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I. Introduction



Introduction

Artificial intelligence (AI) is widely regarded as one of the most transformative technologies of the 21st century, with the potential to reshape economies, industries, and societies. As a general-purpose technology (GPT), AI parallels foundational innovations such as electricity steam engine, electricity, or the internet in its ability to drive widespread change across multiple sectors. Its ability to automate complex processes, analyze vast datasets, and generate new solutions positions it as a key tool for addressing pressing societal challenges and advancing economic growth. A 2024 report by a researcher at the MIT Sloan School of Management suggests that generative AI has the potential to accelerate economic growth more rapidly than previous GPTs, largely due to its accessibility and ease of use.¹ This rapid advancement mirrors the trajectory of earlier GPTs, while AI's ability to foster innovation—by improving existing processes and enabling the creation of entirely new products and services—makes it a driving force across industries.

Globally, AI has demonstrated promising capabilities, driving productivity and innovation across various domains. The Organisation for Economic Co-operation and Development (OECD) highlights AI's potential to improve welfare and well-being, contribute to sustainable economic activities, and address global challenges such as healthcare, climate change, and cybersecurity.² Investments in AI reflect this optimism, with private sector funding exceeding USD250 billion in 2021.



Figure 1. Global Corporate Investment in AI

Source: Letzin, J. (2024)³

https://mitsloan.mit.edu/ideas-made-to-matter/impact-generative-ai-a-general-purpose-technology.

¹ Stackpole, B "The impact of generative AI as a general-purpose technology", accessed October 7, 2024,

² Filippucci, F., et al., 2024. The impact of artificial intelligence on productivity, distribution and growth: Key mechanisms, initial "The Impact of Artificial Intelligence on Productivity, Distribution and Growth: Key Mechanisms, Initial Evidence and Policy Challenges." OECD Artificial Intelligence Papers. Vol. 15. OECD Artificial Intelligence Papers, April 16, 2024. <u>https://doi.org/10.1787/8d900037-en</u>.

³ Letzing, J. "To fully appreciate AI expectations, look to the trillions being invested" World Economic Forum. April 3, 2024.

https://www.weforum.org/agenda/2024/04/appreciate-ai-expectations-trillions-invested/.

For developing countries like the Philippines, AI offers an opportunity to address persistent development challenges and unlock new pathways for growth. National development frameworks, such as the Philippine Development Plan (PDP) 2023–2028 and *AmBisyon Natin* 2040, emphasize the importance of innovation, research, and technology in achieving sustainable and inclusive progress. AI aligns directly with these priorities, offering the potential to enhance productivity, improve public services, and create high-value jobs.

Nonetheless, realizing the benefits of AI requires overcoming structural barriers such as underdeveloped infrastructure, gaps in technical expertise, and fragmented governance frameworks.

The policy note aims to explore the potential role of AI in supporting economic growth and development in the Philippines and evaluate how AI can enhance productivity, support job creation, and improve public services in the country while highlighting key barriers to its adoption and integration. This policy note also identifies ongoing public and private AI projects and interventions while outlining the priority actions and policy directions that should be implemented to address challenges and leverage AI effectively. The following sections provide an overview of AI as a transformative technology, assess its opportunities and challenges, and propose actionable strategies for embedding AI into the country's broader development agenda. Governance and ethical considerations are also discussed as cross-cutting issues relevant to AI's responsible deployment.

II. Understanding Artificial Intelligence





Understanding Artificial Intelligence

A. Al Technologies

Al refers to technologies that enable machines to perform tasks traditionally requiring human intelligence, such as learning, problem-solving, decision-making, and creativity. The term was first introduced in 1955 by John McCarthy, who described AI as "the science and engineering of creating intelligent machines." Since then, advancements in computational power, algorithmic design, and data accessibility have significantly expanded the scope and applications of AI.

Al encompasses several foundational technologies, with machine learning (ML) and deep learning being central. ML uses algorithms such as linear regression, decision trees, and clustering to enable computers to learn from data and make predictions or decisions. Deep learning, a more advanced form of ML, leverages neural networks inspired by the human brain. These networks consist of layers of interconnected nodes (neurons) working together to process large and complex datasets, making them particularly effective in tasks like natural language processing (NLP) and computer vision.

In recent years, generative AI systems, powered by large language models (LLMs) that can independently create content such as text, images, videos, and even music, have become more prominent. Tools like OpenAI's ChatGPT exemplify the capabilities of generative AI, producing human-like text responses based on natural language prompts. This versatility has broadened AI's applications across sectors, from content creation to software development.

B. Al as a Dynamic System

Al can also be understood as a dynamic system. In 2022, the International Organization for Standardization (ISO) provided a contemporary definition of AI as a "field dedicated to engineered systems that produce outcomes – such as content, predictions, or recommendations – aligned with human-set objectives."⁴ Additionally, in 2024, the OECD defined an AI system as "a machine-based processes that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments. Different AI systems vary in their levels of autonomy and adaptiveness after deployment."⁵ These definitions emphasize that AI systems are not static tools but dynamic entities capable of processing diverse inputs, learning, and adapting to achieve specific objectives.

At its core, AI refers to technologies that enable machines to simulate human-like capabilities, including learning, problem-solving, decision-making, creativity, and autonomy.⁶ By integrating machine learning algorithms, data, and decision-making processes, AI systems impact both physical and virtual domains, evolving to meet changing conditions or requirements. **Figure 2** illustrates this transformation process, emphasizing the interconnected nature of inputs, the AI system, and outputs, all operating within a positive feedback loop that enhances performance over time.



Figure 2. Al Systems: Input and output

Source: Adapted from OECD (2023)⁷

⁴ ISO. "ISO/IEC 22989:2022." Accessed January 13, 2025. <u>https://www.iso.org/standard/74296.html</u>.

⁵ "What Is AI? Can You Make a Clear Distinction between AI and Non-AI Systems?" Accessed January 13, 2025. <u>https://oecd.ai/en/wonk/definition</u>. World Economic Forum. "6 Ways to Unleash the Power of AI in Manufacturing," January 4, 2024. <u>https://www.weforum.org/stories/2024/01/how-we-can-unleash-the-power-of-ai-in-manufacturing/</u>.

⁶ IBM, "What is Artificial Intelligence?," accessed October 7, 2024, <u>https://www.ibm.com/topics/artificial-intelligence</u>.

⁷ OECD 2023, https://www.oecd-ilibrary.org/science-and-technology/the-impact-of-artificial-intelligence-on-productivity-distribution-and-growth_8d900037-en.

Figure 3 depicts the various layers and stakeholders involved in delivering AI solutions, from foundational hardware to end-user applications, and shows how specific AI industry players may be situated across different stages of the value chain. Its key layers – hardware, software, foundational AI models, and AI applications – represent the critical roles played by companies and platforms in creating, managing, and utilizing AI.



Figure 3. Al Value Chain



Source: Adapted from NASDAQ (2023)⁸

⁸ "Diving Deep into the AI Value Chain I Nasdaq." Accessed January 13, 2025. <u>https://www.nasdaq.com/articles/diving-deep-into-the-ai-value-chain</u>.

1. Inputs

The functioning of AI systems relies on two broad categories of inputs: intangible and tangible capital.⁹

- a. Intangible capital refers to the expertise and skills of human professionals, such as programmers, engineers, and data scientists, who design, train, and maintain AI systems. These experts leverage specialized software to develop and refine AI models, ensuring that systems are accurate, reliable, and aligned with their intended objectives. Another critical component of intangible input is data, which serves as the foundation for AI systems. High-quality data enables AI systems to learn patterns, adapt to changing circumstances, and generate meaningful outputs.
- b. Tangible capital includes the physical infrastructure required to support AI operations. This encompasses high-performance computing hardware, such as chips and GPUs, as well as robust connectivity infrastructure needed for data transmission. Reliable high-speed internet and substantial energy resources are critical for enabling large-scale data processing and executing complex computations. The efficiency and scalability of an AI system depend heavily on the quality and availability of these tangible inputs, making their development a priority for widespread adoption.
 - i. Companies such as NVIDIA, AMD, and Intel produce high-performance chips, GPUs, and processors, which are critical for running complex AI algorithms and processing large datasets.¹⁰ Firms like Arm¹¹ and Marvell¹² also contribute by developing specialized processors optimized for AI workloads. Meanwhile, data center infrastructure refers to the physical facilities that house the data of organizations. It consists of equipment that enable the delivery of shared applications and data, such as computing infrastructure or servers, data storage drives, and network equipment.¹³
 - ii. Software consists of platforms and tools that manage, process, and store data. Companies like Snowflake, Databricks and MongoDB provide the data platforms needed to organize, clean, and structure large datasets used by AI models.¹⁴ These platforms ensure that the data fed into AI systems is high-quality and reliable, making them vital for the "Data & Input" phase of the AI lifecycle. Other tools such as AWS, Google Cloud, and Microsoft Azure provide the cloud infrastructure required for the scalable training and deployment of AI models.¹⁵

¹⁰ Mann, Tobias. "AMD, Intel, Nvidia Detail Their Datacenter Roadmaps." Accessed January 13, 2025. https://www.theregister.com/2024/06/05/chipmakers_computex_roadmaps/.

⁹ Filippucci, F., et al., 2024. The impact of artificial intelligence on productivity, distribution and growth: Key mechanisms, initial "The Impact of Artificial Intelligence on Productivity, Distribution and Growth: Key Mechanisms, Initial Evidence and Policy Challenges." OECD Artificial Intelligence Papers. Vol. 15. OECD Artificial Intelligence Papers, April 16, 2024. <u>https://doi.org/10.1787/8d900037-en</u>.

¹¹ Arm Ltd. "Artificial Intelligence | Al Everywhere on Arm." Arm | The Architecture for the Digital World. Accessed January 13, 2025.

https://www.arm.com/markets/artificial-intelligence.

¹² "Marvell Technology, Inc" Accessed January 13, 2025. <u>https://www.marvell.com/</u>.

¹³ Amazon Web Services, Inc. "What Is a Data Center? - Cloud Data Center Explained - AWS." Accessed January 13, 2025. <u>https://aws.amazon.com/what-is/data-center/</u>.

¹⁴ Baer, Tony. "Data Chess Game: Databricks vs. Snowflake, Part 1." *VentureBeat* (blog), July 25, 2022. <u>https://venturebeat.com/data-infrastructure/data-chess-game-databricks-vs-snowflake-part-1/</u>.

¹⁵ "Amazon Web Services vs. Azure vs. Google Cloud in 2024." Accessed January 13, 2025. <u>https://www.mgt-commerce.com/blog/amazon-web-services-vs-azure-vs-google-cloud/</u>.

- iii. Al developer tools such as those offered by Scale Al,¹⁶ Confluent,¹⁷ LangChain,¹⁸ and Weights & Biases¹⁹ provide solutions for developers ranging from data labeling and data streaming to workflow streamlining and model performance monitoring. Vector databases from companies like Pinecone and Weaviate allow efficient storage and retrieval of complex data structures used in Al applications such as search engines or recommendation systems.²⁰ Cybersecurity and observability services, from providers like Palo Alto Networks, Zscaler, and SentinelOne, ensure that data is handled securely and that Al systems are continuously monitored for risks and threats.²¹
- iv. The Internet is essential for data transmission, connectivity, and support for AI applications. Data centers require access to points of presence (POPs) established by internet service providers (ISPs)allowing AI applications to have reliable access to computing infrastructure and data.²² The responsiveness of software, AI foundational models and AI applications also relies on real-time data processing, and thus, access to high-speed connectivity with low latency.²³ ISPs must also provide high-capacity bandwidth and flexible solutions given the evolving AI technologies.

2. Al System

Al systems can be categorized into two types based on the type of their outputs: nongenerative Al systems and generative Al systems.²⁴

a. Non-generative AI systems, also referred to as discriminative or pre-generative AI, typically rely on ML or deep learning techniques to perform tasks such as pattern recognition, anomaly detection, user behavior analysis, forecasting, and optimization.²⁵ These systems excel at handling large, unstructured datasets, making them indispensable for applications requiring predictive analytics and data-driven decision-making. For example, non-generative AI might analyze consumer behavior to optimize marketing strategies or detect anomalies in financial transactions to prevent fraud.

- https://www.techzine.eu/blogs/security/125602/the-security-platform-what-is-it-and-what-does-it-deliver/.
- ²² "Supporting the AI Boom: What's Needed from Data Centers and ISPs Zayo." Accessed January 13, 2025. https://www.zayo.com/resources/supporting-the-ai-boom-whats-needed-from-data-centers-and-isps/.

¹⁶ "Accelerate the Development of AI Applications | Scale AI." Accessed January 13, 2025. <u>https://scale.com/</u>.

¹⁷ Confluent. "Generative Artificial Intelligence (GenAl)." Accessed January 13, 2025. <u>https://www.confluent.io/generative-ai/</u>.

¹⁸ "LangChain." Accessed January 13, 2025. https://www.langchain.com/.

¹⁹ <u>https://wandb.ai/site</u>

²⁰ "The 7 Best Vector Databases in 2025 | DataCamp.". <u>https://www.datacamp.com/blog/the-top-5-vector-databases</u>.

²¹ Klinken, Erik Van. "The Security Platform: What Is It and What Does It Deliver?" Techzine Global, October 25, 2024.

²³ "Bridging the Connectivity Gap to Power the next Generation of Al." Accessed January 13, 2025. <u>https://www.telecomstechnews.com/news/bridging-the-connectivity-gap-to-power-the-next-generation-of-ai/</u>.

²⁴ Filippucci, F., et al., 2024. The impact of artificial intelligence on productivity, distribution and growth: Key mechanisms, initial "The Impact of Artificial Intelligence on Productivity, Distribution and Growth: Key Mechanisms, Initial Evidence and Policy Challenges." OECD Artificial Intelligence Papers. Vol. 15. OECD Artificial Intelligence Papers, April 16, 2024. <u>https://doi.org/10.1787/8d900037-en</u>.

²⁵ Agrawal, Ajay, Joshua Gans, and Avi Goldfarb. "The Turing Transformation: Artificial Intelligence, Intelligence Augmentation, and Skill Premiums." Harvard Data Science Review, no. Special Issue 5 (February 3, 2024). https://doi.org/10.1162/99608f92.35a2f3ff.

b. Generative AI systems represent a newer class of AI technology. These systems use large language models (LLMs) to generate content in response to natural language prompts. Unlike non-generative systems, generative AI can produce text, images, videos, sounds, and even program code. Notable examples are foundational models developed by Cohere, OpenAI, Anthropic, and Adept, which are pre-trained on massive datasets, serving as the base for more specialized AI applications. These models reduce the time and resources needed for developing custom AI solutions by providing a general-purpose framework that can be tailored for specific tasks. Foundational models represent a key phase in the "AI Model" phase of the AI System Life Cycle, where developers build, validate, and refine AI models using the data prepared by the infrastructure layer.

3. Outputs

Al systems could produce a variety of output, including but not limited to content, predictions/recommendations, and physical tasks.²⁶

- a. Content generation is the hallmark of generative AI systems, which creates text, images, videos, or sounds directly in response to user inputs. These outputs have diverse applications, from automating report writing, designing graphics, and producing educational content and entertainment.
- b. Predictions and recommendations are typical outputs of non-generative AI systems. These systems analyze data to provide actionable insights, optimize processes, and guide decision-making. For instance, AI can forecast market trends, recommend personalized content, or enhance operational efficiency through predictive maintenance.
- c. Physical tasks become possible when AI systems are integrated with robotics. This combination enables systems to perform actions in the physical world, such as operating autonomous vehicles, automating industrial processes, or assisting in precision tasks in healthcare and manufacturing.

Outputs may also be classified into three categories: Enterprise, Prosumer, and Consumer,²⁷ depending on the user base and its intended use.

a. In the **Enterprise** category, platforms like ServiceNow, HubSpot, Shopify, and Autodesk provide AI-enhanced tools for automating business processes, improving customer service, and optimizing supply chains, to enable large organizations integrate AI into their operations.

²⁶ Filippucci, F., et al., 2024. The impact of artificial intelligence on productivity, distribution and growth: Key mechanisms, initial "The Impact of Artificial Intelligence on Productivity, Distribution and Growth: Key Mechanisms, Initial Evidence and Policy Challenges." OECD Artificial Intelligence Papers. Vol. 15. OECD Artificial Intelligence Papers, April 16, 2024. <u>https://doi.org/10.1787/8d900037-en</u>.

^{27 &}quot;Diving Deep into the Al Value Chain I Nasdaq." Accessed January 13, 2025. https://www.nasdaq.com/articles/diving-deep-into-the-ai-value-chain.

- b. The **Prosumer** category pertains to users who are both producers and consumers of Al content, targeting both individuals and small businesses. These include companies like Canva and Figma, which offers Al-driven design tools to design graphics and prototypes, while platforms like Notion AI and Zapier automate workflows, and Cohere and Stability AI provide custom AI models that allow users to create custom content, such as text and images.
- c. The **Consumer** category targets everyday users of AI-powered platforms like Spotify, TikTok, Snapchat, and Duolingo, where AI is used to deliver personalized content and user experiences.

4. Feedback Loop and Continuous Improvement

Al systems operate within a positive feedback loop, where outputs contribute to the system's ongoing improvement. For example, predictions and recommendations generate new data that feeds back into the system, enhancing its algorithms and refining its performance. Similarly, content generated by generative AI can provide additional data for training and adaptation. This iterative process ensures that AI systems become more effective and responsive over time. As the system processes increasing volumes of data, both intangible inputs (i.e., improved algorithms and expertise) and tangible inputs (i.e., optimized infrastructure) are strengthened, driving continuous advancement in capabilities.

III. Legal Regulatory Landscape





Legal Regulatory Landscape

The global landscape of artificial intelligence (AI) regulation reflects diverse approaches aimed at balancing innovation with ethical considerations and societal risks.

A. European Union and the United States

The European Union (EU) enacted the EU AI Act,²⁸ which is the world's first comprehensive AI legislation. The EU AI Act regulates the development, marketing and use of AI, and categorizes AI use cases into different risk levels each with varying requirements and obligations. Under the law, systems posing an unacceptable risk such as those used for subliminal influencing techniques to manipulate behavior, social scoring, and real-time biometric identification in public spaces, are prohibited. On the other hand, high risk systems (e.g., those related to the operation of critical infrastructure, systems used in hiring processes or employee ratings, credit scoring systems, automated insurance claims processing, or setting of risk premiums for customers), are permitted but must be registered in an EU database, comply with stringent compliance standards, and undergo a conformity assessment. Lastly, those considered to pose limited or minimal risk (e.g., chat bots or deep fakes which are not considered high risk but for which, it is mandatory that users know about Al being behind it) are subject to transparency obligations and must inform their users that they (user) are interacting with an AI. For all operators of AI systems, the implementation of a Code of Conduct around ethical AI is recommended. Non-compliance with the provisions of the EU AI Act shall be subjected to penalties and sanctions, including substantial administrative fines (e.g., up to a maximum of 7% of worldwide turnover for engaging in prohibited AI practices, or up to 3% of worldwide turnover for violation of requirements and obligations under the EU AI Act).²⁹

²⁸ Artificial Intelligence Act (Regulation (EU) 2024/1689)

²⁹ Article 99, EU Al Act

In contrast, the United States adopted a flexible approach to AI regulation through the issuance of Executive Order (EO) on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence³⁰ 30 October 30, 2023. The EO directs agencies and offices in the executive branch to study the use of AI technologies within their purview, and assigns to them concrete task for their appropriate action within specified timelines. For example:

- The Secretary of the US Department of Commerce, through its National Institute of Standards and Technology (NIST) and in coordination with the Secretaries of the US Department of Energy and US Department of Homeland Security, and heads of relevant agencies, must establish guidelines and best practices for (a) developing and deploying safe, secure, and trustworthy AI systems; and (b) to enable developers of AI, especially of dual-use foundation models, to conduct AI red-teaming tests to enable deployment of safe, secure, and trustworthy systems.³¹
- The Secretary of the US Department of Commerce, in coordination with the Director of the Office of Management and Budget and other relevant agencies, shall develop guidance regarding tools and practices for the authentication of digital and synthetic (i.e., Al-generated) content.³²
- In the financial sector, the Secretary of the US Treasury shall issue a public report on the best practices for financial institutions to manage AI-specific cybersecurity risks.³³
- On worker protection, the EO required the formulation of several reports, including a report by the Chairman of the Council of Economic Advisors on the labor-market effects of AI,³⁴ and mandated the Secretary of the US Department of Labor to develop and publish principles and best practices for employers that may be used in mitigating potential harm to employees or maximize benefits of AI.³⁵
- On health care, the Secretary of the US Department of Health and Human Services was mandated to develop, with other agencies, a plan to use AI in research and discovery, drug and device safety, health care delivery and public health.³⁶

The EO demonstrates flexible, sector-specific vertical regulation, emphasizing adaptability and innovation.

B. ASEAN Countries

The Association of Southeast Asian Nations (ASEAN) has formulated a Guide on AI Governance and Ethics (ASEAN AI Guide).³⁷ It provides guiding principles for the use of AI,

³⁰ United States Executive Order 14110, October 30, 2023.

³¹ Section 4.1, EO 14110

³² Section 4.5, EO 14110

 ³³ Section 4.3, EO 14110
 ³⁴ Section 6(a)(i), EO 14110

³⁵ Section 6(a)(i), EO 14110 ³⁵ Section 6(b)(i), EO 14110

³⁶ Section 8(b)(i), EO 14110

³⁷ ASEAN, "ASEAN Guide on AI Governance and Ethics", <u>https://asean.org/wp-content/uploads/2024/02/ASEAN-Guide-on-AI-Governance-and-Ethics beautified 201223 v2.pdf.</u>

namely: Transparency and Explainability; Fairness and Equity; Security and Safety; Robustness and Reliability; Human-centricity; Privacy and Data Governance; Accountability and Integrity. The ASEAN AI Guide aims to foster alignment and operability of AI frameworks among ASEAN states, ensuring harmony of local laws and initiatives in designing, developing, and deploying AI systems across the region through (a) recommendations on the promotion of responsible uses of AI such as adapting current governance structures to account for algorithmic decision-making; and (b) proposal to setup a methodology to determine levels of acceptable risks and level of human involvement in AI-augmented decision-making.

Table 1 provides a snapshot on the status of each ASEAN country's progress in Al policymaking.



Table 1. AI Policy-Making Progress in ASEAN

Source: Southeast Asia Public Policy Institute (SEAPPI), Policy State of Play: Artificial Intelligence in Southeast Asia (August 2024)

1. Singapore

In 2019, Singapore was among the world's first to articulate AI governance principles applicable to traditional AI through the publication of the Model AI Governance Framework (MGF), which was updated on 2020.³⁸ Subsequently, in 2024, with the advent of generative AI, Singapore issued its MGF for Generative AI that lays down nine dimensions for "a

³⁸ "PDPC | Singapore's Approach to Al Governance." Accessed January 13, 2025. <u>https://www.pdpc.gov.sg/help-and-resources/2020/01/model-ai-governance-framework</u>.

systematic and balanced approach to address generative AI concerns while continuing to facilitate innovation,³⁹ as shown in **Figure 4**.

Figure 4. Nine Dimensions of Singapore's Model AI



2. Malaysia

Malaysia identifies the establishment of an AI Governance as one of the strategies in its AI National Strategy. At present, there is no central AI governance coordination structure in the country, with most AI activities planned and implemented in silos. As a result, many agencies "incur needless financial, personnel and operational expenses."⁴⁰ The government aims to address this issue through (a) the review of policies, standards, incentives, programs for the

³⁹ AI Verify Foundation, and IMDA"Proposed Model AI Governance Framework for Generative AI" <u>https://aiverifyfoundation.sg/downloads/Proposed MGF Gen AI 2024.pdf</u> p. 3

⁴⁰ MASTIC, "Malaysia National Artificial Intelligence Roadmap 2021-2025", <u>https://mastic.mosti.gov.my/publication/artificial-intelligence-roadmap-2021-</u> 2025/ Slide 34.

promotion of AI investment policy; (b) establish a stakeholder communication platform; (c) adoption of cybersecurity policies for AI; (d) promulgation of an AI code of ethics and guidelines; and (e) data sharing collaboration among government agencies.⁴¹

3. Thailand

In 2022, the Thai government created a National AI Committee to serve as the driving committee for its National AI strategy.⁴² One of the strategies identified by the Committee is the enactment of an AI law, which will pave the way for Thailand's readiness in social, ethics, law and regulation for AI applications.

4. Vietnam

The Prime Minister of Vietnam promulgated a Decision approving the National Strategy on Research, Development and Application of AI, which shall be in place until 2030. The Decision sets forth its target to be a center for innovation, development of AI solutions and applications.⁴³ To this end, it tasks the Ministries of Science and Technology, the Information and Communications, Finance, Planning and Investment, Defense, among others, with concrete deliverables relating to AI within their specific mandates and expertise.

Annex A (Survey of International Policies on Artificial Intelligence and Sectors Focused) is a summary of international AI policies and its targeted sectors, offering additional context for understanding global and regional AI policy landscapes.

C. Philippines

The Philippines has initiated efforts to integrate AI into its development strategy and has commenced the roll-out of programs and projects on AI adoption. Notable government-led AI-related initiatives include, among others:

- 1. In 2021, the Department of Trade and Industry (DTI) issued its National AI Strategy Roadmap (NAISR), which laid the foundation for the country's AI development. An updated version, NAISR 2.0, was launched in 2024, to incorporate rapid advancements in technology, including generative AI. The strategy focuses on fostering ethical AI practices, strengthening governance, and encouraging innovation.⁴⁴
- 2. The DTI has also launched the Center for AI Research (CAIR), which will serve as the country's hub for AI research. CAIR's envisions becoming a Center of Excellence in AI R&D, while its mission is to transform the Philippines into a premier destination for AI-driven innovation and investments. CAIR shall create AI solutions for regional concerns, sustainable agriculture, urban planning, and disaster resilience.

⁴¹ Ibid., at Slides 35 to 40.

⁴² Ministry of Digital Economy and Society 6. "Thailand National AI Strategy and Action Plan (2022-2027)", <u>https://ai.in.th/wp-content/uploads/2022/12/2022-NAIS-Presentation-eng.pdf</u> slide

⁴³ Prime Minister's Decision On Issuing the National Strategy on Research, Development and Application of Artificial Intelligence until the Year 2030.

⁴⁴ Draft National AI Strategy Roadmap 2.0

- 3. The Department of Science and Technology (DOST), through the Advanced Science and Technology Institute (ASTI) and Philippine Council for industry, Energy and Emerging Technology Research and Development (PCIEERD), has pioneered research resulting in AI the development of applications in different areas like agriculture and disaster risk reduction and management.
- 4. Pursuant to its mandate to promote the development and use of ICT, the Department of Information and Communications (DICT) likewise initiated programs geared towards fostering the development of AI applications and capacity-building.
- 5. The DICT also formulated the National Cybersecurity Plan (NSCP) 2023-2028, which consists of strategies to minimize national security risks for a peaceful, secure, open and cooperative ICT environment. The country has also taken steps in crafting AI ethical guidelines for the public sector.⁴⁵

Annex B (Other Ongoing Government Initiatives Involving Artificial Intelligence) summarizes other government programs and projects on AI.

Philippine legislature has passed laws to promote, incentivize, and foster innovation which may, in turn, hasten the adoption of AI, such as Republic Act No. (RA) 11293 or the Philippine Innovation Act, RA 11337 or the Innovation Startup Act, and RA 11927 or the Philippine Digital Workforce Competitiveness Act.

⁴⁵ DICT and Civil Service Commission, Draft Joint Memorandum Circular on the Principles and Guidelines for an Ethical and Trustworthy Use of Artificial Intelligence (AI) in the Government.

IV. Opportunities in Al





Opportunities in Al

Al represents a transformative force which could redefine global economic and social landscapes. Its applications span diverse fields, offering solutions that enhance productivity, foster innovation, and support decision-making. Moreover, AI's ability to generate new markets and drive innovation, positions it as a catalyst for sustainable and inclusive development, particularly in countries like the Philippines, where traditional development hurdles can be bypassed with strategic adoption.

A. Impact on Growth and Development

Al holds immense potential to drive economic growth, enhance productivity, and foster innovation across various sectors. By automating repetitive tasks, Al significantly reduces operational costs and increases efficiency.⁴⁶ It has been predicted that should Al reach certain thresholds, it could have an economic effect as substantial as the Industrial Revolution.⁴⁷

By 2030, AI is projected to contribute USD15.7 trillion to global GDP, representing a 16 percent increase in economic output.⁴⁸ The boost will come from productivity enhancements, expected to add USD6.6 trillion, and increased consumer demand from AI-enabled products and services, contributing an additional USD9.1 trillion.⁴⁹ Manufacturing, finance, and healthcare are among the sectors poised to benefit most from AI integration. According to estimates, the global AI in manufacturing market was valued at USD3.2 billion in 2023 and is

⁴⁶ Gonzales, Julius Tan. "Implications of Al Innovation on Economic Growth: A Panel Data Study." *Journal of Economic Structures* 12, no. 1 (September 9, 2023): 13. <u>https://doi.org/10.1186/s40008-023-00307-w</u>.

⁴⁷ Korinek, Anton, and Joseph Stiglitz. "Artificial Intelligence, Globalization, and Strategies for Economic Development." Cambridge, MA: National Bureau of Economic Research, February 2021. <u>https://doi.org/10.3386/w28453</u>.

⁴⁸ PwC. "Sizing the prize: What's the real value of AI for your business and how can you capitalise?",

https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf

⁴⁹ Ibid, at 27.

poised to grow to USD20.8 billion by 2028.⁵⁰ A recent Citi GPS report indicates that AI could boost global banking industry profits to USD2 trillion by 2028, reflecting a 9 percent growth over the next five years.⁵¹

Advancements in AI are making technology more accessible and democratizing its benefits. The development of smaller, more efficient AI models that can run on local devices means that powerful AI tools are no longer confined to large organizations with extensive computational resources. This democratization of AI enables smaller businesses and individual entrepreneurs to harness AI's capabilities, fostering innovation at all levels of the economy. This shift is particularly crucial for developing countries, where access to cutting-edge technology can drive significant economic and social progress.⁵²

Moreover, AI's ability to analyze vast amounts of data and generate actionable insights is profoundly transforming decision-making processes in various fields. For example, in urban planning, AI can analyze traffic patterns and propose efficient transportation solutions, thereby reducing congestion, fuel consumption and enhancing the quality of life in cities. Real-time adjustments to traffic signals can shorten travel times by up to 25 percent and lower energy use and emissions by 15-20 percent.⁵³

Realizing the benefits of AI requires that the challenges and risks in AI deployment are sufficiently addressed, and key enabling factors are in place to encourage adoption, ensuring that the technology is used to create a positive and inclusive future for all members of society.

B. Use Cases in Select Sectors

In the following sections, we will discuss AI use cases in select sectors and their implementation in the Philippines.



The Future of Jobs 2023 report by the World Economic Forum predicts that AI will reshape the global labor market, potentially causing a net loss of 14 million jobs by 2028.⁵⁴ AI is expected to generate 69 million new roles but displaces 83 million, mostly in routine tasks like data entry and administration.⁵⁵

The Asian Development Bank's report emphasizes that AI is disrupting skills demand in Asia, with a significant shift toward digital and cognitive competencies.⁵⁶ It estimates that 25-50

⁵⁰ Singh, J. (04 January 2024). 6 ways to unleash the power of AI in manufacturing. World Economic Forum. Accessed January 13, 2025 https://www.weforum.org/agenda/2024/01/how-we-can-unleash-the-power-of-ai-in-manufacturing/

⁵¹ Citi Global Perspectives & Solutions. "Al in Finance." Accessed January 13, 2025. https://www.citigroup.com/global/insights/ai-in-finance.

⁵² Read more on Al and democratization here: <u>https://www.tandfonline.com/doi/epdf/10.1080/13510347.2024.2338852</u>

⁵³ Elassy, Mohamed, Mohammed Al-Hattab, Maen Takruri, and Sufian Badawi. "Intelligent Transportation Systems for Sustainable Smart Cities." Transportation Engineering 16 (June 2024): 100252. https://doi.org/10.1016/j.treng.2024.100252.

 ⁵⁵ World Economic Forum. "Future of Jobs Report 2023." Accessed January 13, 2025 <u>https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf</u>
 ⁵⁵ Ibid.

⁵⁶ Parischa, M. "The Future of Work, Artificial Intelligence, and Digital Government: Policy Perspectives for Asia. Asian Development Bank Institute", Accessed January 14, 2025 <u>https://www.adb.org/sites/default/files/publication/995866/adbi-future-work-artificial-intelligence-and-digital-government-policy-perspectives-asia.pdf</u>

percent of current jobs will require reskilling by 2030,⁵⁷ focusing on technical skills like creative thinking, analytical thinking, and technological literacy.⁵⁸ Meanwhile, sectors with high automation potential, like finance and telecommunication, may see AI-related job roles increase by 15-30 percent.⁵⁹ In contrast, education and healthcare are likely to integrate AI to enhance human roles rather than replace them. Public policies need to prioritize reskilling initiatives and digital literacy to mitigate skills disruption and ensure workforce readiness.⁶⁰



Figure 5. Skills Disruption in Select Occupations

Source: Boston Consulting Group (2022).61

The significant impact of AI to the labor market is exemplified in the business process outsourcing (BPO) sector. A Deloitte global contact center survey conducted in 2023 showed that 81 percent of contact center executives are investing in AI for agent-enabling technologies.⁶² Additionally, according to KPMG, AI is expected to reduce delivery center footprint up to 80 percent by automating repetitive tasks and enabling more sophisticated service offerings.⁶³ The use of generative AI enables BPO firms to improve customer service by reducing human intervention in routine inquiries and enabling more proactive outreach through advanced analytics and automation, personalize interactions, and provide higher levels of service quality.⁶⁴ The growing role of AI in contact centers is expected to shift the

⁵⁷ Ibid.

 ⁵⁸ World Economic Forum. "Future of Jobs Report 2023." Accessed January 13, 2025 https://www3.weforum.org/docs/WEF Future of Jobs 2023.pdf
 ⁵⁹ Manyika, James, and Kevin Sneader. "AI, automation, and the future of work: Ten things to solve for." (2018). Accessed

https://www.mckinsey.com/featured-insights/future-of-work/ai-automation-and-the-future-of-work-ten-things-to-solve-for.

⁶⁰ Ibid, at 47

⁶¹ Sigelman, Matt, Bledi Taska, Layla O'Kane, Julia Nitschke, Rainer Strack, Jens Baier, Frank Breitling, and Ádám Kotsis. "Shifting skills, moving targets, and remaking the workforce." *People Strategy/Report* (2022).

⁶² Deloitte.. "Trends & AI in the Contact Center." Accessed January 13, 2025, <u>https://www2.deloitte.com/content/dam/Deloitte/us/Documents/process-and-operations/us-consulting-trends-and-ai-in-contact-center.pdf</u>

⁶³ KPMG. "Will Generative AI Mean the Death of Service Delivery Centers?" KPMG LLP. Accessed January 13, 2025 <u>https://kpmg.com/kpmg-us/content/dam/kpmg/pdf/2023/will-gen-ai-mean-the-death-of-service-delivery-centers.pdf</u>

⁶⁴ Ibid.

focus from transactional work to value-added services that demand higher levels of expertise. $^{\rm 65}$



Accenture⁶⁶ is actively integrating generative AI into its operations. Accenture's AI strategy goes beyond workforce training, as the company has committed USD3 billion to promote responsible AI usage across various industries. This commitment involves assisting clients in implementing AI for growth, efficiency, and resilience. In addition to investing in technology, Accenture emphasizes the importance of responsible AI governance to ensure ethical and principled AI adoption at all levels of business. This approach aims to strike a balance between innovation and accountability, preparing both the workforce and companies for a future shaped by AI.

The Philippine IT-BPO sector has embraced AI to remain competitive in the global market. The IT and Business Process Outsourcing Association of the Philippines (IBPAP), the umbrella organization of contract center and BPOs in the country, recognizes the critical role of AI in shaping the future of the Philippine BPO industry,⁶⁷ and has acknowledged that AI-driven services, such as learning processes and knowledge transfer and data analytics, will be major growth areas for the industry. In response to this shift, IBPAP is collaborating with government, educational institutions, and industry stakeholders to develop training programs, aimed at equipping workers with the necessary skills to handle more complex roles in the digital workplace.⁶⁸



Al is reshaping educational systems by enabling learning experiences that adapt to each student's needs.⁶⁹ According to a report published by the World Economic Forum (WEF) in 2024, Al can enhance global education by addressing teacher shortage, automating routine tasks, and personalizing learning experiences. It is projected that up to 20 percent of educators' clerical work could be automated, freeing time for personalized instruction.⁷⁰

⁶⁵ Ibid.

⁶⁶ Gonzales, Gelo. "Accenture PH Country Head on Adapting to Generative AI: 'Be Open to Learning,'" September 5, 2023.

https://www.rappler.com/technology/accenture-ph-country-head-ambe-tierro-adapting-generative-ai/.

⁶⁷ Cortez, Gillian. "IT-BPM Industry Reaps the Rewards; Now to Gear up for New Technology - BusinessWorld Online," July 22, 2019.

https://www.bworldonline.com/special-reports/2019/07/22/242763/it-bpm-industry-reaps-the-rewards-now-to-gear-up-for-new-technology/literation and the second seco

⁶⁸ H. Bula, Roey Ryan, Marivie G. Catahan, and Sofia D. Enorasa. "The Transformation in Philippine BPO Companies: The Impact of Digital Workplace Transformation to the Front Office CSR in Terms of Their Work Culture." *International Journal of Engineering, Business and Management* 7, no. 4 (2023): 40–49. <u>https://doi.org/10.22161/ijebm.7.4.6</u>.

⁶⁹ Duggan, Steven, and Svetlana Knyazeva. "Al in education: change at the speed of learning; UNESCO IITE policy brief." (2020).

⁷⁰ Elhussein, Genesis, Elselot Hasselaar, and Ostap Lutsyshyn. "Shaping the future of learning: The role of ai in education 4.0." World Economic Forum, 2024.

In the Philippines, there is increasing recognition of AI's potential to address persistent challenges, especially in remote and underserved areas. The Second Congressional Education Commission, or EDCOM II report, found early literacy and numeracy deficiencies in Key Stage 1 (Kindergarten to Grade 3), and emphasizes resource reallocation to improve learning outcomes.⁷¹ In addition, the 2022 PISA results revealed substantial gaps in reading, math, and science performance, underscoring a significant skills gap affecting national competitiveness and workforce readiness.⁷² AI integration could help address these systemic inefficiencies by streamlining administrative processes, in which, educators can focus on teaching. Further, AI tools can analyze performance data and provide real-time feedback on teaching effectiveness,⁷³ help tailor educational experiences, and improve engagement through personalized learning environments.⁷⁴

The Department of Education (DepEd) is implementing a comprehensive Digital Education Program, focusing on integrating technology into the educational system through the development of digital resources and training for teachers.⁷⁵

DepEd Initiatives on AI and Digital Literacy

The DepEd, in collaboration with private entities, has initiated efforts that aim to bridge the learning gap through AI.



- In collaboration with Google Philippines, DepEd launched training programs focused on enhancing digital skills, including AI literacy. The program aims to provide teachers and students with AI and digital tools such as Google Classroom,⁷⁶ which streamlines communication, content sharing, and feedback mechanisms.
- The DepEd has also partnered with Microsoft to introduce AI-powered tools for reading proficiency of around 27 million Filipino students. In addition, the partnership also aims to train 100,000 women in AI and cybersecurity.⁷⁷
- DepEd also has recently partnered with Khan Academy, recognized for its free online courses and AI tools, and iamtheCODE, a global movement focused on coding education

⁷² Chi, Cristina. "Philippines Still Lags behind World in Math, Reading and Science — PISA 2022." Philstar.com. Accessed January 13, 2025. https://www.philstar.com/headlines/2023/12/06/2316732/philippines-still-lags-behind-world-math-reading-and-science-pisa-2022.

⁷¹ Second Congressional Commission on Education (EDCOM II) (2024). Miseducation: The Failed System of Philippine Education.

⁷³ Sadiku, Matthew N. O., Tolulope J. Ashaolu, Abayomi Ajayi-Majebi, and Sarhan M. Musa. "Artificial Intelligence in Education." International Journal Of Scientific Advances 2, no. 1 (2021). https://doi.org/10.51542/ijscia.v2i1.2.

⁷⁴ Baker, Ryan S. "Artificial intelligence in education: Bringing it all together." *Digital education outlook: Pushing the frontiers with AI, blockchain, and robots* (2021): 43-54.

⁷⁵ World Bank. "Digital Transformation of Philippine Higher Education." (2023).

⁷⁶ Luna, Enzo. "Google Delivers Four Initiatives to Support Inclusive Distance Learning in the Philippines." Manila Bulletin, August 24, 2020. https://mb.com.ph/2020/08/24/google-delivers-four-initiatives-to-support-inclusive-distance-learning-in-the-philippines/.

⁷⁷ "Microsoft to Educate 100k Filipino Women in Al, Cybersecurity," March 12, 2024. <u>https://www.asiaeducationreview.com/technology/news/microsoft-to-educate-100k-filipino-women-in-ai-cybersecurity-nwid-1375.html</u>.

for women and girls, to enhance literacy and numeracy through personalized, adaptive learning experiences⁷⁸ and promote tech readiness and gender equity.⁷⁹

DepEd-ICTS-Educational Technology Unit

The DepEd - Information and Communications Technology Service (ICTS), Educational Technology Unit (ETU)⁸⁰ is focused on integrating ICT and digital tools into the Philippine educational system. Its initiatives include expanding digital access and resources, particularly through the Digital Rise Program, which enhances connectivity in schools. ICTS also supports the development and maintenance of Learning Management Systems for virtual learning, creates and promotes Open Educational Resources (OER) to provide free digital instructional materials, and leads digital capacity-building programs for both teachers and students to enhance digital literacy and competency across the education sector.⁸¹

The Commission on Higher Education (CHED)'s Smart Campus Initiative encourages higher education institutions to adopt AI technologies for improved student services and campus management.⁸² CHED is revising its curriculum to address the evolving job market, focusing on fields like AI, robotics, and digital transformation.⁸³ Furthermore, CHED is also prioritizing the retraining and upskilling of graduates to prepare them for emerging jobs⁸⁴ and has committed to restructure its technical panels and committees to enhance the quality and relevance of academic programs.⁸⁵ AI will serve as a vital tool to enable adaptive learning platforms, tailored learning paths, and advanced assessment tools to drive curricular reforms.⁸⁶

Meanwhile, the Technical Education and Skill Development Authority (TESDA) is enhancing vocational training through Al-driven programs that offer personalized pathways for skills.⁸⁷ The agency is developing the National Technical Education and Skills Development Plan (NTESDP) 2023-2028, which prioritizes digitalization and prepares the workforce for Industry 4.0. To further support this, the Supporting Innovation in Philippine TVET System (SIPTVETS) project is modernizing training centers across the country, transforming them into innovation hubs capable of teaching high-level AI skills.⁸⁸

⁸⁶ Second Congressional Commission on Education (EDCOM II) (2024). Miseducation: The Failed System of Philippine Education.

⁸⁷ Technical Education and Skills Development. (2021). "The Potential of AI: Divergent Possibilities of Innovation. Accessed January 14, 2025 https://www.tesda.gov.ph/Uploads/File/LMIR/2021/LMIR%203_The%20Potential%20of%20AI%20Divergent%20Possibilities%20of%20Innovation.pdf

⁷⁸ Hernando-Malipot, Merlina. "DepEd, Khan Academy Collaborate to Improve Foundational Skills for Filipino Students," August 31, 2024. https://mb.com.ph/2024/8/31/dep-ed-khan-academy-collaborate-to-improve-foundational-skills-for-filipino-students.

⁷⁹ Bajo, Anna Felicia. "DepEd Inks Deal with Global Movement iamtheCODE to Enhance Women's Coding Skills I GMA News Online." GMA News Online, August 30, 2024. <u>https://www.gmanetwork.com/news/topstories/nation/918773/deped-inks-deal-with-global-movement-iamthecode-to-enhance-women-s-coding-skills/story/.</u>

⁸⁰ ICTS-EdTech (n.d.) Empowering Educators in Using ICT for a World -Class Basic Education. Accessed January 13, 2025 https://sites.google.com/deped.gov.ph/icts-edtech/home

⁸¹ Llego, M.A. (n.d.) DepEd Educational Technology Unit (ETU). Accessed January 13, 2025 <u>https://www.teacherph.com/deped-educational-technology-unit-etu/</u>

⁸² World Bank. "Digital Transformation of Philippine Higher Education." (2023).

⁸³ Lazaro, Jacob. "AI, Tech Jobs Easing out Traditional Work." INQUIRER.net, June 27, 2024. <u>https://newsinfo.inquirer.net/1955386/ai-tech-jobs-easing-out-traditional-work</u>.

⁸⁴ Ibid.

⁸⁵ Mandated by CHED Administrative Order No. 3, s. 2019, this effort involves including industry and government representatives to ensure curricular revisions focus on technology integration, interdisciplinary approaches, skill-based learning, and experiential education.

⁸⁸ "Gov't Signs Policies to Strengthen TVET, Address Skills Gap," May 10, 2024. <u>https://tesda.gov.ph/Media/NewsDetail/20343</u>.

TESDA has also entered into collaborations with the public and private sector to ensure its curriculum aligns with current technological advancements.⁸⁹ As an example, TESDA has partnered with Microsoft Philippines to train over 1.2 million vocational students in AI-related fields such as cybersecurity, productivity tools, and digital literacy. Through platforms such as Microsoft Learn and LinkedIn Learning, students gain access to certifications that enhance their employability particularly in AI-driven industries.⁹⁰

The Philippine Skills Framework—a collaborative effort by the DICT and the Analytics and Artificial Intelligence Association of the Philippines (AAP)—builds on these advancements by identifying essential AI and analytics skills for various fields thereby empowers educational institutions to refine curricula and design new courses that prepare learners for AI-driven careers.⁹¹

The private sector Is likewise active in projects to enhance accessibility and learning through AI. Startups such as Edusuite⁹² are developing innovative AI-driven solutions for classroom management and student engagement. Partnerships between tech giants like Cisco, Microsoft, or CompTIA for education and local educational institutions provide essential training and resources for effectively integrating AI technologies into curricula.⁹³ Furthermore, Coursera is actively seeking to expand partnerships in the Philippines to enhance its course offerings, including new AI features to improve learning outcomes and accessibility for students across the country.⁹⁴ Corporate social responsibility initiatives by telecommunication companies, such as Globe Telecom, focus on promoting digital literacy and AI education are implemented to enable better access to digital learning resources and more interactive learning experiences for students.⁹⁵

To ensure that AI integration in education aligns with ethical standards, the University of the Philippines (UP) has established principles for responsible AI use, emphasizing ethical development and deployment. The framework emphasizes ethics in AI by prioritizing human rights, fairness, transparency, accountability, and safety. It promotes inclusive applications in education, healthcare, and public services, ensuring marginalized groups benefit from AI developments.⁹⁶

 ⁸⁹ "TESDA Advances PH TVET Through More Partnership, Cooperation." January 9, 2023 <u>https://www.tesda.gov.ph/Media/NewsDetail/20210</u>
 ⁹⁰ Microsoft Philippines Communications Team. "TESDA Launches Digital Skilling Program for over 1.2 Million Tech-Voc Learners in Partnership with Microsoft – Microsoft News Center Philippines," September 7, 2023. <u>https://news.microsoft.com/en-ph/2023/09/07/tesda-launches-digital-skilling-program-for-over-1-2-million-tech-voc-learners-in-partnership-with-microsoft/</u>.

⁹¹ Department of Trade and Industry. "Gov't Agencies, Private Sector Join Forces to Upskill PH Workers through Philippine Skills Framework." Department of Trade and Industry Philippines, June 29, 2021. <u>https://www.dti.gov.ph/archives/news-archives/philippine-skills-framework/</u>.

⁹² Edusuite. Accessed January 14, 2025 <u>https://www.edusuite.asia</u>

⁹³ Baker, Ryan S. "Artificial intelligence in education: Bringing it all together." *Digital education outlook: Pushing the frontiers with AI, blockchain, and robots* (2021): 43-54.

⁹⁴ Lacsamana, B.H.. "Coursera eyeing more PHL partners, launches AI features." Business World Online. 27 April 2023

https://www.bworldonline.com/technology/2023/04/27/519541/coursera-eyeing-more-phl-partners-launches-ai-features/ ⁹⁵ Globe Telecom. Globe Group's Cascadeo Embarks on AI Centricity in 2024." 16 January 2024 <u>https://www.globe.com.ph/about-us/newsroom/corporate/cascadeo-embarks-on-ai-centricity-2024#gref</u>

⁹⁶ University of the Philippines. "University of the Philippines Principles for Responsible and Trustworthy Artificial Intelligence. University of the Philippines Media and Public Relations Office. Retrieved (n.d) <u>https://up.edu.ph/up-principles-for-responsible-artificial-intelligence/</u>



The WEF identified high-potential use cases for AI in healthcare, emphasizing its capacity to scale smart solutions that can significantly impact patient outcomes and operational efficiencies. ⁹⁷ Based on a study published by the University of Chicago Press, AI could save the U.S. healthcare sector with a total amount of USD200-USD360 billion annually, reducing overall spending by 5-10 percent. Administrative costs might drop by 7-14 percent (USD65-USD135 billion), while medical costs could decrease by 5-8 percent (USD130-USD235 billion).⁹⁸ AI will affect around 15 percent of healthcare work hours, automating routine tasks and alleviating workforce shortages.⁹⁹ Professions like nursing, administrative roles, and diagnostic specialties are projected to be significantly impacted, enabling staff to focus on more complex, patient-centered care while AI supports efficiency improvements.¹⁰⁰ AI's predictive capabilities are crucial in public health, improving disease modeling and crisis management.¹⁰¹

Nonetheless, according to the World Health Organization, the integration of AI in health necessitates regulatory frameworks to ensure safety and efficacy, emphasizing the need for ethical guidelines and governance structures.¹⁰² In this regard, the WHO¹⁰³ has established guiding principles to support ethical AI integration for health. WHO's framework promotes transparency, accountability, inclusiveness, and sustainability to ensure AI aligns with public trust and global health goals.

The Philippine Institute for Development Studies identifies AI as a "silver bullet" for augmenting the capabilities of healthcare workers, enabling them to focus on more complex tasks while AI handles routine processes.¹⁰⁴ This perspective is supported by the DOST, which highlights ongoing projects that leverage AI for digital health solutions, fostering partnerships that enhance the capabilities of local healthcare systems.¹⁰⁵ Furthermore, there is an increasing adoption of high-tech solutions in healthcare settings, suggesting a growing acceptance of AI-driven innovations among healthcare professionals and institutions.¹⁰⁶

 $\label{eq:https://www.mckinsey.com/industries/healthcare/our-insights/reimagining-healthcare-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-in-the-age-of-ai-industry-service-operations-industry-service-operations-industry-service-operations-in-the-age-of-ai-industry-service-operations-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry-service-operations-industry$

⁹⁷ Reiss, Dan, and Antonio Spina. "Scaling smart solutions with Al in health: unlocking impact on high-potential use cases." (2023).

⁹⁸ Sahni, Nikhil, George Stein, Rodney Zemmel, and David M. Cutler. The potential impact of artificial intelligence on healthcare spending. No. w30857. Cambridge, MA, USA:: National Bureau of Economic Research, 2023.

⁹⁹ Spatharou, Angela, Solveigh Hieronimus, and Jonathan Jenkins. "Transforming healthcare with AI: The impact on the workforce and organizations." McKinsey & Company 10 (2020).

¹⁰⁰ Chodhary. "Improving Consumer Experience with AI in Healthcare Service Operations | McKinsey," September 19, 2024.

¹⁰¹ Siwicki, Bill. "Al and Public Health – a Major Opportunity." Healthcare IT News, January 5, 2024. <u>https://www.healthcareitnews.com/news/ai-and-public-health-major-opportunity</u>.

¹⁰² World Health Organization (WHO) (2023). "Regulatory considerations on artificial intelligence for health." Accessed https://iris.who.int/bitstream/handle/10665/373421/9789240078871-eng.pdf?sequence=1&isAllowed=y

¹⁰³ World Health Organization. Regulatory considerations on artificial intelligence for health. World Health Organization, 2023.

 ¹⁰⁴ BusinessMirror. "Artificial Intelligence – a Silver Bullet to Enhancing Healthcare Workers Jobs and Improving Patient Care in the Philippines."

BusinessMirror, May 30, 2023. https://businessmirror.com.ph/2023/05/30/artificial-intelligence-a-silver-bullet-to-enhancing-healthcare-workers-jobs-andimproving-patient-care-in-the-philippines/.

¹⁰⁵ Department of Science and Technology. "DOST-PCHRD highlights projects on digital health solutions leveraging on partnerships." Accessed January 14, 2024 <u>https://www.pchrd.dost.gov.ph/news_and_updates/dost-pchrd-highlights-projects-on-digital-health-solutions-leveraging-on-partnerships/</u>

¹⁰⁶ Umlas, Mary Beatrice. "Health Care Goes High-Tech." INQUIRER.net, April 12, 2024. https://business.inquirer.net/454257/health-care-goes-high-tech.



Medhyve¹⁰⁷ is a Philippine startup that enhances digital medical procurement by using AI to streamline hospital processes, especially in rural areas. Through "Medhyve Intelligence," the platform offers AI-powered tools that optimize procurement efficiency, cutting traditional processes down to a few steps. The DOST-Philippine Council for Health Research and Development supports this initiative to make procurement timely and more cost-effective, improving access to quality medical supplies for healthcare facilities nationwide.

The development of AI-powered mobile clinics in the Philippines demonstrates the practical application of AI technologies in enhancing healthcare access, particularly in underserved areas. These initiatives aim to deliver essential health services using AI-driven tools, such as diagnostics systems and patient management platforms. Notable examples include telemedicine consultations enabled by AI in rural communities, predictive analytics to streamline patient flow in hospitals, and AI-powered chatbots for preliminary medical advice. These diverse applications showcase AI's potential to enhance service delivery and make healthcare more efficient and accessible.¹⁰⁸

Additionally, the healthcare business process outsourcing (BPO) sector in the Philippines is increasingly adopting AI to facilitate better patient-provider communication, thereby enhancing operational efficiency and improving patient care.¹⁰⁹

qure.ai

Qure.ai, a health-tech company based in India, through its Advancing Client-centered Care and Expanding Sustainable Services for TB (ACCESS TB) Program, automated the chest X-ray interpretation process using Al to improve tuberculosis diagnosis in the Philippines. The program reduces waiting time and dependency on the availability of radiologists, which, in turn, may reduce the risk of community transmission of tuberculosis.¹¹⁰

¹⁰⁷ Philippine Council for Health Research and Development. "PH Startup to Use AI to Improve Digital Medical Procurement." Accessed January 14, 2025. https://www.pchrd.dost.gov.ph/news_and_updates/ph-startup-to-use-ai-to-improve-digital-medical-procurement/.

¹⁰⁸ Dharmaraj, Samaya. "Al-Powered Mobile Clinic Unveiled in the Philippines – OpenGov Asia," February 21, 2024. <u>https://opengovasia.com/2024/02/21/ai-powered-mobile-clinic-unveiled-in-the-philippines/</u>.

¹⁰⁹ Philstar.com. "Healthcare BPO Philippines: Revolutionizing the Industry." Philstar.com, May 9, 2023. <u>https://www.philstar.com/business/biz-</u>memos/2023/05/09/2264763/healthcare-bpo-philippines-revolutionizing-industry.

memos/2023/05/09/2264763/healthcare-bpo-philippines-revolutionizing-industry. ¹¹⁰ qure.ai. "ACCESS TB Program in Philippines," September 20, 2022. <u>https://www.qure.ai/impact_stories/access_tb_philippines</u>.



The financial sector, with its reliance on vast amounts of data and the need to assess complex metrics, provides an ideal environment for AI applications to thrive.¹¹¹ AI applications are able to process and analyze data to improve credit decisions, detect fraud and threats, address financing gaps, and facilitate the extension of financial services to individuals and businesses which would otherwise have no access to these services.¹¹²

In the Philippines, banks and other financial institutions are at the forefront of deploying Al powered solutions. Private financial institutions have developed AI applications to augment customer service and streamline backroom processes.¹¹³ Digital banks like UNO Digital Bank¹¹⁴ and Tonik¹¹⁵ are redefining how credit is granted in the Philippines. By harnessing AI-powered credit scoring, they analyze non-traditional data sources such as telco usage and transaction patterns, which allows them to assess creditworthiness more effectively. This approach not only speeds up lending decisions but also improves their accuracy, making it easier for individuals, especially those previously underserved, to access financial services. By minimizing biases present in traditional credit evaluations, these innovations help open the doors to more inclusive financial opportunities.

Recognizing this potential, the Bangko Sentral ng Pilipinas (BSP), the Philippine's central banking authority, has endorsed the use of alternative data for credit scoring, emphasizing its potential to provide more accurate risk assessments and broaden access to credit for underserved populations in the Philippines.¹¹⁶



The **BSP** is exploring applications of ML in areas of forecasting and banking supervision,¹¹⁷ and is receptive of innovation in financial products. BSP Circular No. 1153, Series of 2022 provides for a Regulatory Sandbox Framework, allowing BSP-supervised institutions with financial solutions involving new or emerging technologies, including AI, to participate in a regulatory sandbox and eventually offer said products for public consumption.

- https://fintechnews.ph/57339/lending/uno-digital-bank-taps-trusting-social-for-ai-powered-credit-scoring/ ¹¹⁵ Fintech News Philippines. "Philippines Digibank Tonik Taps FinScore's Alternative Credit Scoring Solution." February 5, 2021
- https://fintechnews.ph/44501/lending/philippines-digibank-tonik-taps-finscores-alternative-credit-scoring-solution/
- ¹¹⁶ Rosales, E.F. "BSP pitches alternative data for credit score." The Philippine Star. January 5, 2022.

https://www.philstar.com/business/2022/01/05/2151818/bsp-pitches-alternative-data-credit-score

¹¹⁷ Amodia, R., Gabriel, V.M.C and Mapa, C.R.. "Thinking Al-Head: Exploring Machine Learning Applications in Central Banks. Bangko Sentral ng Pilipinas Ecnomic Newsletter No. 21-03. December 2021 <u>https://www.bsp.gov.ph/Media_And_Research/Publications/EN21-03.pdf</u>

¹¹¹ Tierno, P.. "Artificial Intelligence and Machine Learning in Financial Services." Congressional Research Service. April 03, 2024 https://crsreports.congress.gov/product/pdf/R/R47997

 ¹¹² Biallas, M. and O' Neill, F. "Artificial Intelligence Innovation in Financial Services." International Finance Corporation, Note 85: 2-5. June 2020.
 ¹¹³ Schnabel, Chris, and Chrisee Dela Paz. "Artificial Intelligence Reinventing Banking in PH," April 24, 2017. <u>https://www.rappler.com/business/167751-</u>

artificial-intelligence-banking-philippines-bpi-bdo/. ¹¹⁴ Fintech News Philippines. "UNO Digital Bank Taps Trusting Social for Al-Powered Credit Scoring." December 19, 2022. https://fictochangur.gov/fictoch

5. Agriculture

Al is also recognized for its potential to address global challenges, such as climate change and food security. Investment in Al for agriculture stood at USD518.7 million in 2017 and is projected to surge to USD2.6 billion by 2025, reflecting a robust 16.2 percent annual growth rate.¹¹⁸ Al-driven precision farming boosts yields by up to 21 percent, reduces pesticide use by 9 percent, and can enhance farmer incomes by USD800 per acre.¹¹⁹ Al also supports regenerative agriculture by reducing water wastage by 30-40 percent through optimized irrigation. Chemical use drops by 10-20 percent, cutting costs and environmental impact, with energy efficiency up by 17.3 percent and emissions dropping by 23 percent, making agriculture more efficient and sustainable.¹²⁰ These advancements in agriculture are crucial, given the expected addition of 2 billion people by 2050.¹²¹

In the Philippines, the Philippine Development Plan 2023-2028 Chapter 5 on Modernizing Agriculture and Agribusiness, recognizes the need to adopt modern production technologies that increase sustainability and yield while reducing the overall cost of operation. Different applications of AI may significantly assist the agriculture sector. AI-based surveillance systems may facilitate the efficient monitoring of crops, detection of pests, and diagnosing soil faults.¹²² Likewise, AI applications can forecast weather patterns and assess crop health.¹²³ Agricultural robots can also perform labor-intensive and demanding tasks.¹²⁴



Project Gul.Al, an initiative by the Department of Agriculture (DA) and developed by the DOST-ASTI, focuses on using Al to revolutionize farming practices in the Philippines. Through the integration of Al technologies, the project aims to assist farmers in monitoring critical variables such as soil health, weather conditions, and crop status. Providing real-time data and insights helps optimize decisions related to irrigation, fertilization, and pest control. This approach enhances productivity while promoting more sustainable and efficient agricultural methods, which is essential in addressing challenges in the sector.¹²⁵ In 2021,

¹²⁰ Papadopoulos, George, Simone Arduini, Havva Uyar, Vasilis Psiroukis, Aikaterini Kasimati, and Spyros Fountas. "Economic and Environmental Benefits of Digital Agricultural Technologies in Crop Production: A review." *Smart Agricultural Technology* (2024): 100441.

¹²¹ Heard, J. "From the field to the dinner table, Al in agriculture can create a resilient food system." World Economic Forum. April 29, 2022. https://www.weforum.org/agenda/2022/04/ai-can-create-a-resilient-food-system-from-the-lab-to-the-field-to-the-dinner-table/

¹¹⁸ Mana, A. A., A. Allouhi, A. Hamrani, S. Rahman, I. el Jamaoui, and K. Jayachandran. "Sustainable Al-Based Production Agriculture: Exploring Al Applications and Implications in Agricultural Practices." *Smart Agricultural Technology* (2024): 100416.

¹¹⁹ Warrik, J. & Borthakur, S. "Farms of the future: How can AI accelerate regenerative agriculture?" World Economic Forum. September 10, 2024 https://www.weforum.org/agenda/2024/09/farms-ai-accelerate-regenerative-agriculture/

¹²² Javaid, Mohd, Abid Haleem, Ibrahim Haleem Khan, and Rajiv Suman. "Understanding the potential applications of Artificial Intelligence in Agriculture Sector." Advanced Agrochem 2, no. 1 (2023): 15-30.

¹²³ Ibid.

¹²⁴ Ibid.

¹²⁵ DOST-Advanced Science and Technology Institute (DOST-ASTI). "Project Gul.AI: Promoting AI Technology in Agriculture." December 7, 2020 https://asti.dost.gov.ph/communications/angsurian/2019/project-gul-ai-promoting-ai-technology-in-agriculture/

a Memorandum of Agreement (MOA) between DOST-ASTI and the University of Rizal System (URS) to support research and practical AI deployment in agriculture, modernize farming methods, and enhance sustainability and productivity.¹²⁶



The Philippine Rice Information System (PRiSM)¹²⁷ uses satellite data, crop modeling, and ICT to monitor rice production and support informed decision-making for the DA. PRiSM provides real-time mapping of rice areas, yield estimation, and disaster assessments, helping manage rice resources efficiently. PRiSM also assists in policy formulation, planning, and field monitoring, aiming for a rice-secured Philippines through enhanced data-driven strategies. Recently, PRiSM conducted a national retooling event to refine its 2024 protocols, focusing on improved field data collection and utilization.

Other projects include, among others:

- The Robot for Optimized and Autonomous Mission-Enhanced Responses (ROAMER) Project involves a prototype of a robot that identifies plants with diseases, aiding in decision making processes.¹²⁸
- The Philippine Rice Research Institute launched its **e**-**Damuhan application**, which employs AI weed recognition theory.¹²⁹
- The Artificial Intelligence for Census of Agriculture and Fisheries Project In collaboration with the Philippine Statistics Authority, the project aims to modernize the nationwide census on agriculture and fisheries, resulting in a more reliable and timely statistical data that supports informed policy-making and strategic planning. Through a partnership with the National Mapping and Resource Information Authority, the project enables comprehensive landcover mapping

 ¹²⁶ DOST-Advanced Science and Technology Institute (DOST-ASTI). Virtual MOA Signing between the DOST-ASTI and the University of Rizal System (URS) for the Gul.ai Project. December 23, 2021 https://www.asiaresearchnews.com/content/virtual-moa-signing-between-dost-asti-and-university-rizal-system-urs-gulai-project
 ¹²⁷ Philippine Rice Information System (PRISM). National Retooling on Prism Field Protocols for 2024 Implementation. August 9, 2023

¹²⁷ Philippine Rice Information System (PRiSM). National Retooling on Prism Field Protocols for 2024 Implementation. August 9, 2023 <u>https://prism.philrice.gov.ph/_trashed-4/______</u>

¹²⁸ Arayata, M.C. (September 05, 2022). "ASTI to develop robot that detects plant diseases." Philippine News Agency. September 5, 2022 https://www.pna.gov.ph/articles/1182964

¹²⁹ Philippine Rice Research Institute. "e-DAMUHAN" 2021. <u>https://www.philrice.gov.ph/edamuhan/</u>.

using AI and satellite imagery, producing detailed and precise maps essential for resource management and sustainable agricultural practices.

Notwithstanding AI initiatives in the agriculture sector, the persistence of issues on digital literacy and resource accessibility hinder full utilization of AI particularly by small scale farmers.¹³⁰

¹³⁰ Briones, R. M., Galang, I. M. R., & Latigar, J. S. (2023). Transforming Philippine Agri-Food Systems with Digital Technology: Extent, Prospects, and Inclusiveness (No. 2023-29). PIDS Discussion Paper Series

V. Challenges and Barriers to Al Adoption





Challenges and Barriers to AI Adoption

Despite the potential of AI adoption, the Philippines faces numerous barriers to adopting AI. These challenges are reflected in the 2023 AI Readiness Index, which ranked the Philippines below many of its regional peers in terms of preparedness for AI adoption.¹³¹ The index evaluates countries based on government, technology, and data and infrastructure, among other factors. While the Philippines has made strides in its digital and AI ecosystem, it continues to face significant impediments, particularly in areas such as digital infrastructure, skills development, data availability, regulatory frameworks, and energy sufficiency.

A. Insufficient Digital Infrastructure

Al technologies rely on real-time data processing and cloud-based solutions, requiring fast, reliable internet connectivity and substantial data processing capabilities. However, to date, many areas, particularly those outside urban centers like Metro Manila, continue to experience slow, unreliable, and expensive connections¹³², significantly hindering AI adoption in the country.

¹³¹ BusinessWorld Online. "Philippines Slips in Government AI Readiness." BusinessWorld Online, December 26, 2023.

https://www.bworldonline.com/infographics/2023/12/27/565501/philippines-slips-in-government-ai-readiness/. ¹³² NEDA, Policy Note on Open Access in Data Transmission, 2024



Figure 7. Broadband Internet Penetration by Connectivity Types and Provinces

Source: World Bank staff calculations based on data from the PSA 2020 Census of Population and Housing. Note: Bars are sorted by total access to fixed broadband. Bar width is weighted by population. Only NCR and provinces with at least 1 million population are labeled.

Source: World Bank Group

B. Human Capital and Digital Skills Gap

There appears to be a dearth of professionals with expertise in AI development and management, such as data scientists, machine learning engineers, and AI specialists in the Philippines. These professionals are critical for developing, deploying, and maintaining AI systems across industries. Without a strong pipeline of professionals trained in these advanced technical skills, the Philippines will continue to lag behind in AI innovation as businesses and public sector organizations struggle to find the talent needed to integrate AI solutions effectively.

While the problem may be directly attributed to the lack of programs and trainings dedicated to AI technologies, the more pressing issue that needs more urgent attention is the struggle of the Philippine educational system to provide even the foundational skills necessary for the digital economy. Based on the 2022 PISA results, Filipino students ranked near the bottom globally in reading, mathematics, and science.¹³³ These results reflect deeper issues in the country's ability to equip its population with the necessary skills to participate in AI-driven sectors.

One major gap is in basic digital literacy or the ability to use digital tools and technology effectively, which is crucial for engaging with AI-powered systems. Many Filipino students and workers lack basic familiarity with these technologies.¹³⁴ Schools and training programs need to focus on ensuring that students and workers are proficient in using everyday digital tools and have the capacity to adapt to new technologies. It should also be noted that certain sectors, such as agriculture, tend to lag behind other sectors in the adoption of technology.¹³⁵

Beyond basic digital literacy, there is also a need for skills related to data literacy—the ability to interpret and work with data. Al technologies rely heavily on data, and many roles in the future workforce will require workers to make decisions based on data, analyzing patterns from data, and applying these insights in everyday tasks. For example, in sectors like healthcare, Al-powered diagnostic tools can assist medical professionals, but they need to understand how to interpret the data produced by these systems. Without data literacy, the full potential of Al to improve decision-making and productivity will not be realized.

Lastly, there is a growing need for AI literacy—a basic understanding of how AI works, its potential benefits, and its risks. While not every Filipino needs to be an AI expert, it is important for the general public to have a basic comprehension of AI concepts. This is particularly relevant for workers who will need to collaborate with AI systems in various industries and for consumers who will interact with AI in everyday applications, such as online services, finance, and retail. Awareness of AI's capabilities and limitations will empower people to use these technologies more effectively and safely.

C. Data Availability and Governance Issues

The availability of high-quality data and the establishment of proper governance frameworks are critical to the successful adoption of AI. Without access to sufficient, reliable, and well-governed data, AI systems cannot function as effectively, leading to suboptimal outcomes and reduced public trust in AI-driven solutions.

One major challenge faced in the Philippines is the limited digitalization of data across sectors. Data, even government data, is still collected and stored in non-digital formats, making it difficult to access, process, and integrate into AI systems. For example, healthcare records, agricultural data, and public service information are often maintained manually or in

¹³³ OECD PISA, 2022 Results (Volume I and II) – Country Notes: Philippines, OECD, 2023

¹³⁴ ASEAN Foundation, One Divide or Many Divides? Underprivileged ASEAN Communities' Meaningful Digital Literacy and Response to Disinformation, ASEAN Foundation, 2024

¹³⁵ Briones, R. M., Galang, I. M. R., & Latigar, J. S. (2023). Transforming Philippine Agri-Food Systems with Digital Technology: Extent, Prospects, and Inclusiveness (No. 2023-29). PIDS Discussion Paper Series.

outdated systems. This reliance on paper-based or legacy technologies creates significant obstacles for AI applications that require vast amounts of structured, machine-readable data to generate insights, optimize operations, or automate decision-making. Until these sectors undergo full digital transformation, the ability to use AI effectively remains constrained.

Another issue is the fragmentation of data sources. Data that could be valuable for AI systems is often scattered across various government agencies, private organizations, and regions, with little coordination between them. For example, different government departments may collect similar types of data—such as population statistics, economic indicators, or public health information—but lack the infrastructure or policies to share and consolidate these datasets. This fragmentation limits the potential for AI applications. Moreover, inconsistent data collection standards across sectors exacerbate the problem, as data generated by one entity may not be compatible with data from another, making it harder to aggregate for AI use.

Data quality also poses a significant challenge. Many datasets that can potentially be used for AI applications are incomplete, outdated, or unrepresentative of the broader population. This issue is particularly pronounced in rural areas, where less data is collected and where data collection practices may not be as rigorous as in urban centers. Poor data quality can lead to biased AI models, which can, in turn, result in unfair or inaccurate outcomes. For example, an AI system designed to improve healthcare delivery may underperform if it is trained on datasets that disproportionately represent urban populations, while neglecting the healthcare needs of rural communities. Ensuring the availability of diverse, accurate, and up-to-date data is crucial for building AI systems that work effectively across all sectors and regions.

Data privacy laws and regulations may need to be reviewed to ensure that personal data is used responsibly and ethically in AI applications without undermining public trust or innovation.

D. AI Ethics and Accountability

The development of regulatory and ethical frameworks for AI in the Philippines is still in its formative stages, presenting a significant barrier to the widespread adoption of AI technologies. The lack of comprehensive and cohesive guidelines on regulating AI development and deployment creates uncertainty for both businesses and government institutions. Without clear rules on issues such as accountability, transparency, and ethical considerations, many organizations, especially in the public sector, remain hesitant to integrate AI into their operations.

One key issue is the lack of clear accountability mechanisms for AI-driven decisions. Al systems, especially those that employ machine learning algorithms, can make automated decisions based on vast datasets. However, when an AI system makes an incorrect or biased decision, it is often unclear who is responsible—the developers, the organization deploying the AI, the person using the AI, or the AI system itself. This lack of clarity can lead to legal uncertainties, particularly in sectors like healthcare, finance, and public services, where

decisions made by AI could have significant consequences for individuals. The absence of clear regulations on accountability for AI decisions reduces the likelihood of the adoption of AI on a broader scale.

Transparency in AI systems is another area that requires regulatory attention. Many AI algorithms operate as "black boxes," meaning that their decision-making processes are not easily understandable, even to experts. This lack of transparency can lead to distrust, especially when AI systems are used in critical decision-making areas, such as law enforcement, loan approvals, or hiring practices. In these contexts, the inability to explain how an AI system arrived at a particular decision can raise concerns about fairness and bias. Establishing regulations that require AI systems to be transparent and explainable is essential to ensuring that AI technologies are used ethically and that their decisions can be scrutinized and understood by both developers and users.

Bias and discrimination in AI algorithms are significant ethical concerns that the Philippines needs to address through a more comprehensive regulatory framework. AI systems can unintentionally perpetuate bias present in the data they are trained on, leading to discriminatory outcomes. For example, if an AI system is trained on biased data, it may make decisions that unfairly disadvantage certain groups based on gender, race, or socioeconomic status. Without proper regulations to ensure that AI systems are developed and tested to prevent such biases, there is a risk that AI could reinforce existing inequalities. Ethical guidelines need to be established to ensure that AI systems are designed to be fair and unbiased.

E. Energy Constraints

The availability, sufficiency and cost of electricity are among the barriers to AI adoption in the Philippines, particularly for systems requiring large-scale data processing, machine learning, and cloud computing.¹³⁶ The integration and advancement of AI technologies require substantial energy consumption. Consequently, the same has substantial implications for environmental sustainability. While AI has the potential to contribute positively to environmental protection, such as through optimizing energy use and enhancing climate modeling, it also presents significant environmental risks and sustainability challenges.

The training and operation of AI models, especially large-scale deep learning models, require vast amounts of computational power. This computational power is typically provided by data centers that consume enormous quantities of electricity. For example, training a single AI model can emit as much carbon dioxide as five cars over their entire lifespans.¹³⁷ A study conducted by the Massachusetts Institute of Technology reveals that the Cloud, a necessary component for AI applications, has a greater carbon footprint than the entire airline industry, and that a single data center can consume the equivalent electricity of 50,000 homes.¹³⁸ The

¹³⁶ Within the first half of 2024, the main power grids of the Philippines were placed on red or yellow alerts, indicative of the failure of the power supply's inability to meet power demand.

¹³⁷ Strubell et al., "Energy and Policy Considerations for Deep Learning in NLP," *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*, 2019.

¹³⁸ Monseratte, S.G. "The Staggering Ecological Impacts of Computation and the Cloud", Accessed January 14, 2025. https://thereader.mitpress.mit.edu/the-staggering-ecological-impacts-of-computation-and-the-cloud/

same study reveals that electricity utilized by data centers accounts for 0.3 percent of overall carbon emissions worldwide, and if we extend our accounting to include networked devices like laptops, smartphones, and tablets, the total shifts to 2 percent of global carbon emissions. The reliance on fossil fuels for electricity in many parts of the world exacerbates the carbon footprint of AI, contributing to climate change. This is particularly relevant for the Philippines, where energy consumption is heavily dependent on fossil fuels, making the environmental impact of AI development a significant concern.

The Philippines has some of the highest rates in Southeast Asia.¹³⁹ This places a considerable burden on businesses and government agencies aiming to implement energy-intensive AI solutions. Expensive electricity makes AI adoption prohibitive for small enterprises, particularly in a developing economy where businesses are already grappling with limited access to funding and poor infrastructure challenges.



Figure 8. Electricity Prices: Philippines vis-à-vis Neighboring Countries

Source: Ravago, 2023

Energy stability is another significant challenge to AI adoption in the Philippines, particularly in rural and remote areas where power outages are frequent. While the Department of Energy projects that pipeline capacity will be sufficient to meet demand,¹⁴⁰ seasonal energy disruptions still occur. These disruptions would severely impact AI operations that rely on constant data processing and real-time analytics, reducing both efficiency and reliability.

¹³⁹ Ravago, Majah-Leah V. The Nature and Causes of High Philippine Electricity Price and Potential Remedies. No. 202301. Department of Economics, Ateneo de Manila University, 2023. ¹⁴⁰ Department of Energy. "*Philippine Energy Plan 2023-2050*"

VI. Risks in the Use of Al



Risks in the Use of Al



Although the development and use of AI technologies results in significant benefits, there are certain risks to its adoption such as worker displacement, disinformation, security and privacy breaches, cybercrime and environmental externalities. To maximize Al's potential, it is imperative to understand these risks and how they may be mitigated.

A. Cybersecurity and Data Privacy

The integration of AI into various aspects of life and industry brings with it significant cybersecurity and data privacy risks. Due to the large scope of datasets that AI applications use, the degree of control over the processing of information may decrease, resulting in data privacy breaches and even adversarial attacks. This may occur due to (a) lack of robust cybersecurity architecture, (b) inadequate measures to identify potential threats and attack vectors, (c) insufficient data privacy safeguards, and (d) improperly implemented authentication and authorization mechanisms, among others.¹⁴¹

Regulations must be in place to sufficiently safeguard the rights of individuals to data privacy and protection, while not unduly stifling the useful application of AI technologies.

To address such concerns, the government has issued regulations such as the National Cybersecurity Plan (NSCP), which consists of robust and coherent strategies that would minimize national security risks in order to promote a peaceful, secure, open, and cooperative ICT environment.¹⁴² The NSCP 2023-2028 identified the following desired outcomes: (a) the

¹⁴¹ GOV.UK. "Cyber Security Risks to Artificial Intelligence," May 15, 2024. https://www.gov.uk/government/publications/research-on-the-cyber-security-ofai/cyber-security-risks-to-artificial-intelligence. ¹⁴² Section 5 (r), RA No. 10844 IRR.

State and its people in cyberspace proactively protected secured; (b) cybersecurity workforce capabilities increased; and (c) cybersecurity policy framework strengthened.

There are also pending legislative measures¹⁴³ to institutionalize the creation of the comprehensive cybersecurity program and the strengthening and modernization of National Cybersecurity Inter-Agency Committee (NCIAC) established pursuant to Executive Order (EO) No. 189, series of 2015, as amended by EO No. 95, series of 2019. The NCIAC is mandated to assess the vulnerabilities and risks of the country's cybersecurity, issue updated security protocols to all government employees, for the proper handling, distribution and storage of all forms of documents and communication, and enhance the public-private partnership to deter cyberattacks, minimize cyber risks and increase cyber resiliency.

Additionally, the National Privacy Commission has issued NPC Advisory No. 2024-04 dated December 19, 2024, which provides guidelines on the application of RA 10173 or the Data Privacy Act to AI systems processing personal data, and outlines the obligations of personal information controllers and personal information processors as regards transparency, accountability, fairness and accuracy of their AI processes.

B. Disinformation, Misuse and Cybercrime

One of the major risks associated with AI is its potential to exacerbate disinformation. Disinformation refers to the deliberate spread of false or misleading information with the intent to deceive.¹⁴⁴ AI technologies, particularly those involving generative models, have significantly amplified the scale and sophistication of disinformation campaigns, posing substantial challenges to societies worldwide, including the Philippines.

Al-driven disinformation leverages sophisticated techniques to create and disseminate false information. Generative AI models can produce highly realistic images, videos, and audio that are difficult to distinguish from authentic content. These technologies enable malicious actors to fabricate speeches, manipulate visual evidence, and create entirely fictitious events. The use of AI to automate and amplify such disinformation campaigns increases their reach and effectiveness, making them more dangerous to economic stability.

The rapid spread of AI-generated disinformation has serious implications for democratic processes, such as elections. AI-driven disinformation can also exacerbate social divisions and fuel conflicts. Lastly, AI-driven disinformation may have significant negative impact to the economy.

While there are several laws relating to public disinformation and cybercrime, a review of these laws indicates that they may not be sufficient to capture the possible disinformation and the malicious misuse of AI. Given the rapid pace and sophistication by which AI applications are utilized, penal laws may not be able to contemplate all malicious activities involving said AI applications.

¹⁴³ House Bill (HB) Nos. 10260 (Rep.Romero); HB No. 10355 (Rep. Fresnedi); HB No. 10383 (Rep. Tan); HB No. 10649 (Romero); HB No. 10787 (Rep. Hernandez), and Senate Bill No. 1365 (Sen. Marcos)

¹⁴⁴ Read more on AI and disinformation here: <u>https://www.cambridge.org/core/journals/data-and-policy/article/role-of-artificial-intelligence-in-</u> disinformation/7C4BF6CA35184F149143DE968FC4C3B6.

Notably, in 2021, the Philippines adopted the UNESCO Recommendation on AI Ethics, emphasizing human rights at the core of AI regulatory frameworks. Furthermore, in 2023, the Philippines joined the Bletchley Declaration alongside the European Union (EU) and other countries, committing to principles of human rights protection, transparency, fairness, accountability, and ethical oversight in AI applications.

More recently, in 2024, the DICT and Civil Service Commission has drafted a Joint Memorandum Circular (JMC) on the Principles and Guidelines for an Ethical and Trustworthy Use of AI in the Government. The draft JMC provides that government institutions are encouraged to adopt the following principles in the use of AI: (a) principle of do no harm; (b) cyber safety and security; (c) data privacy and protection; (d) robustness and reliability; (e) fairness and non-discrimination; (f) transparency and explainability; (g) responsibility and accountability; (h) contestability; (i) reasonable human control; (j) human-centricity; and (k) sustainability. Notably, the foregoing principles are aligned with the core principles provided by the UNESCO Recommendation on AI Ethics.

C. Intellectual Property and Antitrust Challenges

Given its vast capabilities, AI may diminish or even replace human intervention and ingenuity in the creation of intellectual property.¹⁴⁵ In these scenarios, the question of whether intellectual property rights are created arises. Parenthetically, should intellectual property rights be granted, determining the personalities that enjoy these rights, the extent of said rights, and the manner by which such rights would be protected is a challenge.

The Intellectual Property Code (IP Code) or RA 8293 provides the legal framework for intellectual property rights in the Philippines. Under the IP Code, "author" refers to natural person,¹⁴⁶ thereby precluding recognition of copyright over AI-generated works. This position is consistent with jurisprudence in other countries which have held that that work generated by AI without sufficient human authorship may not be considered as "original work" that may be subject to protection of copyright laws.¹⁴⁷

On the other hand, the converse appears to apply to patents. Based on the definition of "patentable inventions" under the IP Code, any "technical solution of a problem in any field of human activity which is new, involves an inventive step and is industrially applicable" may be subject of a patent grant, regardless of how the same was generated. The United States Patents and Trademarks Office, in its guidance issued on February 2024, supports such interpretation when it declared, that Al-assisted inventions are not categorically unpatentable, and patent protection may be sought for Al-assisted inventions where one or more persons made a significant contribution to the claimed invention.¹⁴⁸

With regards to market competition, AI technologies may be leveraged to achieve procompetitive efficiencies through increased access to information and transparency,

¹⁴⁵ Cuntz, Alexander, Carsten Fink, and Hansueli Stamm. "Artificial Intelligence and Intellectual Property: An Economic Perspective." World Intellectual Property Organization (WIPO) Economic Research Working Paper Series 77 (2024).

¹⁴⁶ Section 171.1, Intellectual Property Code. "Author" is the natural person who has created the work.

¹⁴⁷ Thaler v. Perlmutter, No. 1:22-cv-1564 (D.D.C. August 18, 2023); In re: Second Request for Reconsideration for Refusal to Register SURYAST (SR # 1-11016599571; Correspondence ID: 1-5PR2XKJ) dated December 11, 2023.

¹⁴⁸ US PTO Inventorship Guidance for AI-Assisted Inventions, <u>89 FR 10043</u>, <u>10044</u> FN1 (February 13, 2024).

allowing firms to optimize their resources in producing goods that better respond to demand, thereby reducing wastage. Al may also be used to detect inefficiencies and defects in their systems and processes, and improve the quality and delivery of their services. On the other hand, consumers may use Al make decisions which better address their individual preferences.¹⁴⁹

Nonetheless, the resulting transparency in the market may be used by firms to engage in anticompetitive coordinated conduct or abuse their market power in violation of RA 10667 or the Philippine Competition Act.

The high capital and data demands of AI can result in the rise of a few companies, which may leverage their access to necessary inputs in perpetuating exclusionary and exploitative conduct to harm market competition. Firms that gather extensive datasets possess a distinct competitive advantage as these can develop more accurate and effective AI solutions. Due to network effects, early adopters may establish substantial advantages, making it difficult for new entrants to compete effectively with established firms.¹⁵⁰ Additionally, the ability of AI to enhance predictability and market transparency, make interactions between competitors easier, thereby increasing the risk of explicit and tacit collusion among rival firms.¹⁵¹ With AI, it becomes easier for competitors to share pricing signals, monitor compliance, and identify any departures from their collusive agreements.

D. Labor Market Disruptions

As with other technological advancements, the adoption of AI could potentially exacerbate existing disparities among different segments of the population if not accompanied by inclusive policies and safeguards. A study conducted for the International Monetary Fund¹⁵² revealed some consistent patterns concerning AI exposure: women and college-educated individuals are more exposed but also better poised to reap AI benefits, and older workers are potentially less able to adapt to the new technology. The impact of AI may also increase labor income inequality and widen wealth gap among social classes.

As AI technologies advance, they are increasingly capable of performing tasks that were traditionally done by humans, leading to concerns about widespread job losses and the broader implications for employment. A study by McKinsey Global Institute indicates that up to 375 million workers worldwide may need to switch occupational categories and acquire new skills by 2030 due to advancements in automation and AI technologies.¹⁵³

This risk is particularly pertinent to the Philippines, where many workers are engaged in sectors susceptible to automation. The World Bank reported that within East Asia and Pacific, the Philippines is more exposed to AI's labor displacement effect given the country's higher

¹⁴⁹ Gal, Michal S., and Niva Elkin-Koren. "Algorithmic consumers." Harv. JL & Tech. 30 (2016): 309.

¹⁵⁰ Carugati and Guerra, "Antitrust in the Age of Artificial Intelligence: Lessons from "I, Robot", May 2024.

¹⁵¹ OECD. OECD Business and Finance Outlook 2021 AI in Business and Finance" September 24, 2021 <u>https://www.oecd.org/en/publications/oecd-business-and-finance-outlook-2021 ba682899-en.html</u>)

¹⁵² Cazzaniga, Mauro, Ms Florence Jaumotte, Longji Li, Mr Giovanni Melina, Augustus J. Panton, Carlo Pizzinelli, Emma J. Rockall, and Ms Marina Mendes Tavares. Gen-AI: Artificial intelligence and the future of work. International Monetary Fund, 2024.

¹⁵³ Manyika, James, Susan Lund, Michael Chui, Jacques Bughin, Jonathan Woetzel, Parul Batra, Ryan Ko, and Saurabh Sanghvi. "Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages." (2017).

engagement in cognitive services sectors.¹⁵⁴ In fact, the Department of Labor and Employment (DOLE) has voiced concerns about the potential for AI to displace jobs in the IT-BPO sector, particularly those involving routine and repetitive tasks.

However, the DOLE views AI as an opportunity for the industry to transition towards highervalue services that require advanced skills, such as AI system management and data analytics.¹⁵⁵ This is affirmed by the Contact Center Association of the Philippines (CCAP), representing a major segment of the BPO industry. The CCAP expressed optimism about the opportunities presented by AI but also stresses the need for adaptation. While AI can automate routine tasks, it will not fully eliminate human roles, especially those requiring complex problem-solving and emotional intelligence. Industry leaders emphasize that AI will instead create opportunities for upskilling and higher-value tasks, complementing the existing workforce.¹⁵⁶

To respond to these challenges, the Philippine government has enacted legislations, such as RA 11629 or the *Trabaho Para sa Bayan Act* and RA 11927 or the Philippine Digital Workforce Competitiveness Act. Both laws aim to enhance the skills and competitiveness of the Philippine workforce, ensuring they are equipped to adapt to the rapid pace of digitalization and technological advancements.

E. Environmental Sustainability and Resource Consumption

Al may potentially accelerate resource consumption. Al technologies enable more efficient extraction and use of natural resources, while beneficial for economic productivity, can lead to overexploitation.

Apart from energy constraints, researchers have observed an increase in the use of water due to increased AI use. Data centers use significant amounts of water to manage their temperatures. Coinciding with increased AI use, researchers found that major technology firms have increased water consumption by up to 34 percent.¹⁵⁷ Data centers, essential for storing and processing the massive datasets required for AI, are also significant sources of greenhouse gas emissions. These facilities need continuous cooling to prevent overheating, which further increases their energy consumption.

The production of hardware necessary for AI, including servers, GPUs, and other electronic components, involves mining and manufacturing processes that have their own environmental impacts. Mining for rare earth metals, essential for many electronic components, often leads to habitat destruction, soil and water pollution, and significant carbon emissions. The disposal of electronic waste (e-waste) from outdated or obsolete

¹⁵⁴ World Bank. 2024. "Jobs and Technology, World Bank East Asia and Pacific Economic Update" (October 2024). Washington, DC: World Bank, doi: 10.1596/978-1-4648-2175-2.

 ¹⁵⁵ Bula, Roey Ryan H., Marivie G. Catahan, and Sofia D. Enorasa. "The transformation in Philippine BPO companies: The impact of digital workplace transformation to the front office CSR in terms of their work culture." *International Journal of Engineering, Business and Management* 74 (2023): 40-49.
 ¹⁵⁶ Fernandez-Brojan, C. and Israel, D.. "Al won't take over BPO jobs, execs assure." <u>Inquirer.net</u>. July 29, 2023 <u>https://business.inquirer.net/412848/ai-wont-take-over-bpo-jobs-execs-assure</u>

wont-take-over-bpo-jobs-execs-assure ¹⁵⁷ Criddle, C. and Bryan, K. "Al boom sparks concern over Big Tech's water consumption" Financial Times February 25, 2024 <u>https://www.ft.com/content/6544119e-a511-4cfa-9243-13b8cf855c13</u>.

hardware presents additional environmental challenges, as improper disposal can release toxic substances into the environment.

Al-driven precision agriculture can increase crop yields but can also encourage intensified farming practices that deplete soil health and biodiversity.¹⁵⁸ Increased efficiency in other industries might lead to higher consumption levels, offsetting the environmental benefits through a phenomenon known as the rebound effect.¹⁵⁹

¹⁵⁸ Garnett, Tara, Michael C. Appleby, Andrew Balmford, Ian J. Bateman, Tim G. Benton, Phil Bloomer, Barbara Burlingame et al. "Sustainable intensification in agriculture: premises and policies." *Science* 341, no. 6141 (2013): 33-34. ¹⁵⁹ Berkhout, Peter HG, Jos C. Muskens, and Jan W. Velthuijsen. "Defining the rebound effect." *Energy policy* 28, no. 6-7 (2000): 425-432.

VII. Strategic Policy Recommendations





Strategic Policy Recommendations

To maximize AI's transformative potential in the Philippines, interventions must focus on addressing the most binding constraints first—those that currently prevent AI from delivering broad and sustainable benefits. This approach prioritizes actions with the highest immediate impact, while recognizing the need for phased implementation to align with limited government and private sector resources. The recommendations are categorized into two tiers: foundational priorities for immediate action and complementary measures for long-term success.

Foundational Priorities

Set clear directions and strategies specific to AI. Given the numerous but separate initiatives on AI by different government agencies, it is imperative to establish a unified national AI strategy to align efforts, reduce inefficiencies, and unlock AI's full potential across the economy. A lead agency or office should be designated to spearhead this effort, building on existing work accomplished by the DICT, DTI, DOST, and other agencies while incorporating inputs from industry leaders, academia, and civil society. This collaborative approach ensures the strategy addresses AI's cross-cutting impacts comprehensively.

To ensure clarity and enforceability, the strategy should be formalized through an Executive Order (EO), similar to the U.S. Executive Order on AI or Vietnam's Prime Minister's Decision on AI. The EO should designate the lead agency or office as responsible for the strategy's implementation and oversight. At the same time, it should assign roles to other agencies and offices based on their expertise. For instance, the DOST could advance AI research and innovation, the DOH could focus on patient safety and data privacy in healthcare AI, and

DepEd could work on integrating AI literacy and digital skills into education. This structure fosters collaboration and accountability, enabling the strategy to leverage the unique competencies of each institution.

Flexibility must be given to individual sectors to develop their own policies and regulations tailored to their unique challenges and opportunities. Each sector presents distinct risks and benefits, requiring a more nuanced approach. For example, the Department of Agriculture could leverage AI for precision farming and supply chain optimization to address food security, while the financial sector could focus on deploying AI for credit risk analysis and fraud detection while mitigating algorithmic bias. A sectoral approach avoids the pitfalls of one-size-fits-all regulations that can stifle innovation and fail to address sector-specific needs effectively.

Sectoral AI councils can be established to support this flexible, sector-specific approach. These councils, comprising representatives from government, industry, academia, and civil society, would identify sector-specific AI risks and challenges, propose practical solutions, and develop tailored regulatory guidelines and best practices. They would also foster collaboration and knowledge-sharing through communities of practice, allowing sectors to learn from each other's experiences and adopt effective AI use cases.

A risk-based framework for AI governance, patterned after the EU's AI Act, could also be adopted and applied per use case or sector. This framework would categorize AI systems based on their potential risks and benefits, enabling agencies to design flexible, contextspecific regulations that promote innovation while safeguarding against ethical and societal risks. Considering that AI use cases in the Philippines are still in their nascent stages, rigid horizontal rules that apply uniformly across all sectors could stifle innovation before the full benefits and risks of AI are understood. Allowing sectoral flexibility ensures that regulations are tailored to the unique challenges and opportunities of each sector, evolving alongside AI adoption to balance innovation with appropriate safeguards.

By establishing a unified National AI Strategy with clear leadership and accountability of a lead agency or office, with clarification and direction on various responsibilities of different agencies and offices through an EO, and promoting sectoral flexibility and collaboration, the Philippines can create a governance framework that maximizes AI's potential while addressing ethical, societal, and sector-specific considerations. This approach ensures that AI adoption evolves responsibly and inclusively, aligning with the country's economic and social goals.

Expand digital infrastructure. Reliable and modern digital infrastructure is critical to unlocking the full potential of AI in the Philippines. However, access to high-speed broadband, 5G networks, and energy-efficient data centers remains limited, particularly in underserved areas. These deficiencies restrict the scalability and inclusivity of AI technologies, widen the digital divide, and limit economic opportunities. Outdated laws, such as the Public Telecommunications Policy Act of 1995 (RA 7925) and the Radio Control Law of the Philippines (RA 3846), hinder investment and innovation in the

telecommunications sector. Reforming these laws is essential to create an enabling environment for modern connectivity infrastructure.

One critical reform is removing the legislative franchise requirement for connectivity service providers, data centers, and cloud service providers. This change would lower barriers to entry, foster competition, and attract much-needed private sector investment in digital infrastructure. In parallel, spectrum management reforms are necessary to ensure efficient allocation and access to the frequencies required for wireless communications, particularly for 5G networks. These measures will enable the accelerated rollout of advanced connectivity infrastructure, bridging the digital divide and supporting Al-driven innovations in areas such as smart cities, healthcare, and Internet of Things ecosystems.

A modernized and streamlined regulatory framework is essential to create an environment conducive to private sector participation and innovation. Reforms should aim to simplify processes, promote competition, and provide clear and predictable rules for investment. Strengthening institutional capacity to regulate the rapidly evolving telecommunications sector is also critical to ensuring that infrastructure development aligns with national priorities and meets the needs of AI adoption.

These steps will lay the foundation for inclusive and transformative growth in the digital economy. By addressing regulatory bottlenecks and prioritizing infrastructure investments, the Philippines can position itself as a competitive hub for AI-driven solutions, empowering businesses, improving public services, and enhancing economic opportunities across the country.

Strengthen data governance. Data is a cornerstone of AI systems and the broader digital economy, serving as the foundation for innovation, informed decision-making, and effective governance. However, fragmented and inconsistent data practices in the Philippines limit the utility of AI solutions and undermine public trust. To address these challenges, a comprehensive national data governance framework must be established under the leadership of the Philippine Statistics Authority (PSA). With its statutory mandate under RA 10625 to ensure data quality, standardization, and accessibility, the PSA is uniquely positioned to lead this initiative, supported by relevant agencies such as the Department of Budget and Management (DBM), National Privacy Commission (NPC), and DICT.

The DBM's efforts under the Open Government Partnership (OGP) are vital for enhancing transparency and fostering citizen engagement, particularly in fiscal matters. These initiatives complement the broader objectives of data governance by promoting participatory mechanisms and open access to information. However, given its technical expertise and centralized authority as the country's statistical agency, the PSA is better equipped to lead the development of a comprehensive and cohesive data governance framework. The DBM's participatory governance principles should serve as a valuable supporting element within this framework.

The proposed framework should establish unified standards for data generation, collection, storage, processing, and sharing across both public and private sectors. It must address

fragmented governance practices by promoting consistency and interoperability across government agencies and stakeholders. Guidelines on data protection, privacy, cybersecurity, and ethical use must also be developed to safeguard sensitive information and foster public trust.

The non-rivalrous nature of data (i.e., its ability to be used simultaneously by multiple entities without being depleted) creates opportunities for value creation through effective sharing. To harness this potential, the framework should include the development of a centralized data portal managed by the PSA. This portal would provide secure access to curated, high-quality datasets for authorized researchers and regulators, ensuring that data is both accessible and responsibly managed. Policies guaranteeing the right of access for authorized users should accompany these efforts.

The framework must clearly delineate the roles and responsibilities of stakeholders to ensure accountability and collaboration. The PSA, as the lead agency, should coordinate with the DBM, NPC, DICT, and other relevant entities to align policies and promote synergy. Public-private partnerships should also be encouraged to accelerate data digitalization, particularly in high-impact sectors like healthcare, education, and agriculture. These efforts will create datasets that are critical for AI applications, improving service delivery and decision-making in these sectors.

To build public confidence, the framework must prioritize data privacy, accountability, and transparency. Regular publication of an Annual Data Governance Report by the PSA will provide updates on progress, challenges, and compliance with standards, ensuring accountability and reinforcing trust in data governance efforts.

By leveraging the PSA's leadership, the collaborative efforts of key agencies, and the inherent value of data as a public good, the Philippines can establish a robust data governance framework. This initiative will not only enhance the country's capacity to deploy AI solutions effectively but also ensure that data serves as a driver of innovation and societal benefit.

Develop human capital. A shortage of skilled professionals and significant digital literacy gaps hinder the workforce's ability to engage with and benefit from AI technologies. Addressing this bottleneck is critical to ensuring that the Philippine workforce is prepared for roles in AI-driven sectors and can adapt to the transformative impacts of AI across industries. Building on efforts established under the *Trabaho Para sa Bayan* Act (RA 11962) and the Philippine Digital Workforce Competitiveness Act (RA 11927), further targeted actions are necessary to align workforce development with the specific demands of AI adoption.

To build foundational skills, AI and data literacy programs must be integrated into education curricula starting from basic education level. These programs can focus on critical thinking, numeracy, and problem-solving, alongside an introduction to AI concepts. Higher education and vocational institutions should complement these efforts by developing specialized programs tailored to AI-related fields, such as machine learning, data science, and AI ethics. The initiatives under RA 11927, which promote digital skills development through an interagency council, provide a strong framework for coordinating these educational reforms.

Collaboration with the private sector is equally important. Partnerships with industry leaders, as envisioned under the Philippine Digital Workforce Competitiveness Act, can help create and recognize certification programs for AI-related skills. Such certifications, widely accepted across industries, can enhance workers' employability and ensure alignment between training programs and labor market needs. This collaboration can also support the development of internship and apprenticeship programs that provide hands-on experience with AI technologies.

Targeted upskilling and reskilling initiatives are needed for workers in industries particularly susceptible to AI-driven automation, such as BPOs and manufacturing. These programs should prioritize transitioning workers into roles that complement AI capabilities, focusing on skills like oversight, advanced analysis, creative problem-solving, and customer engagement. The *Trabaho Para sa Bayan* Plan should provide a comprehensive framework for employment generation and recovery that can guide these reskilling efforts, ensuring they address both immediate and long-term workforce needs.

By integrating these strategies with the foundational frameworks established by recent legislation, the Philippines can build a resilient and adaptive workforce capable of thriving in an AI-powered economy. This approach not only mitigates the risks of structural unemployment but also positions the country as a competitive hub for AI talent in the global market.

Complementary Measures

• Enhance governance and public trust in AI. Strong institutional oversight is essential for effective AI implementation and fostering public trust. Having a dedicated body to monitor progress, align policies, and engage stakeholders will create a more coordinated and accountable system. This oversight body would provide a central platform for addressing concerns, coordinating with sectoral agencies, and tracking the outcomes of AI-related initiatives.

Public awareness campaigns are equally vital to building trust and acceptance of AI technologies. Transparent communication about the benefits, risks, and limitations of AI can help demystify the technology and reduce apprehension. These campaigns should highlight real-world examples of AI's potential to improve lives while addressing common misconceptions and ethical concerns. By promoting transparency and informed dialogue, the government can build a foundation of trust that encourages greater adoption of AI innovations.

National guidelines for AI governance must prioritize fairness, accountability, and transparency. These principles are essential to mitigating risks such as bias, discrimination, and misuse of data, which could erode public confidence in AI systems. Clear regulatory standards and ethical frameworks will reassure citizens and businesses that AI applications are being developed and deployed responsibly.

Beyond formal governance, fostering AI literacy among the broader population is critical. This involves equipping individuals with a basic understanding of AI concepts, their societal implications, and ethical considerations. Expanding AI literacy initiatives to complement workforce upskilling efforts will help build a society that not only understands but also trusts and actively engages with AI technologies.

Promote energy-efficient technologies and manage e-waste. The adoption of Al technologies brings environmental challenges due to their high energy requirements and the hardware waste generated by rapid advancements in digital technologies. To address these challenges, the government must ensure that Al adoption is environmentally responsible by prioritizing energy efficiency, leveraging renewable energy, and managing the lifecycle of digital technologies.

Adopting standards for measuring energy consumption and the carbon footprint of AI processes and applications is a key step in mitigating their environmental impact. These benchmarks will guide the development of interventions and ensure accountability in AI deployment. Encouraging the use of energy-efficient technologies, particularly in critical infrastructure like data centers, will also reduce energy demands. Investments in energy-efficient cooling technologies and the integration of renewable energy sources should be supported to align AI development with sustainability goals.

Managing e-waste is equally important in minimizing the environmental footprint of AI systems. The government should develop strategies for the responsible disposal, recycling, and repurposing of obsolete digital devices, ensuring that materials are recovered and waste is reduced. These efforts will mitigate the environmental harm associated with AI adoption and ensure that its growth does not come at the expense of ecological integrity.

Sector(s) targeted	Australia	Czech Rep.	Denmark	France	Finland	Hungary	Japan	Korea	Latvia	Netherlands	Norway	Poland	Turkey	U.K.	U.S.	China	India	Singapore	Malta	Saudi Arabia	U.A.E.
Agriculture and food	\checkmark		~			√	√	~	\checkmark	~		1	\checkmark		~	\checkmark	\checkmark				
Cybersecurity							\checkmark					1	\checkmark					\checkmark			
Defence/ Security				\checkmark				~	~				\checkmark		\checkmark	\checkmark		~			√
Education		~				\checkmark	\checkmark	\checkmark					\checkmark		\checkmark		\checkmark	\checkmark	\checkmark		
Energy			√		√	√			~	~	√	√		\checkmark	\checkmark	\checkmark			~	\checkmark	√
Environment	✓			\checkmark		\checkmark				~				\checkmark	\checkmark					\checkmark	
Finance								\checkmark	~									\checkmark			
Health care	✓	√	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	~	~	\checkmark	\checkmark	√	\checkmark	√							
Manufacturing						\checkmark	\checkmark	~					\checkmark	\checkmark	\checkmark					√	
Mobility and transportation		~	\checkmark	\checkmark	√	\checkmark	\checkmark		~	\checkmark	\checkmark	√	\checkmark	~	√						
Productivity					√		\checkmark					√	\checkmark								
Public administration				\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark	~	\checkmark						\checkmark		
Seas and oceans/Marine								\checkmark	~		√										
Smart cities/ Construction	✓								\checkmark			✓	\checkmark				\checkmark			\checkmark	√
Aerospace/ Space		~						\checkmark							\checkmark						
Telecomms and IT							\checkmark	\checkmark	~				\checkmark		\checkmark				\checkmark		

Annex A. Survey of International Policies on Artificial Intelligence and Sectors Focused

Source: Galindo et. al (2021)¹⁶⁰

¹⁶⁰ Galindo, L., K. Perset and F. Sheeka, "An overview of national AI strategies and policies", OECD Going Digital Toolkit Notes, No. 14, OECD Publishing, Paris, <u>https://doi.org/10.1787/c05140d9-en</u>. (2021)

Agency	Program Name	Program Details
Department of Information and Communications Technology (DICT)	Philippine Skills Frameworks for the ICT Industry	The frameworks serves as a guide in enhancing the competencies and skills of workers in the new and emerging technologies industry, particularly on Software Development and Security, Global In-House Center, Contract Center and Business Process Management, and Analytics and Artificial Intelligence.'
DICT	Tech Trends	A self-development program that involves a series of webinars aimed at equipping participants with relevant skills and technical know-hows on innovation and emerging technologies. The Tech Trends project is comprised of seven
		 (7) tracks that participants can freely choose from, namely: Data Analytics, Internet of Things (IoT), Blockchain, Artificial Intelligence (AI), Cybersecurity, Cloud Computing, and the Gig Economy.
DICT	Ai.Deas for Impact: Al for Innovation and Social Impact Workshop	In collaboration with local government units and academic institutions, local AI practitioners, and government agencies, the DICT holds workshops for senior students focusing on harnessing AI's potential in critical areas.
DICT	Development of Data for Development (D4D)	The program harnesses data for IoT and AI use cases.
DICT	National Analytics and Al Summit	The summit brings together experts, practitioners and interested individuals to share the latest industry insights, engage in in- dept discussion, and explore opportunities for collaboration.
Department of Trade and Industry (DTI)	National Artificial Intelligence (AI) Strategy Roadmap 2.0 (NAISR 2.0)	The roadmap pursues the strategic mission to harness AI's transformative potential in boosting the Philippine economy and improving the quality of life for its citizens.
DTI	Promoting Research and Innovation to	The PRISTINE Project aims to improve the innovation ecosystem and establish applied

Annex B. Other Ongoing Government Initiatives Involving Artificial Intelligence

Agency	Program Name	Program Details						
	Strengthen Transformation of Industries and Enterprises (PRISTINE) Project	R&D, skills development, and innovation infrastructure. The project includes: (a) Industry 4.0 Pilot Factory; (b) National Center for AI Research; (c) an MSME innovation academy; (d) space for						
		academic institutions and think tanks for forward-thinking education and tech policies; and (e) one-stop shop for government solutions to business and investor concerns.						
DOST	Al Pinas and Project Sparta	Al Pinas and Sparta (which is now under DAP) provide training programs on data application and data science, respectively.						
DOST-Advanced Science and Technology Institute (ASTI)	Automated Labeling Machine (ALaM) Project	The Project intends to promote mapping and other computer vision tasks through application of traditional remote sensing, machine learning, and deep learning methods to be used through the developed model store and in training and optimization of models.						
		Applications include automated classification of mapped areas into categories (e.g., agricultural, trees, urban, and water).						
DOST-ASTI	Remote Sensing and Data Science (DATOS)	The project uses AI to automate the identification of flood areas in a satellite image.						
DOST-ASTI	iTanong	iTanong is an AI system allowing users to access information by asking queries in Filipino, English, or Taglish.						
DOST-ASTI	Artificial Intelligence for Census of Agriculture and Fisheries (AI4CAF) Project							
Philippine Space Agency (PhilSA)	AI Training Sessions	 The Satellite Data Processing Training Session (SDPTS) under the SIKAP+ project covers theoretical and practical aspects of image pre-processing, land cover mapping, water and coastal applications, and disaster risk management. It involves 						

Agency	Program Name	Program Details
		 hands-on exercises using remote sensing tools like QGIS, SAGA, Python, Jupyter, SNAP, and Google Earth Engine. 2. The <i>Pagsasanay para sa Kalawakan</i> program includes training modules on space technology applications, especially limage Processing relevant to the security.
		sector. Al-enabled Object Detection aids in monitoring by detecting and tracking objects like ships, aircraft, and vehicles. This technology extends beyond satellite imagery to other surveillance platforms
		including cameras and drones, and can
PhilSA and Department of	Environment and National Resources	The project covers two initiatives:
Environment and Natural Resources	Geospatial Database	 National Greening Program (NGP) progress monitoring through the use of current and emerging space science and technology applications (SSTA) capabilities in the country; and
		2. Establishment of a comprehensive national geospatial database for the Environmental and Natural Resource Accounting Program (ENRAP), which includes the collection of climate information and conduct analysis.
		The initiative will use AI to monitor progress monitoring of the NGP.

Constraints Identified	Recommendations	Responsible Institutions
 Regulatory gaps Insufficient regulations addressing accountability, transparency, and bias in AI decision-making. Limited guidance on ethical considerations, such as preventing misuse in disinformation or ensuring fairness in AI algorithms. Overlapping mandates among agencies like DICT, DOST, and DTI cause confusion and inefficiencies. Data challenges Fragmented and non-digital data across sectors and government agencies. Inconsistent data collection 	 Develop a flexible regulatory framework that enshrines ethical AI principles, establishes voluntary governance guidelines, enables innovation through regulatory sandboxes, mandates sector-specific AI guidelines, promotes capacity building, incentivizes ethical AI adoption, and identify the roles of government agencies Develop a data governance framework to accelerate data digitalization, establish data collection standards to ensure compatibility and 	NEDA, DICT, NPC, DTI, DOST, DOJ NEDA/PSA, DICT, relevant sectoral agencies
 Inconsistent data collection standards and poor data quality limit the effectiveness of AI systems. Privacy and ethical concerns around the collection and use of large-scale personal data for AI applications. Digital infrastructure Limited and inconsistent internet access, especially in rural areas, hinders the deployment of AI solutions reliant on real-time data processing and cloud-based systems. Slow expansion of high-speed 	 ensure compatibility and quality, promote data- sharing frameworks among government agencies and private stakeholders. Introduction of a central data access portal for AI Remove regulatory barriers in digital infrastructure deployment Mandate universal service obligations for broadband providers 	DICT, NTC, Congress
broadband and limited 5G availability restrict the functionality of advanced AI applications.		
 Human capital and skills gap Lack of basic digital literacy, data literacy, and AI-specific skills among the workforce. Shortage of professionals with expertise in AI development and management, such as data scientists and machine learning engineers 	 Integrate AI and data literacy programs into education curricula. Partner with private sector stakeholders to recognize certification programs for AI- related skills. Develop targeted upskilling 	DepEd, CHED, TESDA, DAP, DICT
and machine rearning engineers.	and reskilling programs for workers in industries	

Constraints Identified	Recommendations	Responsible Institutions
• Limited public awareness and understanding of AI capabilities and risks.	susceptible to automation, such as BPOs and manufacturing.	
 Energy constraints High energy costs and inconsistent supply hinder the scalability of AI, particularly for energy-intensive technologies like machine learning and cloud computing. Dependence on fossil fuels increases environmental concerns, while rural areas face frequent power outages. 	• Encourage investment in green data centers with energy-efficient cooling technologies.	DOE, BOI, DOF, NEDA
 Environmental sustainability concerns High computational power requirements for AI models contribute to significant carbon emissions. Increased resource consumption and e-waste from hardware production and data center operations. 	 Support research to minimize the environmental footprint of AI systems. Promote sustainable e-waste management for AI hardware. 	DENR, DOE, DOST
 Sector-specific barriers Education – persistent gaps in digital skills education and limited access to Al-driven learning tools in underserved areas. Healthcare – regulatory and ethical concerns limit the adoption of Al in critical decision-making processes. Agriculture – small-scale farmers face accessibility and affordability challenges for Al-driven solutions, leaving large corporations as the primary beneficiaries. 	 Form sectoral councils and community of practice to address unique needs and challenges Foster a Community of Practice (CoP) per sector to drive knowledge sharing, collaboration, and dissemination of best practices. 	Sectoral agencies



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