an AI neural network. This AI-powered system leverages data from 2,000 video surveillance cameras and integrates information from various security systems to contrast real-time events with historical crime patterns, enabling predictive analytics and rapid response.

The AI system employs advanced algorithms to recognize specific images and movements, generating actionable insights for law enforcement. Heat maps and real-time data help guide police efforts by identifying high-risk areas and prioritizing camera analytics based on historical crime data. The system's ability to continuously update and refine its analytics ensures an adaptive approach to public safety, enhancing both efficiency and accuracy.

This initiative highlights the transformative potential of integrating AI and advanced surveillance technology into law enforcement. By combining predictive analytics with real-time data, the Ministry of the Interior is improving its capacity to prevent crimes, allocate resources effectively, and respond swiftly to emerging threats. The project underscores the importance of leveraging cutting-edge technology to create safer, more secure communities.

ECU 911: AI-Integrated Emergency Response System¹⁸

- Year: 2019
- Country: Ecuador
- Region: Nationwide
- Leader: National government
- Funding agency: Government
- Technology: AI, cameras, and drones

ECU 911 is a nationwide integrated emergency response system in Ecuador. It is equipped with more than 4,300 surveillance cameras, 16 regional response centers, and more than 3,000 government employees dedicated to monitoring video footage and responding to emergencies. This system serves a dual purpose: enhancing public safety by tracking criminal activity and supporting disaster preparedness through the surveillance of seismic and volcanic activity.

¹⁸ Sources consulted: Gobierno del Ecuador (n.d.); Mozur et al. (2019).

The system employs advanced technologies, including thermal cameras for monitoring snow-capped volcanoes and night vision drones for nighttime operations. An automated platform is used to send video evidence directly to courts and an AI research lab, facilitating judicial processes and supporting the development of AI-driven public safety tools. Gradually, since 2019, the Ecuadorian government has expanded ECU 911's capabilities to include large-scale facial recognition in major cities and airports. This technology is used to identify suspects and locate missing individuals, demonstrating its potential to enhance urban safety.

Despite its benefits, ECU 911 has raised concerns about privacy and data protection. Reports indicate that video recordings are shared with Ecuador's national intelligence agency, leading to questions about the system's compliance with privacy standards. A New York Times investigation (Mozur et al., 2019) highlighted these practices, underscoring the need for robust data governance and transparency to balance public safety with individual rights.

This use case exemplifies the transformative potential of integrated surveillance and AI technologies for emergency response and public safety. However, it also emphasizes the importance of implementing ethical frameworks to ensure that technological advancements align with privacy and human rights standards. By addressing these challenges, ECU 911 can serve as a model for other nations seeking to integrate AI and surveillance for public safety and disaster management.

Public Administration: Simplifying Procedures

Boosting Employment Services with AI¹⁹

- Years: 2019 and 2024
- Country: Paraguay
- Region: Nationwide
- Leader: National government
- Funding agency: IDB
- Technology: AI

In 2019, the Paraguayan government, in collaboration with JANZZ.technology and supported by the IDB, developed the ParaEmpleo platform under the Labor Insertion Support Program (Programa de Apoyo a la Inserción Laboral, or PAIL). ParaEmpleo was designed by the Ministry of Labor, Employment, and Social Security (Ministerio de Trabajo, Empleo y Seguridad Social) to connect job seekers with employment opportunities, enhancing the efficiency of the recruitment process for both individuals and companies. By leveraging AI, the platform analyzed applicants' skills, qualifications, and linguistic knowledge to match them with the most suitable job vacancies.

The technology behind ParaEmpleo utilized deep learning algorithms and knowledge graphs to analyze labor market data and identify optimal matches between candidates

¹⁹ Source consulted: Gobierno del Paraguay (n.d.).

and employers. Users could create online profiles detailing their competencies, while maintaining full control over their privacy preferences, deciding which information to share with prospective employers. Additionally, the platform offered personalized guidance to improve users' employability by identifying in-demand skills and recommending free or paid courses to enhance their competitiveness in the job market. For companies, ParaEmpleo streamlined recruitment processes, reducing costs and improving access to qualified talent.

In 2024, the platform evolved into Emplea.py, an advanced system integrating Paraguay's electronic ID framework for authentication and data validation. Developed by the Ministry of Labor, Employment, and Social Security, Emplea.py connects citizens to employment opportunities by validating their data through an information exchange system. Since its launch, Emplea.py has significantly expanded the reach and effectiveness of employment services. It facilitated connections between 10,000 job seekers and more than 4,000 job vacancies in the private sector, while increasing the number of companies utilizing the platform from 130 to 300. Furthermore, 18 job fairs were organized, offering 3,500 job opportunities.

This use case demonstrates how AI-driven platforms can modernize employment services, improve job placement efficiency, and foster workforce development. By integrating advanced technology and national digital identity systems, Paraguay has set a benchmark for leveraging AI to enhance labor market outcomes and promote inclusive economic growth.

Economy: Improving Financial Administration

Streamlining Government Agreements with AI²⁰

- Year: 2018
- Country: Brazil
- Region: Nationwide
- Leader: Brazilian Audit Office (Controladoria-Geral da União, or CGU)
- Funding agencies: Ministry of Planning and Budget (Ministério do Planejamento e Orçamento) and Ministry of Science, Technology, and Innovation (Ministério da Ciência, Tecnologia e Inovação)
- Technology: AI, ML

Between 2008 and 2018, Brazilian government departments exchanged approximately US\$300 billion through inter-agency agreements. A critical final step in this process, known as "accountability," ensures that all exchanges comply with regulations and standards. However, this step faced significant delays, averaging 2.5 years per agreement, which left more than US\$5 billion of funds in procedural limbo. To address these inefficiencies and improve oversight, the Brazilian Audit Office (CGU) implemented an ML model to streamline the review process and assess the risk of government agreements.

The AI-driven model evaluates historical data on agreements to identify potential risks such as conflicts of interest, rule violations, and financial irregularities. By classifying

²⁰ Source consulted: Open Government Partnership (n.d.).

agreements based on risk, the tool enables government agencies to prioritize high-risk agreements for detailed review while expediting the approval of low-risk agreements. This approach significantly reduces processing times and optimizes resource allocation. For example, if an agreement is deemed low risk, it can be finalized more quickly, freeing up resources for other critical tasks.

In 2018, the ML tool flagged more than 4,000 potential issues and helped classify and prioritize 15,300 agreements by risk level. Agreements were categorized into three primary risk areas: conflicts of interest, non-compliance with standards, and financial execution failures. Among these, 3,044 agreements were flagged for further review, while more than 2,000 low-risk agreements were approved using the AI model, demonstrating its capacity to streamline processes and improve governance.

This use case highlights the transformative impact of AI in public administration. By leveraging ML, the CGU has enhanced oversight, reduced delays, and improved resource management in government agreements. This initiative serves as a model for other governments seeking to adopt advanced technologies to increase efficiency and transparency in public financial management.

AI to Detect Fraudulent Taxpayer Operations²¹

- Years: 2017–2024
- Country: Mexico
- Region: Nationwide
- Leader: Tax Administration Service (Servicio de Administración Tributaria, or SAT) of the Secretariat of Finance and Public Credit (Secretaría de Hacienda y Crédito Público)
- Funding agency: National government
- Technology: AI, databases, ML, network analysis techniques

The Mexican Tax Administration Service (SAT) has successfully deployed AI to enhance tax compliance and combat fraud. By leveraging advanced algorithms, SAT can identify anomalies and disruptions in tax registries, enabling the detection of fraudulent companies and transactions. During a six-month pilot program, SAT identified 1,200 fraudulent companies and uncovered 3,500 suspicious transactions—a process that would have required an estimated 18 months of manual analysis. This demonstrates the transformative potential of AI to improve efficiency and accuracy in tax administration.

Collaboration with academic institutions has been a cornerstone of SAT's AI initiatives. Researchers at the National Autonomous University of Mexico (Universidad Nacional Autónoma de México, or UNAM) have developed ML models and network analysis techniques to detect fraudulent digital tax receipts (comprobantes fiscales digitales por internet, or CFDIs). These tools not only help estimate the value-added tax (VAT) evaded through fraudulent activities but also pinpoint potential tax evaders with a high degree of accuracy. By integrating these AI-powered tools into its operations, SAT has significantly enhanced its capacity to monitor and audit taxpayer activities.

²¹ Source consulted: Arguelles Toache (2024).

SAT's commitment to AI extends beyond fraud detection. In 2021, SAT introduced OrientaSAT, an AI-driven chatbot designed to assist taxpayers with queries, demonstrating the agency's dedication to improving taxpayer experience through innovative solutions. Furthermore, SAT's Master Plan 2024 outlines AI's strategic role in classifying taxpayers by risk, detecting tax evasion networks, and identifying inconsistencies in electronic invoices related to illegal activities. These initiatives reflect SAT's proactive approach to adopting cutting-edge technologies to address complex challenges in tax administration.

By implementing AI-driven audits and fraud detection systems, SAT has set a benchmark for the use of emerging technologies in public administration. These initiatives not only improve revenue collection and compliance but also underscore the broader potential of AI to enhance the efficiency, transparency, and integrity of government operations.

Mobility: Optimizing Transportation Systems

AI to Facilitate Metro Passenger Flow²²

- Year: 2015
- Country: Mexico
- Region: Mexico City
- Leader: PhD students at UNAM
- Funding agency: Secretary of Education, Science, Technology and Innovation of Mexico City (Secretaría de Educación, Ciencia, Tecnología e Innovación, or SECTEI)
- Technology: AI, ML

The Mexico City Metro has successfully implemented an AI-powered system to optimize passenger flow, showcasing how advanced technologies can address complex urban challenges. This initiative originated from a technological innovation contest organized in 2015 by Mexico City's Secretary of Education, Science, Technology, and Innovation in collaboration with the Metro transportation system. The winning team of PhD students from UNAM collaborated closely with Line 1 Metro staff to design a solution grounded in ML and advanced computer simulations.

Using AI, the system analyzed extensive datasets on passenger behavior and train dynamics to simulate various operational scenarios. This enabled the identification of strategies to reduce boarding and alighting times, improving overall efficiency and passenger experience. Initially piloted on Line 1, the success of the system led to its expansion across 14 additional Metro stations, resulting in a 10–15 percent increase in passenger flow efficiency and a noticeable reduction in delays.

This use case demonstrates the transformative potential of AI in public transportation. By leveraging ML, the Mexico City Metro not only enhanced operational performance but also set a precedent for how urban infrastructure can adopt innovative technologies to improve service delivery and address pressing mobility challenges.

²² Source consulted: Martinho-Truswell et al. (2018).

Roadmap for Implementation

The successful adoption of artificial intelligence (AI) and other emerging technologies in Latin America and the Caribbean (LAC) requires a clear and pragmatic roadmap tailored to the diverse socioeconomic and infrastructural contexts of the region. While the ultimate goal for many nations is to establish a robust and independent information and communication technology (ICT) infrastructure, it is neither feasible nor necessary to develop all the physical assets required for AI from the outset. LAC governments can leverage infrastructure as a service (IaaS) hosted elsewhere to bridge immediate gaps while they lay the foundation for their own long-term infrastructure development.

This approach allows LAC countries to benefit from AI applications and emerging technologies even in the absence of local high-performance computing (HPC) systems, advanced data centers, or widespread connectivity. For instance, a government could utilize cloud-hosted AI services for citizen engagement, such as chatbots powered by large language models (LLMs), or for critical applications like disease detection and agricultural monitoring. Meanwhile, investments in physical infrastructure can proceed strategically, aligned with national priorities and available resources.

Defining priorities is essential for determining the type of AI infrastructure required. The needs for implementing LLMs in government services differ significantly from those for enabling remote robotic surgeries or conducting advanced scientific research in fields like genetics. Each of these use cases demands tailored infrastructure, from scalable cloud resources for LLM deployment to HPC systems for computationally intensive tasks. By prioritizing projects based on their strategic value and feasibility, countries can ensure efficient resource allocation and avoid unnecessary expenditures.

This roadmap provides a structured approach to AI implementation across the region, emphasizing the importance of prioritizing investments and projects; aligning

development efforts with short-, medium-, and long-term goals; and establishing robust monitoring and evaluation indicators to measure progress and adjust strategies. Recognizing the diverse contexts of island nations, low-income countries, and middle-income countries, the roadmap offers tailored recommendations for each, ensuring inclusivity and scalability.

Prioritizing Investments and Projects

To maximize the impact of limited resources, a robust methodology is essential for prioritizing AI infrastructure investments and projects. This methodology must account for the unique needs and capabilities of each country, focusing on addressing pressing social challenges, leveraging economic strengths, and aligning with governmental priorities. The following subsections and Table 3 outline a tailored approach for each of the three types of countries in the region: island nations, low-income countries, and middle-income countries.

Island Nations

Island nations face distinct challenges due to geographic isolation, small populations, and vulnerability to climate change. Prioritization could focus on projects that address these specific needs, such as disaster response systems, environmental monitoring, and improving digital connectivity for remote populations.

The prioritization methodology for island nations should include:

- Social needs: Assess critical areas such as disaster resilience, access to healthcare, and educational resources.
- Economic vocation: Focus on sectors like tourism, fisheries, and renewable energy.
- Infrastructure capabilities: Evaluate existing connectivity, such as undersea cables and satellite internet, and identify gaps.
- Cost-sharing opportunities: Explore regional collaborations, such as shared satellite programs or joint investments in undersea cables or data centers.
- Governmental priorities: Align projects with national climate adaptation plans and sustainable development goals.

Low-Income Countries

For low-income countries, prioritization should emphasize projects that directly address poverty alleviation and social equity. AI applications in healthcare, agriculture, and education can deliver the greatest impact.

The prioritization methodology for low-income countries should include:

- Social needs: Prioritize rural healthcare, agricultural productivity, and access to basic education.
- Economic vocation: Focus on agriculture, natural resources, and emerging manufacturing sectors.

- Infrastructure capabilities: Assess existing ICT and energy infrastructure, which may be limited, and plan for foundational improvements.
- Cost-sharing opportunities: Partner with neighboring countries to develop regional data centers or shared research hubs.
- Governmental priorities: Align with national development plans and international commitments, such as the United Nations' Sustainable Development Goals (SDGs).

Middle-Income Countries

Middle-income countries have more advanced ICT infrastructure and greater fiscal capacity, enabling them to pursue ambitious AI projects. These nations should prioritize projects that enhance competitiveness in high-value industries and expand public services.

The prioritization methodology for middle-income countries should include:

- Social needs: Address urban congestion, advanced healthcare systems, and digital literacy.
- Economic vocation: Invest in high-value industries such as fintech, biotechnology, and advanced manufacturing.

TABLE 3
PRIORITIZATION FRAMEWORK FOR AI INVESTMENTS:
TAILORED APPROACHES FOR ISLAND, LOW-INCOME,
AND MIDDLE-INCOME COUNTRIES

Country type	Key factors to consider	Recommended approach
Island nations	Geographic isolation	Focus on developing robust satellite and undersea cable connectivity
	Vulnerability to climate change	Invest in resilient, renewables-powered data centers and networks
	Limited economies of scale	Collaborate regionally to share AI infrastructure and expertise
Low-income countries	Limited financial resources	Prioritize cost-efficient infrastructure, such as community data centers
	Infrastructure gaps in energy and connectivity	Focus on solar-powered microgrids and affordable broadband
	Limited human capital	Establish technical training programs and partnerships with international organizations
Middle-income countries	Rapid urbanization and industrialization	Invest in hybrid cloud solutions and integrate edge data centers in key urban zones
	Growing private sector demand for AI-enabled solutions	Provide tax incentives to stimulate private sector adoption of AI technologies
	Diverse economic sectors	Customize AI infrastructure to support specific industries, such as agriculture or manufacturing

Source: Authors' elaboration.

- Infrastructure capabilities: Leverage established data centers, connectivity networks, and skilled human capital.
- Cost-sharing opportunities: Lead regional initiatives, such as AI innovation hubs or shared HPC facilities.
- Governmental priorities: Align with industrial policies and international trade agreements to position the country as a regional leader in AI.

Development Stages: Short-, Medium-, and Long-Term Horizons

Developing AI infrastructure requires a structured approach that aligns investments and initiatives with the unique socioeconomic context of each country. This section defines short-, medium-, and long-term development stages for three types of countries in LAC: island nations, low-income countries, and middle-income countries. The classification of development stages is based on the complexity, resource intensity, and expected impact of initiatives, with the short term focusing on foundational efforts, the medium term on scaling and optimization, and the long term on advanced capabilities and global competitiveness.

Defining Short-, Medium-, and Long-Term Stages

- Short term (1–3 years): This stage addresses the most pressing and foundational needs, such as improving connectivity, building essential infrastructure, and deploying basic AI applications to address immediate social and economic challenges. Projects at this stage are characterized by lower complexity, quicker implementation timelines, and lower financial requirements relative to later stages.
- Medium term (4–6 years): Medium-term efforts focus on scaling existing infrastructure, integrating regional collaborations, and expanding the reach and sophistication of AI applications. This phase typically involves moderate-to-high investment levels and requires coordination across sectors and stakeholders to align projects with national and regional development priorities.
- Long term (7+ years): The long-term stage emphasizes advanced infrastructure development, cutting-edge AI research, and global competitiveness. Efforts during this phase are highly resource-intensive and involve complex systems such as HPC, quantum computing, and comprehensive AI governance frameworks. The focus is on positioning countries as leaders in AI innovation.

Development Stages for Island Nations

Island nations face unique challenges due to geographic isolation and vulnerability to climate change, making connectivity and resilience key priorities (see Table 4).

- Short term: In the first three years, efforts should focus on expanding broadband access through undersea cables, satellite connectivity, and local infrastructure improvements. Early AI applications should include disaster response systems and environmental monitoring tools to address pressing vulnerabilities.

TABLE 4
AI DEVELOPMENT STAGES FOR ISLAND NATIONS:
SHORT-, MEDIUM-, AND LONG-TERM PROJECTS

Stage	Project	Timeline	Expected outcome
Short term	Establish basic digital infrastructure (broadband connectivity and local data hubs)	1–3 years	Improved internet access and foundational infrastructure for digital services
	Implement training programs for technical skills in AI and ICT		Increased technical capacity and awareness of AI capabilities
	Initiate regional collaboration for shared AI resources		Cost savings and knowledge-sharing opportunities
Medium term	Develop resilient, renewables-powered data centers	4–6 years	Enhanced energy efficiency and reduced dependence on traditional power sources
	Deploy AI applications for disaster management and climate adaptation		Improved response times and risk mitigation strategies
	Establish policies for AI governance, data security, and responsible and ethical use		Greater trust and adherence to international standards
Long term	Scale AI-driven solutions in healthcare, education, and smart city initiatives	7+ years	Improved public service delivery and citizen engagement
	Foster innovation hubs for startups and research in AI and emerging technologies		Creation of new economic opportunities and high-value employment
	Achieve integration of AI systems with global networks and regional frameworks		Enhanced global competitiveness and alignment with broader economic and technological trends

Source: Authors' elaboration.

- Medium term: For years four to six, island nations should scale their connectivity infrastructure by deploying small-scale, renewable energy-powered data centers to improve processing capabilities. Collaborative regional initiatives, such as shared disaster management platforms, should be established to enhance resilience and efficiency.
- Long term: By year seven and beyond, island nations should aim to develop HPC facilities for advanced environmental simulations and AI-driven research in areas like marine biodiversity. Strengthening international partnerships can facilitate access to global AI advancements and funding for sustainable initiatives.

Development Stages for Low-Income Countries

Low-income countries often lack basic digital infrastructure, requiring a focus on foundational investments and scalable solutions to address urgent social needs (see Table 5).

- Short term: In the first three years, investments should prioritize extending connectivity to underserved areas through affordable solutions like community networks and

public Wi-Fi. Early AI use cases could focus on rural healthcare diagnostics and agricultural monitoring, directly addressing poverty and food security challenges.

- Medium term: For years four to six, low-income countries should establish shared regional data centers and begin scaling AI applications in education, public health, and e-governance. Workforce development initiatives, such as AI training programs, are critical during this phase to build local capacity and reduce reliance on external expertise.
- Long term: By year seven and beyond, low-income countries should expand their AI capabilities to include national HPC systems that support research in sustainable agriculture and climate adaptation. Regional collaboration will remain crucial to pool resources and share knowledge for cost-effective advancements.

TABLE 5
AI DEVELOPMENT STAGES FOR LOW-INCOME COUNTRIES:
SHORT-, MEDIUM-, AND LONG-TERM PROJECTS

Stage	Project	Timeline	Expected outcome
Short term	Build foundational digital infrastructure, including affordable broadband and energy-efficient microgrids	1-3 years	Enhanced connectivity and reliable access to power for digital technologies
	Partner with international organizations to fund and implement pilot AI projects		Demonstrated potential of AI applications in critical sectors like agriculture and healthcare
	Develop technical skills through vocational training programs in AI and ICT		Creation of a skilled workforce ready to support AI adoption
Medium term	Scale AI applications for education, healthcare, and agricultural productivity	4-6 years	Improved service delivery and economic outcomes in key development sectors
	Introduce government-supported AI innovation labs and incubators		Support for local startups and increased entrepreneurial activity in AI-related fields
	Establish regulatory frameworks for data privacy and responsible and ethical AI, as well as public sector integration		Ensured accountability and alignment with international standards
Long term	Deploy advanced AI-driven solutions in public administration and disaster resilience	7+ years	Efficient governance and enhanced national preparedness for natural disasters and emergencies
	Attract foreign investment through incentives for sustainable and AI-powered business models		Boosted economic growth and job creation through private sector participation
	Create regional AI networks for collaborative research and development		Strengthened regional ties and shared innovation to drive sustainable development

Source: Authors' elaboration.

Development Stages for Middle-Income Countries

Middle-income countries are better positioned to pursue more sophisticated AI infrastructure, leveraging their relatively advanced ICT systems and fiscal capacity (see Table 6).

- Short term: In the first three years, middle-income countries should focus on enhancing existing infrastructure, such as upgrading data centers and improving urban connectivity. AI applications in traffic management, smart cities, and public health-care can be deployed to address urban challenges and improve quality of life.
- Medium term: For years four to six, efforts should shift to establishing dedicated AI research hubs and innovation clusters. These hubs can drive advancements in biotechnology, fintech, and advanced manufacturing. Strengthening partnerships with regional and global players can further accelerate progress.

TABLE 6
AI DEVELOPMENT STAGES FOR MIDDLE-INCOME COUNTRIES:
SHORT-, MEDIUM-, AND LONG-TERM PROJECTS

Stage	Project	Timeline	Expected outcome
Short term	Develop hybrid cloud infrastructure and integrate edge data centers in urban and industrial areas	1–3 years	Improved scalability and reduced latency for AI applications
	Launch tax incentives to encourage private sector adoption of AI technologies		Increased investment in AI-driven solutions across various industries
	Implement nationwide AI literacy programs to upskill the workforce		Enhanced readiness for AI integration in public and private sectors
Medium term	Expand AI applications in manufacturing, logistics, and financial services	4–6 years	Boosted productivity, cost efficiency, and innovation in key economic sectors
	Establish AI innovation hubs and research centers focused on industrial needs		Creation of a robust ecosystem supporting AI development and entrepreneurship
	Strengthen data protection laws and responsible ethical AI governance frameworks		Increased trust in AI technologies and alignment with global standards
Long term	Implement smart city initiatives leveraging AI for urban management and citizen services	7+ years	Improved urban efficiency, public safety, and quality of life
	Develop regional collaborations for AI-driven trade, research, and infrastructure projects		Enhanced global competitiveness and regional economic integration
	Scale renewable energy-powered AI infrastructure to ensure sustainability		Reduced environmental impact and long-term cost savings

Source: Authors' elaboration.

- Long term: By year seven and beyond, middle-income countries should focus on building HPC systems and quantum computing facilities to support cutting-edge research. The long-term goal is to position these nations as regional leaders in AI-driven industries and global innovation.

Integrated Regional Perspective

The phased development approach recognizes that collaboration between LAC countries—whether through shared infrastructure, pooled investments, or joint research initiatives—is crucial for overcoming resource constraints and accelerating progress. Regional organizations such as the Latin American Cooperation of Advanced Networks (Cooperación Latino Americana de Redes Avanzadas, or RedCLARA) and the Advanced Computing System for Latin America and the Caribbean (Sistema de Cómputo Avanzado para América Latina y el Caribe, or SCALAC) and multilateral institutions can play a pivotal role in facilitating these collaborations, particularly for low-income countries and island nations with limited individual capacities.

Monitoring and Evaluation Indicators

Monitoring and evaluation (M&E) are critical components of any strategic roadmap, particularly for initiatives as complex and transformative as AI infrastructure development. By systematically tracking progress, identifying bottlenecks, and assessing impacts, governments and organizations can ensure accountability, improve resource allocation, and adapt strategies to evolving circumstances. Given the rapid pace of technological advancement, periodic evaluations are essential to maintain alignment between infrastructure development and emerging priorities in AI and other technologies. Moreover, robust M&E frameworks provide stakeholders with the insights needed to measure the social and economic impact of investments, ensuring that the benefits of AI extend equitably across society.

In LAC, the diversity of socioeconomic contexts necessitates a tailored approach to M&E, recognizing that the indicators relevant to a middle-income country may differ significantly from those applicable to a low-income country or an island nation. The indicators proposed in this section draw from established frameworks such as the Artificial Intelligence Index Report 2024 by Stanford University (HAI, 2024) and the Latin American Artificial Intelligence Index 2024 (Centro Nacional de Inteligencia Artificial, 2024), focusing on three key dimensions: (i) the existence and expansion of infrastructure, (ii) the development and use of AI technologies, and (iii) their social and economic impacts.

Indicators for Infrastructure Development

Monitoring infrastructure development involves assessing the growth, accessibility, and performance of key assets such as data centers, connectivity networks, and computing facilities. Periodic evaluations should track not only the quantitative expansion of infrastructure but also qualitative improvements in reliability, energy efficiency, and integration with AI-specific requirements.

For island nations, critical indicators might include the percentage of the population with broadband access, the number of regional data centers established, and the adoption of renewable energy in powering digital infrastructure. For low-income countries, metrics such as rural connectivity penetration, the establishment of shared HPC facilities, and the availability of AI-enabling hardware like graphics processing units (GPUs) and tensor processing units (TPUs) are paramount. In middle-income countries, evaluations should focus on indicators of advanced infrastructure, such as the deployment of national HPC systems and investments in quantum computing capabilities.

Indicators for AI Development and Use

To assess the development and adoption of AI technologies, indicators must capture both the breadth and depth of AI integration across sectors. This includes the deployment of AI applications in public services, industry, and research, as well as their alignment with national development goals.

For island nations, relevant indicators might include the use of AI in disaster response, environmental monitoring, and tourism optimization. Low-income countries could track the implementation of AI tools in agriculture, education, and rural healthcare, measuring their effectiveness in improving productivity and access. Middle-income countries should evaluate AI-driven advancements in fintech, biotechnology, and urban planning, emphasizing innovation and global competitiveness.

Indicators in this category should also measure the level of AI research activity, such as the number of AI-related publications and patents, the volume of AI-focused funding, and the participation of local universities and research centers in global collaborations. These metrics provide a clear picture of a country's capacity to not only adopt AI but also contribute to its evolution.

Indicators for Social and Economic Impact

Ultimately, the success of AI infrastructure and technology adoption must be measured by their impact on society and the economy. Indicators in this category should assess how AI applications are improving quality of life, enhancing economic productivity, and addressing social inequities.

For all country types, key indicators include reductions in service delivery times (e.g., faster healthcare diagnostics or shorter permit processing times), improvements in educational outcomes (e.g., increased digital literacy rates), and enhancements in public safety (e.g., fewer fatalities from natural disasters due to AI-powered early-warning systems). Economic metrics such as GDP contributions from AI-driven industries, job creation in AI-related fields, and the growth of AI-enabled exports provide further insight into the transformative potential of these technologies.

Special attention should be paid to equity indicators, such as the percentage of rural or underserved populations benefiting from AI initiatives and the gender diversity of the AI workforce. These metrics ensure that the benefits of AI are distributed inclusively and support broader social objectives.

Periodic Evaluations and Adaptive Strategies

Periodic evaluations are essential for maintaining the relevance and effectiveness of AI strategies. Governments and organizations should establish annual or biennial reporting cycles to review progress against established indicators. These reviews should involve diverse stakeholders, including policymakers, industry leaders, academia, and civil society, to ensure a comprehensive understanding of achievements, challenges, and opportunities.

Adapting strategies based on evaluation findings are critical for addressing emerging needs and leveraging new opportunities. For instance, if an evaluation identifies underutilized HPC systems, government could invest in training programs to build local expertise. This creates a skilled workforce of researchers and professionals who not only generate a strong demand for HPC resources but also produce valuable research and technological innovations that demonstrate a clear return on investment. This success, in turn, justifies and attracts further public and private funding, allowing for the expansion and improvement of HPC facilities, which then supports the continued growth and expertise of the local talent pool, ensuring that infrastructure remains a productive and essential national asset. Conversely, if M&E reveals that rapid advancements in AI-infrastructure-as-a-service (AlaaS) models reduce the need for on-premises infrastructure, resources could be redirected to higher-impact areas such as connectivity or human capital development.

By aligning M&E frameworks with globally recognized benchmarks and regional priorities, LAC countries can ensure that AI infrastructure development delivers measurable benefits. Robust indicators enable informed decision making, accountability, and the ability to adapt to an evolving technological landscape, maximizing the transformative potential of AI for societal and economic advancement.

Roadmap Summary

This roadmap provides a comprehensive, context-sensitive strategy for implementing AI infrastructure in LAC. By prioritizing investments, phasing development, and establishing robust monitoring frameworks, the region can achieve meaningful progress in AI adoption while addressing diverse social and economic needs.

Conclusions and Future Perspective

This study provides a foundational framework to understand the advanced infrastructure requirements for artificial intelligence (AI) and emerging technologies across Latin America and the Caribbean (LAC). It addresses the technical, social, and economic dimensions of AI implementation to position the region as a global leader in inclusive and sustainable technological development. Below are the conclusions from each section of this report, emphasizing key findings and actionable insights.

Section 1: Introduction

The introductory analysis underscores the critical role of robust information and communication technology (ICT) infrastructure in enabling AI and other emerging technologies. The convergence of technologies such as 5G, Internet of Things (IoT), and advanced computing is driving exponential growth in data-driven solutions. This section establishes the need for immediate action to bridge existing gaps in digital infrastructure, which, if left unaddressed, may exacerbate socioeconomic inequalities across the region. The study reiterates the transformative potential of AI to drive GDP growth, enhance public service delivery, and create high-value employment opportunities. Future efforts should focus on fostering regional collaboration and investments to align infrastructure development with global technological trends.

Section 2: Conceptual Framework for AI Data Technologies and Advanced Digital Infrastructure

This section elaborates on the ecosystem required for effective AI deployment, highlighting the interdependence of physical infrastructure, connectivity, and governance

frameworks. It emphasizes the necessity of scalable, secure, and sustainable solutions that can evolve with technological advancements and identifies global best practices that LAC countries can adopt to optimize their digital ecosystems, including modular data centers, edge computing, high-speed networks, and high-performance computing (HPC) and advanced computing.

Section 3: Infrastructure Needs for AI Development

In this section the infrastructure requirements for data transport, storage, and processing are explored in detail, emphasizing the region's reliance on scalable, high-speed, and secure networks. The findings suggest that targeted investments in edge computing and advanced data centers will be pivotal for addressing latency-sensitive AI applications. Moreover, prioritizing energy-efficient infrastructure will align with global sustainability goals while minimizing operational costs.

Section 4: Cross-Cutting Considerations for AI Infrastructure

This section identifies investment and financing strategies, human capital development, environmental sustainability, scalability, and cybersecurity as essential pillars for successful AI implementation. Tailored recommendations for LAC countries underscore the importance of fostering public-private partnerships (PPPs), aligning regulatory frameworks with technological advancements, and addressing skill gaps through capacity-building initiatives.

Section 5: AI Use Cases in the Public Sector in Latin America and the Caribbean

The use cases presented illustrate the transformative potential of AI across diverse sectors, including healthcare, education, public security, and mobility. These examples demonstrate how targeted infrastructure investments can unlock significant socioeconomic benefits, such as improved access to healthcare, enhanced educational outcomes, and more efficient public administration. Lessons from these use cases offer ideas for scaling AI adoption across the region.

Section 6: Roadmap for Implementation

The roadmap emphasizes the need for phased approaches to AI infrastructure development, with specific recommendations for short-, medium-, and long-term priorities tailored to the unique contexts of island nations, low-income countries, and middle-income countries. It highlights the importance of regional collaboration to pool resources and accelerate progress, particularly in research and innovation hubs.

Future Perspectives

The path to AI-driven innovation in LAC requires decisive action and sustained investment. This report equips policymakers with a clear vision and actionable strategies to overcome existing challenges and seize emerging opportunities. By fostering a collaborative and forward-looking approach, the region can achieve its potential as a global leader in inclusive and sustainable technological development.

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Appendix: Summary of High-Level Recommendations

This appendix brings together the study's high-level recommendations in a concise format that readers can use as a quick reference. It is designed to support policymakers, regulators, and stakeholders seeking to understand the key priorities for developing and strengthening AI-related infrastructure. While the recommendations were informed by the context of Latin America and the Caribbean (LAC), most are broad in scope and can serve as guidance for countries at different stages of digital development. Readers may therefore use this summary both as a checklist of strategic considerations and as a starting point for adapting the recommendations to their own national circumstances.

Digital Infrastructure Needs

Short-Term

1. Data Center Location Optimization
 - Cost: Medium
 - Governments should collaborate with network operators and utility providers to identify optimal sites for new data centers, considering network accessibility, power reliability, land availability, and security risks.
2. Edge Data Center Deployment in Urban Areas
 - Cost: Medium
 - Prioritize the deployment of edge data centers in densely populated urban centers and industrial zones to support real-time applications and regional economic growth.
3. Collaboration for Edge Infrastructure
 - Cost: Low
 - Governments and private enterprises should establish clear guidelines for managing edge infrastructure and leverage public-private partnerships (PPPs) for investments.

Medium-Term

4. Cloud Infrastructure Accessibility
 - Cost: Medium

- Governments must work with cloud providers to create clear data protection guidelines and ensure cloud services are accessible to businesses of all sizes, addressing connectivity and sovereignty challenges.
5. Broadband Expansion in Underserved Areas
 - Cost: High
 - Invest in expanding fixed and mobile broadband connectivity to reduce digital divides and support foundational artificial intelligence (AI) infrastructure.

Long-Term

6. High-Performance Computing (HPC) Development
 - Cost: High
 - Governments should prioritize the establishment of HPC centers to support advanced AI research and innovation in fields like genomics and climate modeling.
7. Integration of Renewable Energy in Data Centers
 - Cost: High
 - Incorporate renewable energy sources into data center operations to align with sustainability goals and reduce carbon emissions.

Cross-Cutting Considerations

Short-Term

1. Streamlined Visa and Work Permits for AI Experts
 - Cost: Low
 - Introduce policies to facilitate cross-border mobility for AI experts, promoting knowledge exchange and skill development.
2. Cybersecurity Measures for Cloud Adoption
 - Cost: Medium
 - Organizations should adopt encryption, multifactor authentication, and zero-trust architectures, supported by regular compliance audits and continuous monitoring.
3. Broad Digital Literacy Campaigns
 - Cost: Medium
 - Implement national campaigns to improve digital literacy, preparing the workforce for AI-driven transformations.

Medium-Term

4. PPPs for AI Education
 - Cost: Medium
 - Collaborate with private enterprises to develop AI-focused training programs, vocational education, and university partnerships.

5. Regional Collaboration for Shared Resources
 - Cost: Medium
 - Encourage multilateral initiatives like the Advanced Computing System for Latin America and the Caribbean (SCALAC) to pool resources for shared HPC facilities and research hubs.

Long-Term

6. AI Governance Frameworks
 - Cost: Low
 - Establish national AI governance frameworks to ensure responsible and ethical AI use, promote transparency, and address bias in AI systems.
7. Comprehensive Monitoring and Evaluation Systems
 - Cost: Medium
 - Create national systems to monitor and evaluate the impact of AI infrastructure investments on socioeconomic development.
8. Human Capital Investment in Specialized Skills
 - Cost: High
 - Scale up investments in advanced skill-building programs, focusing on AI research, data science, and digital responsibility and ethics.

