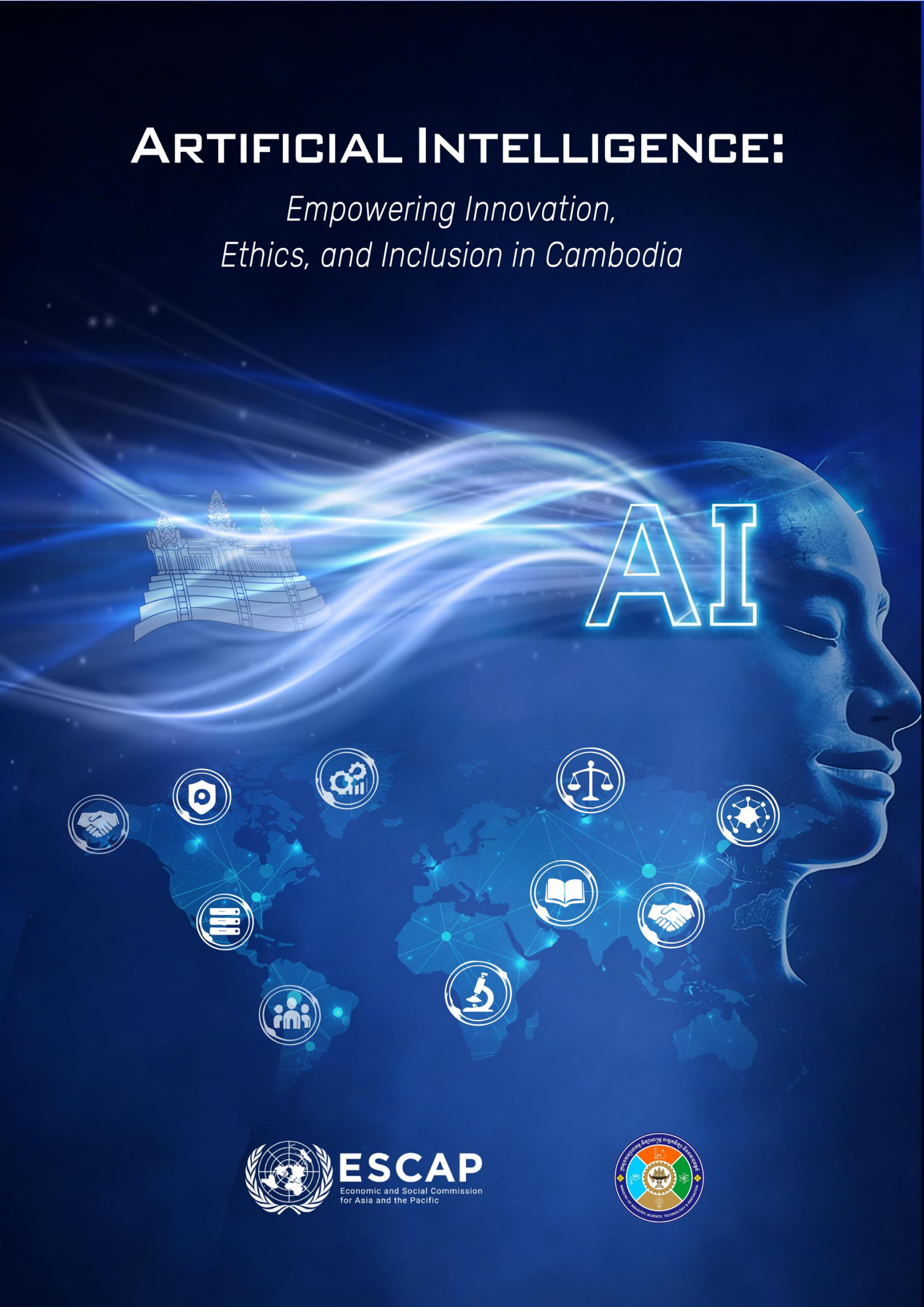
Artificial Intelligence:

Empowering Innovation,
Ethics, and Inclusion in Cambodia



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FOREWORD

Minister of Industry, Science, Technology & Innovation (MISTI), Royal Government of Cambodia

Artificial Intelligence (AI) stands at the frontier of Cambodia's ambition to become a knowledge-driven and inclusive economy, prepared to face the challenges and embrace the opportunities of the Fourth Industrial Revolution. To unlock AI's full potential for inclusive and sustainable growth, strategic actions and evidence-based policies that foster ethical, responsible, and culturally aligned innovation are crucial. Policies that cultivate a dynamic AI ecosystem, empowering Cambodian entrepreneurs, researchers, and communities will ensure the nation's progress leaves no one behind.

This report, *Artificial Intelligence: Empowering Innovation, Ethics, and Inclusion in Cambodia*, is the result of a fruitful collaboration between the United Nations ESCAP and the Ministry of Industry, Science, Technology & Innovation (MISTI), as part of the Community of Practice on AI (COPAI). It explores the current AI landscape in Cambodia, evaluates key strengths and challenges, and identifies opportunities to harness AI ethically and inclusively. The analysis provides critical insights and strategic recommendations that align with Cambodia's national development priorities, including the *Cambodia's Science, Technology & Innovation Roadmap 2030*, the *National Research Agenda 2025*, and the Royal Government's *Pentagonal Strategy*.

The report emphasizes inclusive AI innovation, highlighting key strategies: first, ensuring that AI complements human capabilities across diverse sectors – from education and healthcare to agriculture and small enterprises – thus maximizing socio-economic benefits. Second, reinforcing trust as foundational infrastructure by establishing transparent, accountable, and robust governance frameworks and ethical standards. Third, nurturing AI solutions deeply rooted in Khmer value, language and culture, ensuring widespread adoption, relevance, and fairness for innovation. Additionally, the report outlines strategic interventions including national efforts to develop Khmer-language datasets and AI models, regulatory sandboxes to encourage innovation, strategic investments in digital skills and infrastructure, and robust frameworks for monitoring and evaluating AI impact.

This joint effort embodies the collaborative spirit and shared vision of ESCAP and MISTI, highlighting our joint dedication to advancing AI solutions that respect cultural integrity and promote social inclusivity. As Cambodia embarks on this transformative journey towards 2050, MISTI trusts the research findings will inspire all ministries-institutions and stakeholders at all levels – government, private sector, academia, and development partners – to collectively shape their policies and initiatives toward an AI-enabled future that is equitable, resilient, and prosperous for the interests and security of people of the Kingdom of Cambodia.

Phnom Penh, 18 March 2026

Minister

HEM Vanndy

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The report is authored by Mr. Rafael Torquato Cruz, Community Manager, Innovation, Enterprise and Investment Section (IEIS), Trade, Investment and Innovation Division (TIID), ESCAP and Mr. Pagnarith Srun, National Coordinator and Deputy Director General, General Department of Science, Technology and Innovation (GDSTI), MISTI under the overall supervision of Mr. Seingheng Hul, Under Secretary of State of MISTI, and Ms. Rupa Chanda, Director, TIID, ESCAP; as well as Mr. Jonathan Tsuen Yip Wong, Chief of Innovation, Enterprise and Investment, TIID, ESCAP; and of Ms. Elena Mayer-Besting, Economic Affairs Officer, IEIS, TIID, ESCAP; with the support of Ms. Povvoliak Sakhan, Intern, ESCAP.

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EXECUTIVE SUMMARY

Cambodia stands at a pivotal economic and technological crossroads, with Artificial Intelligence (AI) recognized as a fundamental enabler for achieving its national development vision. Guided by the *Pentagonal Strategy*, the *Science, Technology & Innovation Roadmap 2030*, the *Cambodia Digital Economy and Society Policy Framework 2021–2035* and the *National Research Agenda 2025*, the nation is pursuing a structural transformation towards a higher-value, knowledge-based, and innovation-driven economy. AI presents a unique opportunity to accelerate this transition, offering pathways for productivity leapfrogging, economic diversification, and the enhancement of public services.

The national AI landscape is characterized by a dynamic but fragmented ecosystem of government bodies, academic institutions, private sector actors, civil society and international partners, each operating with emerging but often siloed capacities. To transform this potential into broad-based, sustainable prosperity, Cambodia must navigate multiple interconnected barriers to its meaningful participation in the AI revolution. They can be grouped into five systemic challenges that form a mutually reinforcing set of obstacles:

1. **Resource constraints pose a significant challenge.** With gross expenditure on research and development (R&D) at 0.09% of the gross domestic product (GDP) in 2022 - substantially below the Association of Southeast Asian Nations (ASEAN) average - funding for long-term research and essential high-performance computing (HPC) infrastructure is limited. This calls for a practical "frugal innovation" approach that prioritizes context-appropriate solutions.
2. **Human capital challenges are multifaceted.** A shortage of specialized AI talent is exacerbated by gaps in the education pipeline and the emigration of skilled professionals. Strengthening foundational digital literacy remains a priority, while the gender gap in Science, Technology, Engineering, and Mathematics tertiary education could risk embedding bias into the nation's technological foundation.
3. **Limitations in the data ecosystem create notable obstacles.** The scarcity of publicly available Khmer data for national use combined with underrepresentation in global training datasets may affect the relevance and fairness of AI models and creates a risk of "informational dependency", leading to an over-reliance on external knowledge systems that may not fully align with local needs.
4. **Governance structures, still in early stages, face challenges in fostering cohesive policy development.** Cambodia's ranking in the 2024 Global Cybersecurity Index (132nd out of 182 countries) and the delayed implementation of the Personal Data Protection Law (PDPL) contribute to uncertainty. The fragmentation of digital responsibilities across ministries increases the risk of the country becoming a "rule-taker" of global standards that may not align with its values.
5. **The innovation ecosystem faces hurdles in translating research into practical outcomes.** A lack of strong connections between academia, industry, and government - reflected in limited AI patent registrations and venture capital activity - can hinder the commercialization of promising innovations, reducing their economic impact.

Strategic AI deployment, guided by the missions of the NRA and other national priorities, can boost sectoral productivity and drive innovation. By focusing on these nationally defined goals, AI can serve as a dual engine for growth: first, by enhancing efficiency, quality, and competitiveness in the foundational sectors of the economy, and second, by enabling the creation of new, higher-value digital products and services that can diversify the economic base. The report identifies and examines concrete applications across ten key areas, which collectively represent the most promising pathways for leveraging AI to achieve sustainable and inclusive economic development:

1. **Local Food Production (NRA Mission 1):** Leveraging AI for precision agriculture, crop monitoring, and pest detection to enhance food security and sustainability.
2. **Reliable Energy Supply (NRA Mission 2):** Employing AI for smart grid management, load balancing, and forecasting to improve the integration of renewable energy sources.
3. **Quality Education (NRA Mission 3):** Utilizing AI-powered personalized learning platforms, content creation tools, and teacher support systems to improve educational outcomes.
4. **Electronics and Spare Parts Exports (NRA Mission 4):** Applying AI for visual quality control, defect detection, and predictive maintenance to upgrade manufacturing capabilities.
5. **Cloud-Based Services (NRA Mission 5):** Developing a competitive local cloud ecosystem where AI-as-a-Service offerings can be built and deployed, ensuring data sovereignty.

6. **Universal Electricity and Potable Water (NRA Mission 6):** Using AI to optimize utility distribution networks, predict equipment failures, and detect leaks to improve service reliability.
7. **Carbon Neutrality (NRA Mission 7):** Deploying AI to optimize energy systems, monitor deforestation in near real-time, and enhance climate modeling and adaptation strategies.
8. **Digitally-Enhanced Health (NRA Mission 8):** Implementing AI-assisted diagnostics for medical imaging, public health surveillance to predict outbreaks, personalized care and optimizing hospital operations.
9. **Private Sector Productivity:** Making AI accessible to Micro, Small, and Medium-sized Enterprises (MSMEs) through tools for process automation, marketing, and logistics management.
10. **Public Sector Service Delivery:** Improving government efficiency and citizen engagement through AI-powered chatbots, data analytics for evidence-based policymaking, and streamlined administrative processes.

Cambodia's deep-rooted Theravada Buddhist heritage provides a unique and sophisticated ethical system to guide AI innovation. This cultural foundation emphasizes core principles such as compassion, non-harm, and the pursuit of collective benefit. Its application to AI is grounded in the understanding that AI systems, lacking consciousness (*viññāṇa*) and genuine intention (*cetanā*), are technological tools for which human creators and users bear full ethical accountability. This ethical direction directly supports and provides a culturally resonant interpretation of the universal values articulated in key international and regional frameworks on AI. However, for Cambodia to ascertain that AI innovation is ethical, it will need to overcome significant practical challenges and risks. These include the perpetuation of systemic bias through unrepresentative data, the exacerbation of digital inequality, potential labour market disruptions, spread of misinformation, environmental concerns, and critical vulnerabilities in data privacy, to name just a few concerns. Compounding these risks is a low level of public and corporate awareness of AI ethics and the absence of formal governance frameworks to translate these principles into practice and ensure accountability.

To bridge the divide between ambition and reality, Cambodia requires a coherent, comprehensive, and actionable national strategy. This report provides a strategic blueprint designed to systematically address the identified bottlenecks and build a sovereign, resilient, and verifiably trustworthy AI ecosystem. The following ten strategic directions form the core of this recommended pathway for action:

1. **Fostering private sector productivity:** Establish a high-level National AI Task Force to drive a unified vision, using mechanisms like regulatory sandboxes to de-risk experimentation and accelerate AI adoption across the private sector, particularly for Small and Medium-sized Enterprises (SMEs).
2. **Strengthening AI infrastructure and data ecosystems:** Pursue a coordinated national strategy to build AI-ready digital and energy infrastructure, focusing on closing the "last-mile" connectivity gap, expanding access to HPC, and creating a sovereign, well-governed data ecosystem.
3. **Developing AI human capital and workforce:** Implement a comprehensive national plan for reskilling workers and create a talent pipeline from foundational literacy to world-class expertise, utilizing proven models like paid apprenticeships, international mobility programmes, and agile educational frameworks.
4. **Strengthening AI R&D:** Design a structured "Lab-to-Market" innovation pipeline that de-risks and accelerates the translation of research into viable products, supported by co-funding programmes and a national prototyping hub.
5. **Driving public sector AI adoption:** Execute a roadmap for responsible AI adoption in government, prioritizing high-impact use cases and launching a national mission to create a comprehensive, high-quality Khmer language data corpus for training and validation.
6. **Establishing ethical principles to guide AI research and innovation (R&I) and promote responsible practices:** Formulate and adopt a National AI Ethics Framework that integrates global standards with the culturally resonant values of compassion and non-harm derived from Cambodia's Buddhist heritage, mandating an "ethics-by-design" approach.
7. **Promoting AI awareness and literacy for responsible application:** Launch a national campaign based on local usage patterns to build practical skills in prompt engineering, critical evaluation of AI-generated content, and digital safety protocols for all segments of society.
8. **Fostering strategic international collaboration:** Develop a strategic plan to systematically leverage global expertise and resources, ensuring all international partnerships are aligned with national priorities and contribute to building domestic capacity in data, talent, and infrastructure.
9. **Driving inclusive innovation for shared prosperity:** Embed inclusivity and frugal innovation principles throughout the national AI strategy, prioritizing the development of low-cost, accessible solutions that address the specific needs of women, rural populations, and persons with disabilities.

10. **Championing open and verifiable AI to build trust and preserve culture:** Champion open-source models and link national metrology capabilities to the verification of AI systems, ensuring that Cambodia builds a brand of AI that is not only culturally relevant but also verifiably trustworthy.

CONTENTS

BOXES

TABLES

FIGURES

ABBREVIATIONS

ADB	Asian Development Bank
AI	Artificial Intelligence
AIIB	Asian Infrastructure Investment Bank
API	Application Programming Interface
ASEAN	Association of Southeast Asian Nations
CADT	Cambodia Academy of Digital Technology
CamDX	Cambodia Data Exchange
COPAI	Community of Practice on Artificial Intelligence
DGC	Digital Government Committee
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
ESG	Environmental, Social and Governance
GDP	Gross Domestic Product
Gen AI	Generative Artificial Intelligence
GERD	Gross Domestic Expenditure on Research and Development
GFT	Garment, Footwear and Travel Goods
GPU	Graphics Processing Unit
HDI	Human Development Index
HEI	Higher Education Institution
HPC	High Performance Computing
ICT	Information and Communications Technology
ILO	International Labour Organization
IoT	Internet of Things
IP	Intellectual Property
ITC	Institute of Technology of Cambodia
JICA	Japan International Cooperation Agency
KE	Khmer Enterprise
KIT	Kirirom Institute of Technology
LLM	Large Language Model
MEF	Ministry of Economy and Finance
MISTI	Ministry of Industry, Science, Technology and Innovation
MoEYS	Ministry of Education, Youth and Sport
MPTC	Ministry of Posts and Telecommunications
MSMEs	Micro, Small and Medium Sized Enterprises
NCSTI	National Council of Science, Technology and Innovation
NICC	National Incubation Center of Cambodia
NGOs	Non-governmental Organizations
NRA	National Research Agenda (2025)
OECD	Organisation for Economic Co-operation and Development
PDPL	Personal Data Protection Law
R&D	Research and Development
R&I	Research and Innovation
RGC	Royal Government of Cambodia
RUPP	Royal University of Phnom Penh
SEA-LION	Southeast Asian Large Language Models
SMEs	Small and Medium Sized Enterprises
STI	Science, Technology and Innovation
TRC	Telecom Regulator of Cambodia
TVET	Technical and Vocational Education and Training
UNESCO	United Nations Educational, Scientific and Cultural Organization

CHAPTER 1 INTRODUCTION

1.1. BACKGROUND

Cambodia is at a pivotal moment, actively transitioning towards a knowledge-based, innovation-driven economy. Over the past two decades, the country achieved remarkable economic growth averaging around 7 per cent annually, enabling it to transition from the group of low-income countries to that of the lower-middle income countries in 2015, according to the World Bank classification. In 2024, the United Nations General Assembly adopted resolution 79/230, endorsing Cambodia's graduation from the Least Developed Country (LDC) category, with graduation to take effect by 2029.[1] This national ambition is also clearly articulated in its long-term development goal of achieving high-income country status by 2050.[2]

Simultaneously, the country has significantly improved human development outcomes over the last decades: between 1990 and 2023, for instance, Cambodia's Human Development Index (HDI) rose by over 60 per cent (from 0.368 to 0.606), moving the country into the medium human development category, roughly on par with the medium-development group average, though still below the Asia-Pacific regional average.[3]

The *Pentagonal Strategy–Phase I (2023–2028)*, the Royal Government of Cambodia's (RGC) core socio-economic policy agenda, guides this transformation.[4] The strategy's fifth pentagon crucially prioritizes technology, emphasizing digital technologies to navigate the Fourth Industrial Revolution and enhance national competitiveness.

The government has made digital transformation a central policy priority, adopting in 2021 both the *Cambodia Digital Economy and Society Policy Framework 2021–2035*,[5] which lays the foundations for a nationwide "digital ecosystem", and the *Cambodia's Science, Technology & Innovation Roadmap 2030* (*STI Roadmap 2030*),[6] whose five pillars - governance, education, research, collaboration and an enabling ecosystem - steer Cambodia's transition to a knowledge-based economy. Building on these frameworks, the *Cambodia Digital Government Policy 2022–2035*[7] positions e-government and digital public services as catalysts for broader technology uptake, while the *National Research Agenda 2025* (*NRA 2025*)[8] channels R&I resources into priority subjects that reinforce the *STI Roadmap 2030* and underpin the nation's 2050 development vision.

Within this strategic framework, AI is increasingly recognized not merely as an emerging technology, but as a fundamental enabler with the potential to significantly accelerate progress across multiple sectors, boost productivity, and contribute to sustainable and inclusive growth. Cambodia is favoured by its young demographic profile: in 2019, people between ages 0–14 and ages 15–29 comprised 29,4 per cent and 26,4 per cent

[1] United Nations General Assembly. (19 December 2024). Graduation of Cambodia and Senegal from the least developed country category (A/RES/79/230).

[2] Cambodia. (2018). Rectangular Strategy for Growth, Employment, Equity and Efficiency: Phase IV. Phnom Penh: Royal Government of Cambodia (RGC). Available at https://lpr.adb.org/resource/rectangular-strategy-growth-employment-equity-and-efficiency-phase-iv-2018-cambodia.

[3] United Nations Development Programme (UNDP). (2025). Human Development Report 2025: A matter of choice: people and possibilities in the age of Artificial Intelligence (AI). New York: UNDP. p. 276.

[4] Cambodia. (2023). Pentagonal Strategy – Phase I. Phnom Penh: RGC. Available at https://ncsd.moe.gov.kh/dcc/resource/document/pentagonal/strategy/phase/1.

[5] Cambodia, Supreme National Economic Council. (2021). *Cambodia Digital Economy and Society Policy Framework 2021-2035*. Cambodia: RGC. Available at https://asset.cambodia.gov.kh/mptc/media/EN-Policy-Framework-of-Digital-Economy-and-Society.pdf.

[6] Cambodia, MISTI. (2021). *Cambodia's Science, Technology & Innovation Roadmap 2030*. Cambodia: MISTI. Available at https://misti.gov.kh/public/file/20210826162999011 7.pdf.

[7] Cambodia, Ministry of Post and Telecommunications (MPTC). (2022). *Cambodia Digital Government Policy 2022-2035*. Phnom Penh: MPTC. Available at https://asset.cambodia.gov.kh/mptc/media/Cambodia_Digital_Government_Policy_2022_2035_English.pdf.

[8] Cambodia, MISTI. (2022). *National Research Agenda 2025*. Cambodia: MISTI. Available at https://misti.gov.kh/public/file/20230219167681923 1.pdf.

of the country's population respectively, constituting a sizable young workforce that grew up in the digital age.[9]

Many challenges must be faced though. The COVID-19 pandemic impacted development worldwide. Internet penetration in Cambodia remains low, estimated at about 60.7 per cent as of 2023,[10] and skill gaps and social inequalities are still significant roadblocks to economic and technological progress, which only highlights how inclusive growth strategies, including investments in education, digital literacy, industrial innovation, and infrastructure, are essential to ensure AI benefits all segments of society and does not deepen social divides.

1.2. SNAPSHOT OF AI IN 2025

The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines AI as "systems which have the capacity to process data and information in a way that resembles intelligent behaviour, and typically includes aspects of reasoning, learning, perception, prediction, planning or control".[11] AI in 2025 is largely characterized by the rapid advancements and proliferation of generative Artificial Intelligence (gen AI). Unlike traditional AI systems, which were primarily analytical or predictive (e.g. classifying data or providing recommendations based on learned patterns), gen AI systems are distinguished by their capacity to produce novel content in many formats, such as coherent text, complex images, audio compositions, video, and functional computer code, typically generated in response to user-provided instructions known as prompts. A significant development is gen AI's increasing ability to interact via natural language, lowering access barriers and democratizing AI tools for users without specialized technical skills. This paradigm shift is transforming AI from a specialized tool into a general-purpose technology, capable of augmenting a wide range of other frontier technologies, like the Internet of Things (IoT) and advanced robotics, potentially sparking what some describe as a Fifth Industrial Revolution based on human-machine collaboration.[12]

Gen AI operates on a fundamentally probabilistic paradigm: systems infer statistical trends from training data and apply these to generate new, similar content, rather than following explicit programmatic rules. This approach allows gen AI to perform a wide array of tasks with versatility not seen in earlier AI. Crucially, while gen AI can simulate human-like outputs, these systems lack genuine human creativity, self-awareness, consciousness, or commonsense reasoning. Their intelligence is an artifact of statistical pattern matching, not understanding or intentionality.

At the core of most contemporary generative AI systems are very large "foundation models," typically built with deep learning architectures such as transformers (indeed, the widely used GPT acronym literally denotes a "generative pre-trained transformer"). These models are pre-trained on vast, diverse datasets (text, images etc.) using self-supervised learning, enabling them to discern statistical patterns and relationships. State-of-the-art frontier models demand especially large and diverse datasets to create, train, and test generalizable systems. These data requirements intertwine with infrastructure needs (storage, data centers, and cloud computing), the availability of increasingly complex semiconductors produced by a handful of firms, and the specialized human skills required to develop and manage the underlying algorithms. The synergy between these three key leverage points creates a powerful, self-reinforcing cycle that accelerates AI progress (see Figure 1.1 **Three Key Leverage Points to Accelerate AI Progress**Figure 1.1), but also creates structural bottlenecks for latecomers. More recently, however, there has been a surge of open-source AI models and optimized smaller models capable of running on more accessible hardware, thus reducing barriers to access.

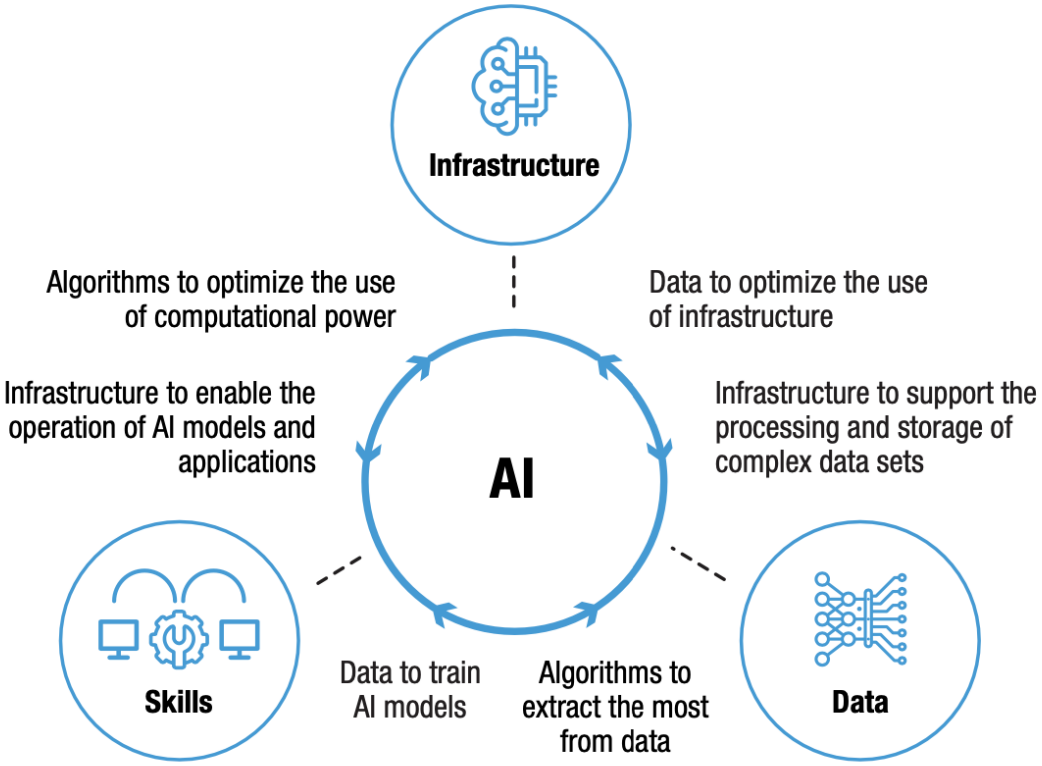
[9] Cambodia, Ministry of Planning. (2020). *General Population Census of the Kingdom of Cambodia 2019*. Cambodia: Ministry of Planning. pp. 28-29.

[10] International Telecommunication Union (ITU). (n.d.). DataHub data on Cambodia. Available at https://datahub.itu.int (accessed on 22 November 2025).

[11] UNESCO. (2021). Recommendation on the Ethics of Artificial Intelligence. SHS/BIO/PI/2021/1 Rev. p. 10.

[12] ASEAN. (January 2025). *Expanded ASEAN Guide on AI Governance and Ethics – Generative AI*. Jakarta: ASEAN Secretariat. Available at https://asean.org/book/expanded-asean-guide-on-ai-governance-and-ethics-generative-ai/.
United Nations Conference Trade and Development (UNCTAD). (2025). *Technology and Innovation Report 2025: Inclusive artificial intelligence for development*. United Nations: Geneva. UNCTAD/TIR/2025. Especially chaps. I, III.

Figure 1.1 Three Key Leverage Points to Accelerate AI Progress



Source: UNCTAD. (2025). *Technology and Innovation Report 2025: Inclusive artificial intelligence for development*. United Nations: Geneva. p. 17. UNCTAD/TIR/2025

1.3. GLOBAL AI TRENDS

The global AI market was estimated at around $279.22 billion in 2024 and is projected to reach $1.8 trillion by 2030, growing at a staggering 37 per cent annual rate.[13] The global discourse on AI in 2025 reveals a profound duality: it is seen as both a tool offering immense beneficial transformative potential and as a disruptive technology that can displace human workers, negatively impact society and amplify the global divide among developed and developing countries, a "development wildcard." Its rise coincides with significant global human development challenges. In fact, after decades of progress, the global HDI has flatlined. Its post-2020 rebound has lost momentum, projected HDI increases are the lowest in 35 years, development gaps between very high and low HDI countries are widening, and traditional development pathways, like export-oriented manufacturing, are narrowing for many countries. The climate crisis remains a global threat and important military conflicts continue to rage in many areas of the world. In this complex environment, AI's impact on human development - enhancing or subverting agency - is not technologically predetermined but hinges on policy choices, ethical frameworks, and societal adaptations in its global and national design, development, and deployment.[14]

Despite these challenges, the adoption of AI is accelerating worldwide, and expectations of its impact are increasing. A United Nations Development Programme (UNDP) global survey identified that, based on data provided by respondents from 21 countries pooled from across all HDI levels, about 20 per cent of them had engaged with AI in

[13] Bergur Thormundsson. (9 July 2025). *Artificial intelligence (AI) worldwide - market size 2021-2030*. Statista. Available at www.statista.com/topics/3104/artificial-intelligence-ai-worldwide/ (accessed on 22 November 2025).

Grand View Research. (2025). Artificial Intelligence Market Size, Share & Trends Analysis Report By Solution, By Technology (Deep Learning, Machine Learning, NLP, Machine Vision, Generative AI), By Function, By End-Use, By Region, And Segment Forecasts, 2025–2030. Available at www.grandviewresearch.com/industry-analysis/artificial-intelligence-ai-market (accessed on 22 November 2025).

[14] UNDP. (2025). *Human Development Report 2025.* Information and recommendations in the next paragraphs of this section were sourced from this report.

health, work, or educational situations in the last 30 days, and a much higher number (from 46 per cent to 66 per cent) expected themselves to do it in the following 12 months.[15]

Moreover, a critical global trend is AI's evolution from a sophisticated tool to an increasingly "agentic" technology. AI systems are no longer merely executing predefined tasks; they can 'make decisions', shape information flows, and influence human choices, profoundly impacting individual and collective agency. For example, while AI-powered systems can synthesize complex information for decision support, they can also curate online experiences in a way that can limit exposure to diverse viewpoints or perpetuate biases found in their original training data. AI's capacity to simulate human-like features, such as nuanced conversation or content creation, necessitates reevaluating the human-machine relationship and defining tasks suitable for automation versus those requiring human judgment and ethical oversight. This evolving agenticity underscores the need for AI systems designed to augment human capabilities and expand freedoms, rather than cede human control.

In response to AI's potential to reshape economies and labour markets, the "complementarity economy" concept is gaining traction. This framework emphasizes leveraging AI to augment human skills and create new roles, rather than focusing solely on automation that displaces labour. Numerous examples show AI assisting human experts to achieve superior outcomes, such as improving diagnostic accuracy in healthcare (e.g. AI augmenting diagnostic capabilities) or accelerating scientific discovery (e.g. use of AI to predict and assist in the creation of new substances and materials, like medicines). Realizing this complementarity, however, requires significant investment in human capabilities, reskilling, and adapting organizational structures for effective AI integration, alongside policies incentivizing pro-worker AI applications. The risk of deploying "so-so AI" – automating tasks without substantial productivity gains but with significant job displacement– remains a global concern.

These technological and economic trends are intertwined with profound ethical, societal, and governance challenges subject to intense global debate and policy action. Paramount concerns include algorithmic bias perpetuating or amplifying societal discrimination, AI technology's high environmental impact in the context of the climate crisis and global efforts to achieve climate targets, the proliferation of AI-generated misinformation and disinformation (e.g. deepfakes), the future of work and potential job displacement, and ensuring data privacy and security. The risk that AI may be used in ways that could potentially harm human rights, for instance in autonomous weapons or pervasive surveillance, also raises significant alarm. Consequently, a global push for robust AI governance frameworks is evident in initiatives like UNESCO *Recommendation on the Ethics of Artificial Intelligence*, the Organization for Economic Co-operation and Development (OECD) *Recommendation of the Council on Artificial Intelligence*,[16] and the United Nations Global Digital Compact. These aim to foster international cooperation for transparent, accountable, and equitable AI development, steering AI towards advancing human development and the fight against the climate crisis, instead of undermining them. The need for new benchmarks to assess AI's true impact on human capabilities and agency beyond purely technical performance or safety, and on the planet's well-being is increasingly recognized as critical for guiding responsible AI innovation.

1.4. THE STATE OF AI IN ASEAN

ASEAN is forging a concerted, strategic approach to capitalize on AI's transformative potential while proactively managing risks, reflecting a commitment to regional cooperation and harmonized development. AI is anticipated to deliver a substantial economic boost to the ASEAN region, with projections indicating a potential $1 trillion contribution to GDP by 2030 (a 10–18 per cent uplift). An estimated 80 per cent of businesses in ASEAN countries are in the early stages of AI adoption, with 15 per cent of companies in advanced stages of implementation. 83 per cent of these companies devote less than 0.5 per cent of their revenues to AI solutions.[17] This indicates that there is strong interest in AI within the business landscape of the region, but it is still in its initial stages of dissemination - a critical moment for intervention.

Recognizing the need to harness AI responsibly, ASEAN has taken steps toward a coordinated approach to AI governance. The ASEAN Ministerial Meeting on Science, Technology and Innovation (AMMSTI) in Siem Reap of the Kingdom of Cambodia coordinated by MISTI to release *Statement on Artificial Intelligence* (2024). Furthermore, ASEAN also has the *ASEAN Guide on AI Governance and Ethics* (2024)[18], and the *Expanded ASEAN Guide on AI*

[15] UNDP. (2025). Human Development Report 2025, pp. 17–18.

[16] OECD. (2019, amended 2024). OECD Council Recommendation on Artificial Intelligence (OECD/LEGAL/0449). Available at https://legalinstruments.oecd.org/en/instruments/oecd-legal-0449.

[17] Soon Ghee Chua, Nikolai Dobberstein. (October 2020). *Racing toward the future: artificial intelligence in Southeast Asia*. Kearney, EDBI. pp. 5-6.

[18] ASEAN, Ministerial Meeting on Science, Technology and Innovation. (7 June 2024). *Statement on Artificial Intelligence (AI)*. ASEAN. Jakarta: ASEAN.

Governance and Ethics – Generative AI (2025)[19] provide a clear roadmap for this endeavor (see Chapter 4). These guides establish common principles for AI governance and address specific risks of gen AI - such as mistakes, disinformation, deepfakes, intellectual property (IP) infringement, and bias propagation - offering policy recommendations across key dimensions of the AI ecosystem, including accountability, data management, and pursuing the public good.

Practical AI applications are already contributing to economic gains in the region. A report on AI economy in ASEAN countries notes that 80 per cent of AI's potential value often derives from fewer than 20 per cent of use cases, predominantly in sales, marketing (e.g. next-product-to-buy recommendations leading to 21–30 per cent revenue increases) and supply chain management (e.g. inventory optimization reducing stock-outs by 21–30 per cent). Key sectors exhibiting opportunities for economic gains from AI in Southeast Asia include manufacturing (which could see a 35–45 per cent manufacturing value added increase), retail and hospitality, agriculture, government/smart cities (e.g. Singapore's Land Transport Authority AI-driven traffic management system), and healthcare (telemedicine, aid in diagnostic process).[20]

Several ASEAN member States have been proactive in formulating national responses. As of 2025, six of the 10 ASEAN member States (Singapore, Malaysia, Indonesia, Thailand, Viet Nam, and the Philippines) have launched national AI strategies or action plans, while others are in earlier stages of policy development.[21] Singapore, a regional leader, launched its *National AI Strategy* in 2019 and a revised *National AI Strategy 2.0* in 2023, emphasizing the necessity of AI technology and the country's role in contributing to AI innovation and setting international standards for AI governance and ethics. It also spearheads initiatives like the AI Verify Foundation's Project Moonshot for Large Language Model evaluation.[22] Malaysia's *National Artificial Intelligence Roadmap 2021–2025* focuses on 11 national AI use cases in priority areas and is developing an AI governance code of ethics.[23] Thailand's *National AI Strategy and Action Plan (2022–2027)* aims to train over 30,000 AI talents and is formulating a draft Royal Decree on AI System Service Business.[24] Viet Nam's Decision No. 127/QD-TTg (2021) outlines its strategy to become an ASEAN innovation hub, tasking 17 ministries with developing legal frameworks and data infrastructure, and issuing guiding principles for responsible AI R&D in June 2024.[25]

Despite these strategic efforts, the region grapples with challenges such as lack of connections among important stakeholders in the AI ecosystem, a persistent AI talent gap, evolving data governance needs, and some user resistance to AI adoption.[26] Investment in AI capabilities is also uneven, with Singapore, for example, having received $68 per capita in AI investments between 2015 and 2019 compared to a regional average of just $2 per capita.[27] In 2024, venture capital investments in emerging AI companies across Southeast Asia totaled approximately $1.7 billion, distributed across 122 funding deals. The region is also witnessing a surge of AI-driven innovations from both major technology firms and startups, particularly targeting climate-related challenges. Earlier, in 2022, agrifood technology startups in South-East Asia had already attracted

In 2024, venture capital investments in emerging AI companies across Southeast Asia totaled approximately $1.7 billion, distributed across 122 funding deals. The region is also witnessing a surge of AI-driven innovations from both major technology firms and startups, particularly targeting climate-related challenges. Earlier, in 2022, agrifood technology startups in South-East Asia had already attracted $1.7 billion in funding through 192 deals,[28] indicating rising investor interest – though still modest compared to East Asia or North America.

Another key regional priority is investment in shared AI infrastructure and cooperation on Large Language Models (LLMs) tailored to local languages and cultures. This is vital for fostering AI innovation that is truly relevant to ASEAN's contexts and aligns with the *Expanded ASEAN Guide on AI* calls for regionally applicable benchmarks and testing tools. The upcoming ASEAN Digital Economy Framework Agreement aims to create a unified regional digital market, including facilitating cross-border data flows and common data standards, which could enable. AI developers, including those in Cambodia, to access larger data pools and markets.[29]

Available at https://asean.org/wp-content/uploads/2024/06/ADOPTED-AMMSTI-Statement-on-AI_7June2024.pdf.

[19] ASEAN. (February 2024). *ASEAN Guide on AI Governance and Ethics*. Jakarta: ASEAN Secretariat. Available at https://asean.org/wp-content/uploads/2024/02/ASEAN-Guide-on-AI-Governance-and-Ethics.pdf. ASEAN. (January 2025). *Expanded ASEAN Guide on AI Governance and Ethics – Generative AI*. Jakarta: ASEAN Secretariat.

[20] Soon Ghee Chua, Nikolai Dobberstein. (October 2020). *Racing toward the future.* pp. 1, 4.

[21] Arup. (2023). *Advancing Safe, Trustworthy and Ethical AI for Climate Action in Southeast Asia*. Available at www.arup.com/globalassets/downloads/insights/a/ai-for-sustainable-development-in-asean/ai-for-sustainable-development-in-asean.pdf.

[22] Lim Chong Kin, Cheryl Seah, (July 2024). *DNA ASEAN Guide to: How the Use of Artificial Intelligence is Regulated in Southeast Asia*. Drew Network Asia. pp. 53-60. Available at www.drewnetworkasia.com/media/bkoljoje/dna-asean-guide-to_how-the-use-of-artificial-intelligence-is-regulated-in-southeast-asia_final.pdf.

[23] Ibid., pp. 36-42.

[24] Ibid., pp. 61-69.

[25] Ibid., pp. 71-78.

[26] Soon Ghee Chua, Nikolai Dobberstein. (October 2020). *Racing toward the future.* p. 2.

[27] Ibid., p. 4.

[28] Arup. (2023). Advancing Safe, Trustworthy and Ethical AI for Climate Action in Southeast Asia. pp. 17, 105.

[29] Information on the Digital Economy Framework Agreement has been provided by ASEAN through official channels.

1.5. Defining Research and Innovation

Research and innovation (R&I) describes the combined process of generating knowledge (research) and transforming it into practical solutions (innovation). For the purposes of this report, innovation is defined as a new or improved product or process that differs significantly from its predecessors and is implemented. Implementation, wherein products are made available to potential users and processes are brought into use within an organization, is a critical requirement that distinguishes innovation from invention or abstract concepts. This definition aligns with the OECD–Eurostat *Oslo Manual 2018*, which further distinguishes two broad objects of innovation – product and business process – and allows for innovations that are "new to the firm", "new to the market" or "new to the world."[30]

This concept is related to R&D, but it is distinct and narrower in scope. According to the OECD *Frascati Manual*, R&D comprises creative and systematic work undertaken to increase the stock of knowledge and to devise new applications of available knowledge.[31] While some innovations are heavily dependent on R&D, many are not. Numerous process changes, service redesigns, digital delivery models, new pricing schemes, or workflow automations qualify as innovations without requiring formal R&D. Conversely, R&D projects may conclude without producing an implemented innovation. Thus, it may be understood as an input or enabler, whereas innovation represents the implemented change and its resulting outcome.

Table 1.1 outlines a framework for the R&I process consistent with the Oslo Manual.

Table 1.1 Stages of the Research and Innovation Process

Stage	Description	Typical activities and tools	Outputs and evidence	Role of R&D
1. Problem framing and opportunity sensing	Understanding needs, constraints, user challenges, and policy objectives.	User research, data analysis, horizon scanning, portfolio reviews.	Clear problem statement, initial hypotheses, preliminary success criteria.	Can occur (e.g. exploratory studies) but is not required.
2. Discovery and concept shaping	Generating options and determining which are viable for further development.	Co-creation, design thinking sprints, feasibility scans, business-case analysis.	Concepts, preliminary service or product designs, go/no-go decisions.	May include basic or applied research to inform concepts.
3. Development and design	Building a solution with the potential for implementation at scale.	Engineering, software development, service design, process redesign, supplier engagement, IP strategy.	Prototypes, pilots, draft standard operating procedures, data pipelines, draft contracts.	Often concentrated on this stage (e.g. experiments, proofs-of-concept).
4. Validation and piloting	Testing with end-users and refining the solution.	Usability testing, A/B tests, safety/quality assurance, compliance review, cost-benefit analysis.	Pilot results, refined specifications, risk and compliance approvals.	Experimental development is frequently utilized.

[30] OECD, Eurostat. (2018). Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation: The Measurement of Scientific, Technological and Innovation Activities. 4th ed. OECD Publishing: Paris. https://doi.org/10.1787/9789264304604-en.

[31] OECD. (2015). Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development: The Measurement of Scientific, Technological and Innovation Activities. Paris: OECD Publishing. https://doi.org/10.1787/9789264239012-en.

Stage	Description	Typical activities and tools	Outputs and evidence	Role of R&D
5. Implementation	Bringing a process into use or making a product available on the market.	Change management, training, deployment, procurement, communications, market launch, post-implementation review.	Qualifies as an "innovation" once implemented per the Oslo Manual (product launched or process in use).	R&D activities typically conclude amd handover to operational teams.
6. Diffusion, scaling and learning	Disseminating and improving the innovation, determining whether to pivot or retire it.	Roll-out, monitoring, benefits tracking, development of standards, open data or application programming interfaces (APIs).	Measured outcomes (e.g. uptake, productivity, satisfaction, emissions), lessons learned for future cycles.	Occasional (e.g. subsequent R&D for major upgrades), but largely operational.

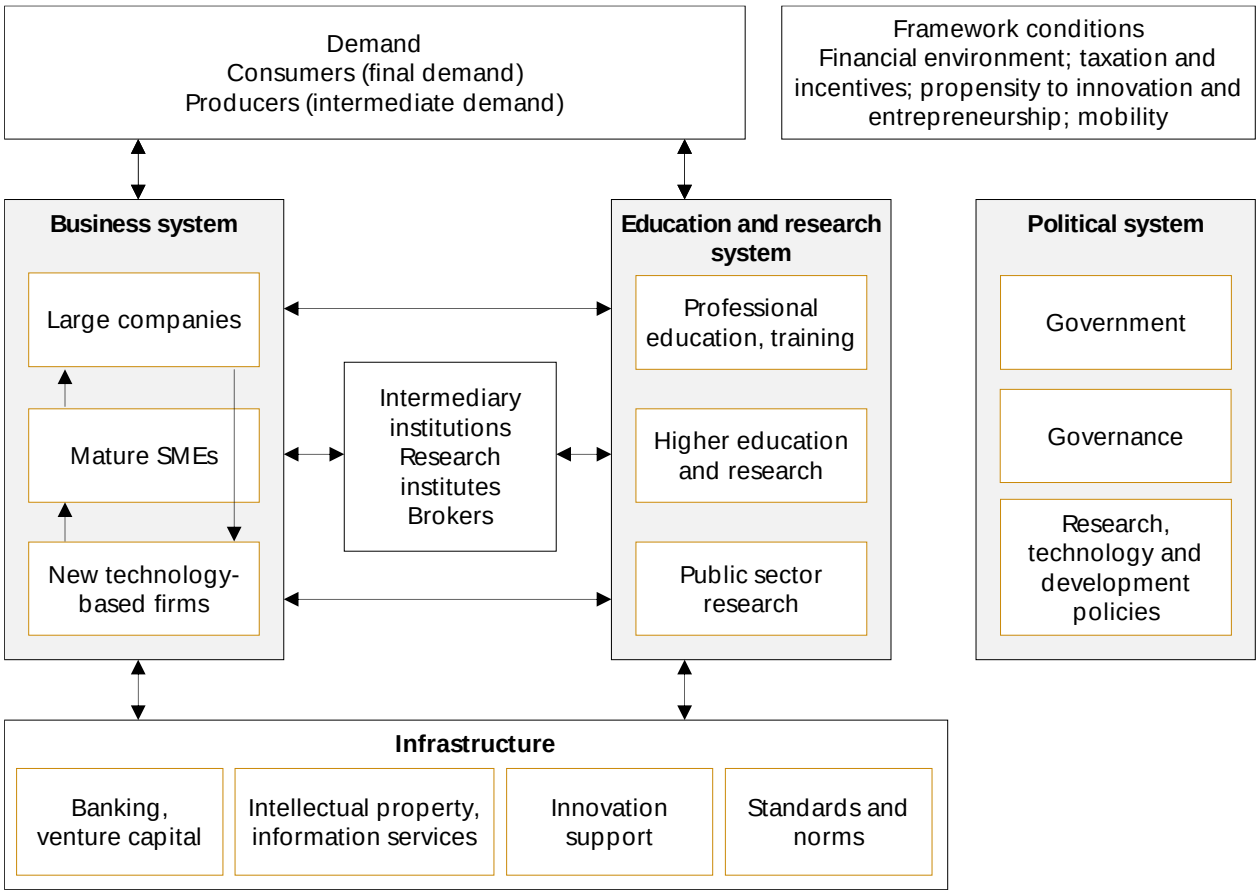
Source: Adapted from OECD and Eurostat *Oslo Manual 2018*. While the manual does not prescribe a single model for innovation, these stages represent a simplified framework for organizing innovation activities that is consistent with its implementation criterion and its distinction between product and business process innovations.

The process of innovation is rarely linear. Decades of research, from the "chain-link" model to systems thinking, have established that organizations engage in an iterative process involving problem framing, discovery, development, testing, and rollout, with frequent feedback from users and partners.[32] This understanding is consistent with the contemporary digital context, in which data, software, and user co-creation blur the distinction between product and process, and facilitate continuous improvement. The *Oslo Manual* acknowledges this dynamic: it defines the characteristics of an innovation and encourages the measurement of *both* the activities leading to innovation and the subsequent outcomes, without prescribing a single, rigid sequence.

At the national level, innovation is embedded in a national innovation system. This constitutes the network of actors (e.g. firms, universities, public laboratories, investors, regulators, civil society), the institutional and regulatory frameworks governing their activities, and the flows of knowledge, talent, capital, and data among them (see Figure 1.2). Effective linkages between these components - including skills, finance, standards, IP regimes, digital and physical infrastructure, public procurement, and competition policy - can accelerate the pace and broaden the distribution of innovation. Conversely, weaknesses or misalignments within the system can impede the translation of promising ideas into tangible outcomes. Accordingly, this report must examine not only AI R&I activities themselves but also the broader stakeholders, policy and market conditions that constitute their operating environment.

[32] Kline, S. & Rosenberg, N. (1986). "An overview of innovation," in *The Positive Sum Strategy: Harnessing Technology for Economic Growth*. National Academies Press. Available at https://nap.nationalacademies.org/catalog/612/the-positive-sum-strategy-harnessing-technology-for-economic-growth.

Figure 1.2 National Innovation System Framework



Source: S. Kuhlmann and E. Arnold, 2001, RCN in the Norwegian Research and Innovation System, Background Report No. 12 in the Evaluation of the Research Council of Norway. Oslo: Royal Norwegian Ministry of Education, Research and Church Affairs.

In Cambodia, enterprise-level innovation measurement is coordinated through the Cambodia Enterprise Innovation Index Guidelines under MISTI. Within MISTI, responsibility for the implementation and overall coordination of these guidelines is assigned to the General Department of Science, Technology & Innovation (GD/STI), and specifically to the Department of Policy Monitoring, Inspection and Evaluation (D/MIE).

1.6. METHODOLOGY AND APPROACH

This study provides a foundational analysis for enhancing Cambodia's R&I ecosystem, aiming to inform the development of a robust, inclusive AI innovation pipeline. It is the primary output of COPAI, a multi-stakeholder initiative co-facilitated by ESCAP and MISTI (see Box 1.1). Consequently, the policy report's methodology is intrinsically shaped by COPAI's co-creative and participatory nature.

Box 1.1 The COPAI: a Co-Creative Methodology

COPAI was established as an innovative collaboration initiative between MISTI and ESCAP to enhance Cambodia's national AI research and innovation capabilities. It was designed to address critical gaps in research capacity, digital infrastructure, data governance, human capital, and the need for an inclusive innovation ecosystem, as identified in prior national policy frameworks.

COPAI employed a collaborative "learning-by-doing" approach that emphasizes active participation, collective ownership, and inclusivity. Its objectives were to: (1) foster AI research through collaborative projects; (2) build capacity among diverse stakeholders; (3) facilitate partnerships between government, academia, and the private sector; (4) strengthen regional collaboration; and (5) develop an evidence-based foundation for Cambodia's AI roadmap.

The initiative was structured around a series of twelve "hub" sessions conducted from late 2024 to mid-2025, engaging approximately 150 diverse participants, including government officials, representatives of businesses and development partners, and university students. This journey was divided into two phases:

- **Phase 1-Incubation and Foundation Setting:** Early sessions focused on aligning concepts and drafting a national vision for AI innovation with key MISTI officials, rapidly prototyping a baseline AI strategy blueprint, and gathering initial expert feedback.
- **Phase 2-Deep Dives:** Subsequent sessions explored specific thematic areas critical to Cambodia's AI development, including youth engagement, ethics grounded in Buddhist values, economic development, human capital, and regional collaboration within ASEAN.

The COPAI process yielded several key outputs. The primary knowledge products are this comprehensive landscape study and a policy brief, *Applying an Inclusive Lens to Artificial Intelligence Innovation: The COPAI Experience*, which distills seven key insights on pathways for inclusive AI innovation in emerging economies, co-created through the hub dialogues:

1. **Cultural values as a powerful framework for ethical innovation:** Integrating local cultural and ethical values (like Buddhist principles in Cambodia) provides an agile and socially resonant foundation for responsible AI governance, especially where formal legal frameworks are still developing.
2. **Youth as present-day co-creators and innovators:** Engaging youth not just as future users but as active partners in the co-creation and auditing of AI systems transforms a demographic asset into a developmental force, bringing fresh perspectives and practical insights.
3. **Resource constraints as a catalyst for frugal and context-appropriate innovation:** Viewing limited resources as a design parameter rather than a purely negative constraint drives the development of efficient, low-cost, and resilient AI solutions (frugal innovation) that are better suited to local conditions.
4. **Regional collaboration as the valuable solution to data scarcity:** For languages and contexts underrepresented in global datasets, strategic regional partnerships (both top-down and bottom-up) are essential for building foundational models and sovereign data commons, reducing dependency on external platforms.
5. **Ecosystem mapping as a strategic policy tool:** The process of mapping the innovation ecosystem is not just a research exercise but a strategic intervention that builds the ecosystem itself by making actors and resources visible to one another, fostering spontaneous and valuable connections.
6. **The co-creative process for building an inclusive ecosystem:** Designing policymaking as an iterative, co-creative dialogue builds trust, collective ownership, and stakeholder buy-in necessary for effective and adaptive implementation in a rapidly evolving technological landscape.
7. **Capacity building as a continuous, multi-level process:** Building an AI-ready nation requires a continuous, "learning-by-doing" approach that goes beyond formal education to include collaborative networks, hands-on experimentation (like innovation labs), and shared discovery among all stakeholders.

Beyond these publications, the process generated lasting outputs: a sustained network of AI researchers and practitioners, a dynamic knowledge base of resources, and the pilot of a model AI innovation lab. This lab leveraged MISTI's HPC platform, enabling student volunteers to gain hands-on experience prototyping frugal AI solutions for local challenges.

Source: Cruz, Rafael Torquato (2025). *Applying an Inclusive Lens to Artificial Intelligence Innovation: The COPAI Experience in Cambodia*. ESCAP / 2-PB / 89.

Rather than a static analysis, the study was built upon a pragmatic "prototyping" approach, mirroring COPAI's process of iteratively developing and refining a shared understanding through a structured series of "hub" sessions. This iterative learning process, which engaged a diverse range of stakeholders from the outset, allowed the research to function as a "live mapping" of the ecosystem, uncovering not only existing capacities and gaps, but also fostering the very connections needed to strengthen it.

This report's structure logically follows this journey of collective discovery of overall perspective (Chapter 1: Introduction). Then, it begins by assessing the nation's foundational assets and systemic gaps (Chapter 2: National Capacities for AI Research, Innovation and Application), then

explores the tangible applications and value propositions within priority sectors (Chapter 3: Economic Opportunities for AI Application). From there, it establishes the culturally resonant principles of Cambodia that should guide development (Chapter 4: Enabling Inclusive and Ethical AI Research and Innovation Ecosystem). The entire analysis culminates in a set of actionable, evidence-based recommendations designed to build a coherent national AI pipeline (Chapter 5: Strategic Directions for Cambodia's AI Future).

Specific objectives include:

- Mapping key actors and initiatives in AI R&I and its priority sector applications,
- Analysing AI R&I and application readiness,
- Identifying critical gaps and strategic opportunities for advancing AI R&I and sectoral application with an inclusive lens,
- Analysing AI's contribution to the missions set out in the NRA,
- Examining the relevance of Cambodia's culturally informed ethical vision for guiding AI R&I and responsible deployment, and
- Providing evidence-based analysis to inform a national AI innovation pipeline.

The study concentrates on AI research, innovation, and sectoral applications. It encompasses core AI concepts with an applied focus, including machine learning, natural language processing (NLP) (particularly for Khmer language), computer vision, and relevant robotics and automation. AI ecosystem stakeholders encompassed by the report's mapping include government agencies, higher education institutions (HEIs), private firms, business associations, development partners, and international collaborators. Resources examined include funding, human capital, and data ecosystems. Infrastructure like computing resources, connectivity, and data centers are also inside the study's scope. R&D activities, innovation outputs, and the enabling environment (standards, university-industry linkages, incubation support) are further considered.

A mixed-methods approach provided a comprehensive, evidence-based, inclusive assessment. The methodology prioritized stakeholder engagement and iterative learning through the COPAI platform. Inclusivity was prioritized in the COPAI design with deliberate efforts for representation across sectors, institutions, locations, age groups, and gender (targeting 40 per cent female participation).

This involved comprehensive desk research and extensive primary data collection:

Desk research included systematically reviewing key national policy documents shaping the STI and digital landscape, including the *Pentagonal Strategy-Phase I*, *Vision 2050* goals, *National Science, Technology and Innovation Policy 2020-2030 (STI Policy 2020-2030)*,[33] *STI Roadmap 2030*, *NRA 2025*, *Cambodia Digital Economy and Society Policy Framework 2021-2035*, and *Digital Government Policy 2022-2035*. Prior ecosystem assessments, notably ESCAP *Science, Technology and Innovation Ecosystem of Cambodia* report (2021)[34] and MISTI's *AI Landscape in Cambodia* study (2023),[35] served as crucial baselines. Relevant academic publications, reports and documents from international organizations (e.g. World Bank, Asian Development Bank (ADB), International Labour Organization (ILO), UNESCO, ASEAN) and news articles on Cambodia's tech sector and policy developments were also analysed.

Primary data collection occurred mainly through COPAI, co–facilitated by ESCAP and MISTI from late 2024 to mid-2025. Participants included senior officials and technical staff from government ministries, faculty and students from key HEIs, private sector representatives, development partners relating to technology and innovation and international collaborators. Consultations utilized interactive online tools, foresight exercises, expert presentations, and facilitated dialogues, with sessions recorded and transcribed. Targeted interviews supplemented group sessions. Focused inquiry explicitly incorporated questions on the digital divide, rural needs, micro, small and medium enterprise challenges, and gender dynamics. Annex 1 includes a list of all organizations engaged in the process.

Data analysis used two primary frameworks: the National Innovation System approach to map and analyse ecosystem components, and ESCAP *Guidelines for inclusive technology and innovation policies for sustainable development.*[36] This inclusive lens aligns with the highest levels of international agreement on AI responsible development: the UN's *Pact for the Future* (General Assembly resolution A/RES/79/1) and its annexes: the *Global Digital Compact* and the *Declaration on Future Generations*, which provide the overarching political mandate for all States Members to ensure technology serves human development, narrows digital divides, and fosters an inclusive digital future. To operationalize this mandate and ensure Cambodia's AI R&I efforts foster technologically

[33] Cambodia, MISTI. (2019). *National Policy on Science, Technology and Innovation 2020-2030.* Phnom Penh: MISTI. Available at https://data.opendevelopmentcambodia.net/en/laws_record/national-policy-on-science-technology-and-innovation-2020-2030 (Khmer only. Accessed on 23 November 2025).

[34] ESCAP, Cambodia, MISTI. (2021). The Science, Technology and Innovation Ecosystem of Cambodia. Bangkok: United Nations. ST/ESCAP/2948.

[35] Cambodia, MISTI. (2023). AI Landscape in Cambodia: Current Status and Future Trends. Phnom Penh: MISTI. Available at https://misti.gov.kh/public/file/20230530168542628 5.pdf.

[36] ESCAP. (2020). *Guidelines for Inclusive Technology and Innovation Policies for Sustainable Development*. United Nations: Bangkok. ESCAP/CICTSTI/2020/4.

advanced, equitable, and sustainable development, the guidelines of ESCAP offered a structured approach for mainstreaming inclusivity throughout the policy cycle, aligning with the UN 2030 Agenda for Sustainable Development and its "Leave No One Behind" pledge. Applying these guidelines helps move beyond purely economic or technical metrics to assess how AI can genuinely benefit all segments of Cambodian society through the critical examination of four key dimensions and their eleven indicators (see Table 1.2).

Table 1.2 Guidelines for Inclusive Technology and Innovation Policies, Applied to AI Innovation

Dimension	Indicator	Explanation and application in the context of AI
A. Overall Objectives Do the overall aims of innovation policies involve more than economic growth?	A.1 Objectives are not exclusively related to economic growth but take account of a wider range of socially desirable outcomes, such as sustainability, equality, equity, social justice, health and well-being.	Scrutinizes whether national AI initiatives extend beyond GDP growth to explicitly include goals for social well-being, environmental sustainability, and broader societal progress.
B. Direction of Innovation Whose needs are being met?	B.1 Support for innovation addressing 'societal' challenges and needs.	Assesses whether AI development is steered towards national priorities, such as the missions outlined in the NRA 2025 (e.g. food security, healthcare, industrial innovation, education).
	B.2 Support for innovation addressing the particular needs of excluded groups.	Examines if deliberate mechanisms direct AI innovation towards the needs of marginalized groups (e.g. rural populations, persons with disabilities) and if Cambodia's Buddhist ethics-informed vision guides R&I towards equity.
C. Participation in Innovation Who participates in innovation?	C.1 Measures to increase the participation of underrepresented and excluded social groups in innovation and innovative sectors of the economy.	Assesses measures to overcome barriers for groups with low participation in STEM and tech, such as women and youth, and examines capacity gaps like low researcher density and skills mismatches.
	C.2 Measures to increase the participation of disadvantaged or lagging communities and districts.	Explores whether AI R&D resources and opportunities are concentrated in urban centers and if there are measures to involve and benefit rural and remote areas.
	C.3 Measures to promote innovation in low-productivity or low-innovation sectors.	Focuses on whether AI is being applied to uplift traditional, high-employment sectors like agriculture and small-scale manufacturing, rather than only high-tech industries.
	C.4 Measures to involve development partners and social economy organizations in innovation.	Examines the role of development partners, social enterprises, and community groups in the co-design and deployment of AI solutions, leveraging their trust and grassroots connections.
D. Governance of Innovation	D.1 Measures to broaden participation in innovation priority-setting.	Assesses how AI R&I priorities are set under NCSTI and MISTI. It asks who participates in these decisions beyond a small group of experts and how R&D funding is allocated.
	D.2 Measures to broaden participation in the regulation of innovation.	Examines how stakeholders (innovators, users, regulators) are involved in co-creating rules for AI, such as through regulatory sandboxes, and how IP is managed to foster innovation.
	D.3 Measures to mitigate the risks of innovation.	Focuses on how specific AI application risks (e.g. bias, job displacement, data privacy) are identified,

Dimension	Indicator	Explanation and application in the context of AI
		managed, and if ethical guidelines for AI research and deployment exist.
	D.4 Measures to promote fair distribution of the benefits of innovation.	Crucially asks how the benefits from publicly supported AI R&I (e.g. improved public services, economic gains) are equitably distributed across society.

Source: Adapted from *Applying an Inclusive Lens to Artificial Intelligence Innovation: The COPAI Experience in Cambodia*. ESCAP / 2-PB / 89.

The study acknowledges a significant limitation: the scarcity of quantitative in general and AI-specific data for Cambodia. Consequently, the analysis relies heavily on qualitative data from consultations, expert opinions, broader STI/digital statistics as proxies, and comparative insights.

CHAPTER

2

National Capacities for AI Research, Innovation and Application

The successful development and integration of AI into Cambodia's socio-economic fabric depends critically on the coordinated actions and capabilities of a diverse array of stakeholders. Building upon the context outlined in Chapter 1, this chapter undertakes a detailed analysis of the key actors within Cambodia's AI innovation ecosystem and the national capacities they rely on, contribute to, or are constrained by. It provides a granular examination of the specific roles, mandates, current initiatives, capacities, inherent challenges, and crucial interdependencies among government ministries and agencies, the private sector, academic and research institutions, and development partners. This is followed by an assessment of the national infrastructure, data ecosystem and workforce crucial for AI.

AI Research and Innovation in Cambodia

Cambodia's AI R&I activity has roots in the mid-2000s. Early scholarly contributions by Cambodian researchers included swarm-intelligence algorithms applied to industrial water reuse/recycling, an example of initial experimentation with AI-related methods in local problem-solving.[37] Concurrently, engineering groups began prototyping robotics and automation at the Intelligent Mechatronics Laboratory of the Institute of Technology of Cambodia (ITC), laying a practice-based foundation for later AI applications.

From the late 2010s onwards, practice communities and early adopters broadened this base. An open-source algorithms community (cambodia.ai) emerged to help developers build practical skills, while use cases such as People in Need's Flood Risk Detection[38] (reducing false positives), Electronic Know Your Customer mechanisms,[39] identity matching and fraud detection initiatives, Khmer chatbots and smart city concepts entered discussion and piloting. In parallel, local higher education institutions - including ITC, the American University of Phnom Penh, Kirirom Institute of Technology, and The Cambodia Academy of Digital Technology (CADT) - introduced AI-related courses to cultivate talent, and startups were experimenting with applied AI and robotics in humanitarian demining. These concrete initiatives applied AI in real world domains responding to specific local needs ahead of formal national strategies.

Academic and policy dialogue intensified around national convenings. The "1st Annual Forum on AI: Human Intelligence in Augmented Era", organized by ITC and the Cambodia Development Resource Institute in 2018, marked an early attempt to gather stakeholders but efforts were disrupted by the COVID-19 pandemic. The process resumed with the "2nd annual forum: AI for Society" on 10 August 2022 at the Cambodia University of Technology and Science, in collaboration with MISTI, to exchange points-of-view on the opportunities, risks and policy suggestions related to AI and to mobilise multi-stakeholder collaboration.[40]

More recently, the journey towards harnessing AI for research and innovation builds upon Cambodia's evolving STI ecosystem. The *National Policy on Science, Technology and Innovation 2020–2030* was approved in late 2019, setting the overarching direction for enhancing the national innovation system in Cambodia. Subsequently, the establishment of dedicated institutions: MISTI on 26 March 2020,[41] tasked with leading the national STI agenda, and the NCSTI on 10 October 2020[42] - an inter-ministerial body chaired by MISTI's Minister and honorarily chaired by the Prime Minister, designed to provide high-level coordination across government agencies. Building upon these structures, the *STI Roadmap 2030*, developed with ESCAP support and launched in 2021, operationalizes the *National STI Policy 2020–2030* with specific pillars, focused on governance, human capital, research capacity, collaboration, and

[37] Seingheng Hul and others. (2007). "Crisp and fuzzy optimisation approaches for water network retrofit", *Chemical Product and Process Modeling*, vol. 2, No. 3. Available at https://doi.org/10.2202/1934-2659.1040.

S. Hul and others. (2007). "Water network synthesis using mutation-enhanced particle swarm optimization", *Process Safety and Environmental Protection*, vol. 85, No. 6, pp. 507–514. Available at https://doi.org/10.1205/psep06065.

[38] Legarta, J. (2025, August 17). *Empowering resilience: People in Need's global impact through early warning systems*. People in Need Cambodia. https://cambodia.peopleinneed.net/en/empowering-resilience-people-in-needs-global-commitment-to-early-warning-systems-for-a-safer-tomorrow-11063gp.

[39] Electronic Know Your Customer (eKYC) is a mechanism that enables financial institutions and other regulated entities to verify the identity of their clients to prevent illicit activities such as money laundering and fraud. Available at https://camdx.gov.kh/docs/open-api/ekyc.

[40] Cambodia, MISTI. (2023). *AI Landscape in Cambodia*. See section 5.5.1 on AI Forums 2019 and 2022.

[41] Cambodia. Royal Decree No. NS/RKT/0320/421 (24 March 2020). Establishment of the Ministry of Industry, Science, Technology & Innovation.

[42] Cambodia. Royal Decree No. NS/RKT/1020/1249 (October 12, 2020). *Establishment of the National Council of Science, Technology & Innovation*.

enabling ecosystem. Subsequently, *NRA 2025*, launched in early 2023, identifies eight priority research missions to strategically direct R&D efforts towards national needs (see Chapter 3).

Concurrently, the Supreme National Economic Council has developed and rolled out the Cambodia *Digital Economy and Society Policy Framework 2021–2035* in 2021, which established the National Digital Economy and Society Council as the highest institution at the political level, chaired by the Prime Minister, for the promotion and development of the digital economy and society.[43] Meanwhile, the Ministry of Posts and Telecommunications (MPTC), through the Digital Government Committee of National Digital Economic and Social Council (NDESC) - one of the Council's three committees acting as "Etat-Major" for technical tasks - is leading the implementation of the *Digital Government Policy 2022-2035*, focusing on foundational digital infrastructure, e-government services, and cybersecurity.[44] The development of a national AI strategy thus requires careful coordination between relevant key government agencies, particularly MISTI/NCSTI (mandated to lead on R&D and innovation aspects) and MPTC/NDESC (leading the development of national the AI strategy and governance).

2.1. Government Ministries, Agencies and Policies

Ministry of Industry, Science, Technology & Innovation and the National Council of Science, Technology & Innovation

MISTI is the lead government ministry mandated with leading and managing the development of industry, science, technology, and innovation across Cambodia, aligning with *Vision 2030/2050*. MISTI's portfolio encompasses STI and industrial policies, SMEs, handicrafts and the informal economy, IP (through the Department of Industrial Property), the promotion of research commercialization (through the Department of Technology Transfer), metrology (through the National Metrology Center of Cambodia, NMCC), entrepreneurship promotion (through Khmer Enterprise, KE), and coordination of national STI policy (through NCSTI).

Cambodia's STI Roadmap 2030 explicitly recognizes a deficit in R&D investment, setting an ambitious target to increase combined public and private STI investment to 1 per cent of GDP by 2030, with a minimum public investment target of 0.5 per cent. To this end, *NRA 2025* proposed a National Research Fund, which government has already established in 2025, but its operationalization and effectiveness is the main consideration.[45] MISTI's current AI-related activities include conducting foundational assessments such as the 2023 study titled *AI Landscape in Cambodia: Current Status and Future Trends*, developing human capital guidelines, operating a HPC platform for R&D, and actively engaging in international collaborations. Critically, MISTI assumes the responsibility as the Secretariat for NCSTI, thereby placing it at the center of national STI coordination.

MISTI's Department of Industrial Property also plays an important role with regards to IP. While Cambodia's legal framework for IP was updated following its accession to the World Trade Organization in 2004 and is considered relatively advanced in some respects, practical implementation faces challenges. Patent filings are low, particularly from domestic innovators. Capacity within MISTI's Department of Industrial Property for examining complex technology patents and enforcement mechanisms needs strengthening, and specific guidelines for protecting AI-related IP are lacking.[46]

Another key component of MISTI's institutional framework is the Department of Technology Transfer, which is tasked with bridging the gap between research and commercial applications. Central to its mandate is the development of the draft Law on Technology Transfer. This pending legislation is designed to create a formal framework for collaboration between public research institutions and the private sector, a critical step for translating R&D, including in AI, into market-ready products and services. The law aims to support domestic innovation, facilitate the commercialization of research outputs, and strengthen Cambodia's capacity to adopt and adapt advanced technologies, thereby reducing reliance on foreign technology.

NMCC, as Cambodia's national metrology institute, oversees all metrology activities mandated by the country's Metrology Law, playing a crucial role in promoting fair competition, enhancing product quality, fostering innovation, minimizing technical barriers, and safeguarding the environment and public welfare. NMCC responsibilities include providing metrology registration, verification, calibration, licensing

[43] Cambodia, Supreme National Economic Council. (2021). Cambodia Digital Economy and Society Policy Framework 2021-2035.

[44] Cambodia, MPTC. (2022). *Cambodia Digital Government Policy 2022-2035*. Phnom Penh: RGC. Available at https://asset.cambodia.gov.kh/mptc/media/Cambodia_Digital_Government_Policy_2022_2035_English.pdf.

[45] ESCAP, Cambodia, MISTI. (2021). The Science, Technology and Innovation Ecosystem of Cambodia.

[46] Cambodia, MISTI. (2023). *AI Landscape in Cambodia*.

services, and training, ensuring accuracy, quality, and safety with international recognition. In the context of AI, its role in setting standards can strengthen confidence in data, algorithms, and AI outputs by extending principles of measurement science, traceability, and uncertainty quantification to the digital realm, a foundational element for trustworthy AI, as further discussed in box 2.5.

Khmer Enterprise functions as a national platform under MISTI entrepreneurship mandate, with the Minister of MISTI serving as Chair of its Board of Trustees. KE provides financial support, including grants and co-investments, to startups and SMEs, and delivers training, mentorship, and networking opportunities to strengthen entrepreneurial capacity. Its portfolio spans digital innovation, agribusiness, and green enterprises, and it frequently collaborates with international development partners and investors to broaden access to markets and capital. By directly supporting entrepreneurs and high-growth firms, KE plays a complementary role to the policy leadership of MISTI, helping to translate national STI and AI priorities into tangible business outcomes. This dual structure allows MISTI to set strategic direction while KE operationalizes support at the enterprise level, bridging the gap between research, innovation, and commercialization.

NCSTI is an inter-ministerial body for STI policy coordination and strategic direction. Chaired by the Minister of MISTI and honorarily chaired by the Prime Minister, with Vice-Chairs including the Minister of MPTC and representation from the Ministry of Education, Youth and Sport (MoEYS) and other key ministries, NCSTI is mandated to oversee the implementation of the *National STI Policy* and *Roadmap*, endorse key initiatives, like *NRA 2025*, and provide high-level guidance on cross-cutting technological issues, like AI.

Despite this structure, MISTI and NCSTI encounter several challenges as relatively new entities. Consolidating their mandates and coordinating effectively across established ministries requires ongoing effort.[47] Building internal technical capacity within MISTI and the NCSTI Secretariat to effectively guide and monitor complex AI initiatives is critical. Their success hinges on strong political will, effective leadership, the ability to foster genuine collaboration across the government apparatus and willingness and buy-in of other agencies to collaborate as well.

Ministry of Posts and Telecommunications and National Digital Economic and Social Council

MPTC is responsible for managing and developing the Post, Telecommunications, and ICT sectors within the Kingdom of Cambodia and has been appointed to coordinate the efforts on formulating the national AI strategy. MPTC's vision states the goal "to promote effective network infrastructure connectivity and accessible services of Post, Telecommunications, and ICT sectors across the Kingdom of Cambodia, the region, and the world to contribute to socioeconomic development"[48]. Under this vision, MPTC is responsible for: (i) managing the post, telecommunications, and ICT sectors in Cambodia based on free-market and social-equity principles; (ii) expanding effective, reliable, and secure backbone infrastructure nationwide; (iii) further modernizing the post, telecommunications, and ICT sectors with high-quality, affordable prices and nationwide service coverage; (iv) developing digital systems at national and sub-national levels to improve institutional administration and deliver public services in a timely, transparent, effective, safe, and economical way; (v) raising awareness on the use and benefits of ICT through dissemination, training, and capacity building for officials, students, and the private sector; (vi) encouraging investment to modernize the posts, telecommunications, and ICT sectors and promoting R&D; and (vii) ensuring operators comply with regulations to maintain fair competition and protect consumers' rights[49].

MPTC is working in several priority actions under the Cambodia Digital Government Policy 2022–2035[50], including strengthening 4G networks as a foundation for 5G, developing a national data center, enhancing the Cambodia Data Exchange (CamDX) platform, strengthening digital identity infrastructure, developing shared platforms and technical standards, and the Competency Framework on Digital, Media, and Information Literacy[51]. The ministry has also developed TranslateKH, an innovative AI-powered machine translation application between Khmer and English[52]. Another critical area requiring MPTC's participation, in working with other bodies, is the establishment of a comprehensive data governance framework, including the enactment of the Personal Data Protection Law (PDPL), to address the current legal vacuum hindering data-intensive AI applications[53].

The Digital Government Committee (DGC) of National Digital Economic and Social Council (NDESC) fulfills its

[47] ESCAP. (2021). *The Science, Technology and Innovation Ecosystem of Cambodia*.

[48] MPTC. (n.d.). Brief About MPTC. Retrieved from https://mptc.gov.kh/en/mptcs-overview/

[49] MPTC. (n.d.). Brief About MPTC.

[50] Royal Government of Cambodia. (2022). Cambodia Digital Government Policy 2022–2035. Retrieved from https://asset.cambodia.gov.kh/mptc/media/Cambodia_Digital_Government_Policy_2022_2035_English.pdf

[51] UNESCO. "Cambodia launches its first competency framework on digital, media and information literacy to empower citizens in today's digital society". 2 July 2024. Available at www.unesco.org/en/articles/cambodia-launches-its-first-competency-framework-digital-media-and-information-literacy-empower?hub=701 (accessed on 23 November 2025).

[52] MPTC. (n.d.). TranslateKH. Retrieved from https://translatekh.mptc.gov.kh/

[53] Stakeholder consultations on the status of Cambodia's Personal Data Protection Law.

function as the "Etat-Major" to the National Digital Economy and Society Council on promoting the digital transformation of the RGC in both technical and policy aspects, as designated by the Cambodia *Digital Economy and Society Policy Framework 2021–2035*[54]. Specifically, the DGC is responsible for "coordinating, leading, preparing, implementing, monitoring, and evaluating the implementation of policies, strategies, measures, technical standards, and action plans related to building the digital government. At the same time, this Committee also has the role of maintaining, protecting, and ensuring information and data security, especially in the public sector."[55]

The Telecom Regulator of Cambodia (TRC), established by the Law on Telecommunications 2015, is mandated to regulate the telecommunications sector. It operates autonomously and independently from telecom operators and ensures fair, efficient, and transparent competition, including the optimal use of frequency spectrum and numbering resources. TRC's objectives include: (i) implementing the National Broadband Policy and Strategic Action Plan adopted by the RGC; (ii) enforcing policies and regulations related to the telecommunications sector and ICT; (iii) promoting public understanding of the telecommunications and ICT sector; (iv) guaranteeing consumers have access to acceptable and quality services at affordable prices; (v) providing transparent regulatory processes and guidance, and enforcing regulations to ensure fair competition and efficiency in the telecommunications industry; (vi) following international standards and practices that contribute to the development and modernization of services and infrastructure; (vii) ensuring the optimal use of scarce resources such as frequency spectrum and telecommunications numbering; and (viii) consulting regularly with consumers and service providers while strengthening collaboration in the telecommunications industry[56]. TRC provides access to key sectoral laws and regulations, ensuring transparency and accountability within the telecommunications industry.

Ministry of Economy and Finance

The participation of the Ministry of Economy and Finance (MEF) on the AI ecosystem is profound, stemming from its central role in national economic policy, public financial management, and oversight of the financial sector. MEF, whose Minister also serves as the chairman of Supreme National Economic Council, plays a critical role leading to the development of the overarching *Cambodia Digital Economy and Society Policy Framework 2021–2035*, setting the broad vision for digital transformation. Its control over the national budget makes it the key facilitator for funding major government initiatives, including potential investments in AI R&D and innovation infrastructure. In practice, this committee is accountable to the council, establishing the framework for tasks related to artificial intelligence.

The direct relevance of MEF to AI R&I and application includes determining budget priorities and allocating funds for STI initiatives, including the proposed National Research Fund. It oversees key financial institutions like the SME Bank of Cambodia and the Entrepreneurship Development Fund, which could be strategically directed to support SMEs adopting AI, or AI-focused startups. MEF also houses the Techo Startup Center, which manages the Cambodia Data Exchange (CamDX) platform (see Box 2.3). These institutions are vital for improving the innovation support ecosystem, particularly access to finance, which is a major bottleneck for start-ups, including AI ventures.[57]

MEF also leads the *Fintech Development Policy 2023–2028*, with the objective to create an enabling environment for financial innovation, including AI applications in areas like credit scoring and fraud detection. The latter is of particular concern as AI-enabled fraud schemes are expected to grow in complexity and scale, making AI-enabled fraud detection an increasingly critical tool to safeguard financial integrity, ensure public trust, and protect both consumers and state revenues. Furthermore, it develops frameworks for e-commerce, implements the Financial Management Information System across ministries, and designs tax policies related to R&D or technology adoption. Effective AI R&I implementation requires securing MEF's buy-in and aligning initiatives with its economic priorities and fiscal constraints.

Ministry of Education, Youth and Sport

MoEYS holds the critical responsibility of developing Cambodia's human capital, from early childhood through higher education and lifelong learning. Key policy documents include the *Education Strategic Plan (ESP) 2019–2023*, and its successor, *ESP 2024–2028* as well as the *Policy on Higher Education Vision 2030*.

MoEYS's relevance to the AI ecosystem encompasses integrating digital literacy and foundational AI concepts into the national curriculum, leading efforts to increase overall enrollment, improve the quality of STEM education (including enhancing gender balance), and supervising public HEIs while setting standards for private ones. MoEYS is also responsible for developing and implementing programmes to upskill teachers in digital literacy and AI capabilities and it collaborates with the Ministry of Labour and Vocational Training on aligning technical and vocational training with industry demands. In the future, it could potentially leverage

[54] Cambodia, Supreme National Economic Council. (2021). *Cambodia Digital Economy and Society Policy Framework 2021-2035*. p. 61.

[55] Cambodia, Supreme National Economic Council. (2021). *Cambodia Digital Economy and Society Policy Framework 2021-2035*. p. 61.

[56] Telecom Regulator of Cambodia (TRC). (n.d.). About TRC. Retrieved from https://trc.gov.kh/en/about/

[57] Cambodia, MISTI. (2023). *AI Landscape in Cambodia*.

AI for educational research or personalized learning platforms.

Ministry of Agriculture, Forestry and Fisheries

As the ministry overseeing Cambodia's largest traditional economic sector, the Ministry of Agriculture, Forestry and Fisheries (MAFF) is a key stakeholder for AI applications aimed at boosting productivity, sustainability, and rural livelihoods. Its mandate includes agricultural policy, research (via the Cambodian Agricultural R&D Institute or CARDI), extension services, irrigation, fisheries, and forestry management. The *Agriculture Development Strategic Plan* guides the sector's development.

AI applications hold immense potential for Cambodian agriculture, including precision agriculture using sensors and AI analytics for optimized resource use, AI models for yield prediction and crop selection, AI platforms for market linkages and supply chain management and AI for monitoring natural resources (see Chapter 3). MAFF's role involves facilitating the adoption of such technologies, particularly among smallholder farmers who face barriers such as low digital literacy, high costs, and difficulties in access to relevant, granular agricultural data, which is a component of the broader data ecosystem challenge. Integrating AI into MAFF's existing research bodies, such as CARDI, and extension services could also advance dissemination of context-appropriate solutions, aligning with the NRA 2025 mission on local food production and potentially leveraging Green AI approaches for climate-resilient farming. On the other hand, the adoption of AI also has a high environmental cost, and it demands significant energy and water resources to power data centers and train large models, which could exacerbate Cambodia's climate vulnerabilities if left unmanaged (see Box 2.1).

Box 2.1 Green AI: Sustainable AI for Cambodia

AI's environmental burden is no longer confined to model training; for today's generative systems, inference at scale can equal or exceed training in energy and water use. The footprint spans the full lifecycle - data collection, model development, data-centre operation and cooling, and rapid hardware turnover - with knock-on effects through electricity, water, minerals and e-waste streams. Recent UN analyses highlight steep growth in data-centre demand driven by AI, rising water withdrawals for cooling, and persistent bottlenecks in materials recovery: in 2022 the world generated ~62 billion kg of e-waste, yet only ~22% was formally recycled in an environmentally sound manner[a], indicating limited capacity to handle accelerated AI hardware refresh cycles.

A "Green AI" approach treats sustainability as a first-order design constraint across that lifecycle. The core idea is to measure and disclose direct impacts (energy, water, materials, CO_2e, e-waste) for both training and inference; optimize models and operations for efficiency (data minimization, compact architectures, scheduling and siting to coincide with cleaner power and less water stress); improve hosting and cooling performance; and make environmental metrics transparent to users and buyers so demand can shift toward lower-impact options. This combines "Greening AI" – making models and infrastructure inherently more efficient – with "AI for Green" applications, but prioritizes standardized metrics and reporting so choices are evidence-based.

For Cambodia, the implication is to anchor AI expansion in measurement, efficiency, and responsible infrastructure siting. Publicly funded AI projects should disclose energy use, water intensity and estimated CO_2 use for both development and deployment; procurers should favour compact models and edge or cloud configurations that minimize net energy and water use; and intensive workloads should be sited with verifiable low-carbon power and water-efficient cooling. Extending device lifetimes, planning upgrade cycles, and establishing take-back and certified recycling can curb e-waste flows. Embedding these requirements into national strategy and procurement would let Cambodia capture AI's benefits without compounding grid constraints, water risks, or material waste.

[a] Cornelis P. Baldé, Ruediger Kuehr, Tales Yamamoto, Rosie McDonald, Elena D'Angelo, Shahana Althaf, Garam Bel, Otmar Deubzer, Elena Fernandez-Cubillo, Vanessa Forti, Vanessa Gray, Sunil Herat, Shunichi Honda, Giulia Iattoni, Deepali S. Khetriwal, Vittoria Luda di Cortemiglia, Yuliya Lobuntsova, Innocent Nnorom, Noémie Pralat, Michelle Wagner (2024). International Telecommunication Union (ITU) and United Nations Institute for Training and Research (UNITAR). 2024. Global E-waste Monitor 2024. Geneva / Bonn.

Source: United Nations Environment Programme (UNEP). (2024). Artificial intelligence (AI) end-to-end: The environmental impact of the full AI lifecycle needs to be comprehensively assessed (Issues Note). Nairobi, Kenya.

Ministry of Health

The Ministry of Health (MoH) is responsible for the nation's public health system, policy, and regulation. Improving health outcomes and access, particularly for vulnerable populations, is a core national goal reflected in the Cambodia Sustainable Development Goals and the NRA 2025 mission on digitally enhanced health.

AI offers transformative potential in healthcare, such as AI-assisted analysis of medical images, predictive diagnostics, AI tools for personalized medicine recommendations, AI for public health surveillance and disease outbreaks prediction, AI for optimizing hospital resource allocation, and AI-

powered chatbots for initial consultations or supporting remote diagnostics (see Chapter 3). MoH's role includes setting policies for digital health adoption, ensuring the safety and efficacy of AI medical applications, establishing standards for health data governance (a critical need given the sensitivity of medical data and the lack of comprehensive electronic health records) and building capacity among healthcare professionals to use AI tools effectively and ethically.

Other Key Ministries and Agencies

Several other ministries and agencies play important roles. The Ministry of Labour and Vocational Training is central to addressing AI's impact on the workforce, overseeing technical and vocational education and training (TVET) institutions and national skills development policies, including reskilling programmes for AI-related job market transformations. TVET institutions require significant and dynamic curriculum updates for AI-related skills to address human capital gaps as AI technologies evolve.

The Ministry of Commerce (MoC) is responsible for trade policy, business registration, consumer protection, and e-commerce development, creating regulatory frameworks that facilitate AI adoption in these areas.

The Ministry of Planning (MoP) and the National Institute of Statistics (NIS) are critical for providing high-quality socio-economic data needed to train, validate, and monitor AI applications, particularly for public policy, though the general scarcity of digitized, standardized, and shared data is a major constraint.

The Ministry of Interior (MoI) is responsible for public administration across the country's provinces and districts. It governs the National Police and manages law-enforcement functions such as police training, anti-drug efforts, border police, immigration and prison administration. Because of this national security mandate, the ministry is inevitably involved in cybersecurity and fraud prevention. Transnational crime groups operating in South-East Asia increasingly use AI-enabled technologies such as deep-fake services and malware in cyber-fraud operations. In this context, AI governance should include MoI and law-enforcement bodies. MoI's General Department of Immigration also handles immigration policy and could help design visa schemes to attract skilled AI professionals to Cambodia.

The Ministry of Environment (MoE) leads environmental protection and climate-change-related efforts. Beyond using AI for environmental monitoring and disaster risk management, AI's environmental footprint falls within its domain. Training and deploying large AI models consumes significant electricity and water, and data centres rely on critical minerals and produce electronic waste. The burgeoning AI industry could strain municipal water supplies, emit planet-warming greenhouse gases and raise e-waste and resource-extraction concerns. The MoE should therefore participate in AI policy discussions and ensure that scaling up AI does not undermine Cambodia's climate-change-mitigation commitments.

The Council for the Development of Cambodia, which houses the Cambodian Investment Board and the Cambodian Special Economic Zones Board, promotes both foreign and domestic investment. It can help create an enabling environment for AI by improving infrastructure, clarifying regulations and offering incentives for R&D and technology transfer.

Finally, the Ministry of Foreign Affairs and International Cooperation (MOFAIC) represents Cambodia to the international community and oversees foreign relations. Cambodia's foreign-policy direction emphasises five tasks: protecting national independence and sovereignty, fostering friendly relations, promoting economic diplomacy, supporting multilateralism and building diplomatic capacity.[58] Economic diplomacy includes attracting foreign investment, diversifying export markets and promoting Cambodian culture. These responsibilities position MOFAIC to negotiate cross-border data-flow agreements, engage in discussions on ethical AI and digital trade, and coordinate with ASEAN and other partners on AI-related initiatives. The Ministry also provides visa services and could collaborate with the MoI to facilitate entry for AI researchers and entrepreneurs while ensuring appropriate safeguards.

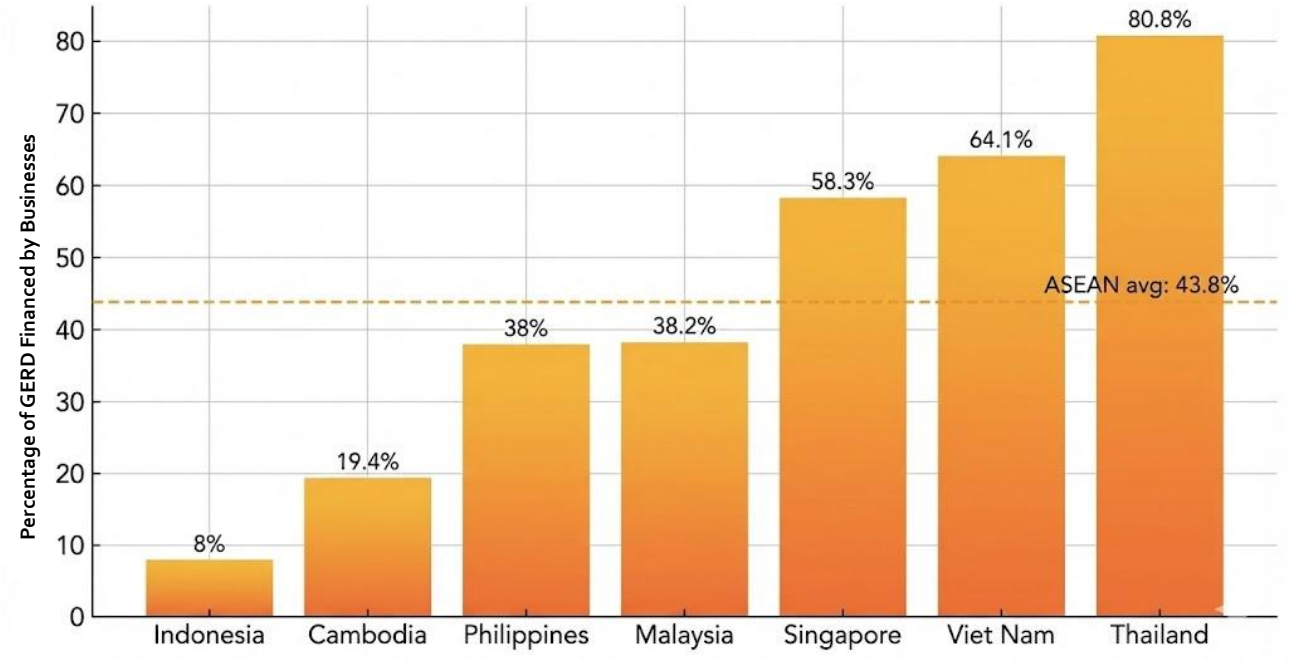
2.2. PRIVATE SECTOR

The private sector in Cambodia, encompassing large corporations, a vast number of Micro, Small and Medium Enterprises (MSMEs) and a nascent tech startup scene, is expected to be the primary engine for AI adoption and

[58] Cambodia, Ministry of Foreign Affairs and International Cooperation. (2021, February 8). Cambodia's foreign policy direction. Available at https://www.mfaic.gov.kh/page/2021-02-08-Cambodia-s-Foreign-Policy-Direction.

market-driven AI applications. However, private R&D capacity is generally low, contributing only 19.4 per cent of Gross domestic expenditure on R&D (GERD), compared with an ASEAN average of about 43.8 per cent (see Figure 2.1), and it faces challenges in accessing skilled talent and leveraging digital and data infrastructure effectively.

Figure 2.1 Percentage of GERD Financed by Businesses, ASEAN Countries, 2024



Source: WIPO Global Innovation Index 2024, country ranking reports (data from Brunei Darussalam, Lao PDR and Myanmar was not available)

Industry Characteristics and AI Readiness

Cambodia's industrial landscape features a "missing middle" – a small cohort of medium-sized domestic firms between a few large enterprises and an extremely large base of MSMEs.

Large enterprises, including major players in garment, footwear, and travel goods (GFT) industries, banking and telecommunications, generally possess greater financial and technical capacity. Telecommunication companies, for instance, are actively gearing up for AI, 5G, and IoT innovations, creating sandboxes and deploying more content delivery networks (CDNs) to support AI applications. For large enterprises, the potential of AI adoption lies in optimizing operations, enhancing customer service, and financial risk management. However, their incentive for deep, locally focused AI R&I may be limited, often favouring imported solutions. Their role in technology transfer is currently considered weak.[59] They are significant users of digital infrastructure and generators of data, but their contribution to national R&D capacity is minimal.

MSMEs constitute over 99 per cent of enterprises and employ the majority of the workforce (often cited as responsible for above 70 per cent of it),[60] though many operate informally. MSMEs typically face severe constraints in financial resources, technical capacity, digital literacy, data availability (often lacking structured data for AI), and scale. Their AI adoption potential lies in accessible, low-cost solutions that deliver clear productivity gains, such as AI-powered marketing tools or simple chatbots (e.g. agritech advice apps). They rely heavily on basic mobile connectivity and would benefit from improved digital infrastructure and AI literacy programmes to enhance their human capital.

Digital startups[61], concentrated mainly in Phnom Penh, are a dynamic but nascent segment focusing on fintech, edtech, agritech, and e-commerce. Notable AI-oriented examples include ChivCheat, an agritech Telegram chatbot in Khmer that helps cashew farmers diagnose pests and receive advisory support (see Box 3.2); VP.Start Technology, a local smart-grid developer whose IoT/SCADA stack for EDC is evolving toward AI/ML for load forecasting and predictive maintenance (see Box 3.3); AI FARM Robotics, a robotics micro-factory with labs aimed at SME automation and

[59] ESCAP. (2021). The Science, Technology and Innovation Ecosystem of Cambodia.

[60] ADB. (2022). "Cambodia" in *Asia Small and Medium-Sized Enterprise Monitor 2022 - Volume I: Country and Regional Reviews, November 2022.* Manila: ADB. Available at https://www.adb.org/sites/default/files/publication/843146/asia-sme-monitor-2022-volume-1.pdf.

[61] A *digital startup* is legally defined as an entity developing prototype digital products or services with high-growth potential under conditions of uncertainty, according to Sub-Decree No. 102 on Management and Incentivization of Digital Startups.

industrial AI toolchains (see Box 3.5); and Boost Capital, a fintech chatbot that streamlines MSME loan applications and delivers chat-based financial education (see Box 3.8). Despite this momentum, key challenges persist - limited seed funding and an underdeveloped VC ecosystem, scarcity of AI talent, small domestic market, and a maturing support system. Initiatives like AI Singapore's AI Apprenticeship Program (AIAP), detailed in Box 2.2, offer models for intensive talent development that could inform Cambodian strategies.

Box 2.2 AI Singapore: Catalyzing a National AI Ecosystem

AI Singapore (AISG), Singapore's national AI programme, established in 2017, offers several initiatives relevant to fostering an AI ecosystem, particularly in talent development and industry adoption:

- **AI Apprenticeship Program (AIAP):** A 9-month full-time programme to upskill professionals and transition them into AI roles, combining intensive training with on-the-job experience on real industry projects. This model has been replicated internationally and serves as a strong example of focused talent development.
- **AI Innovation (100 Experiments, or 100E):** AISG co-funds the development of Minimum Viable Products (MVPs) for AI solutions with companies, particularly SMEs. It provides engineering and project management support, sharing risks to promote AI adoption. Over 100 projects have been undertaken.
- **AI Products and SEA-LION:** Recognizing the data scarcity for regional languages, SEA-LION is an open, collaborative initiative to build foundational LLMs for South-East Asian languages, including ongoing work to improve Khmer language capabilities. These models are treated as digital public infrastructure.
- **South-East Asia Data Initiative and SEABELLS:** AISG is working to build high-quality datasets for SEA languages and developing SEABELLS (South-East Asian Benchmarks for LLMs) to create culturally relevant evaluation metrics.
- **International Collaboration:** AISG actively engages with partners across South-East Asia, including Cambodia, through initiatives like the Visiting Scholars programme to build regional AI talent.

Source: AI Singapore official website (https://aisingapore.org/); Stakeholder consultations.

The informal sector and grassroots innovation represent a significant, though often uncaptured, part of Cambodia's economy. Despite formal capacity limitations, Cambodia's large informal sector and rural population possess significant potential for grassroots innovation.[62] Accessible AI tools, particularly in Khmer and designed for low-resource environments (e.g. simple chatbots via messaging apps, offline capabilities), could empower these communities. Supporting grassroots AI adoption requires enhancing digital literacy, providing access to relevant tools and data (especially Khmer language data), and ensuring access to the required infrastructure and hardware, potentially by establishing community tech hubs.

Finally, business support organizations play a crucial role in nurturing this ecosystem. Entities like the Techo Startup Center (TSC), under MEF, provide a wide range of support for the innovation ecosystem (see Box 2.3). KE is another key governmental platform aimed at fostering entrepreneurship and supporting SMEs and startups through funding, training, and networking. Private incubators and accelerators like Impact Hub Phnom Penh also contribute to this landscape, though the overall support system for highly specialized AI ventures is still maturing. Associations like the Cambodia Chamber of Commerce (CCC) and the Federation of Associations for Small and Medium Enterprises of Cambodia (FASMEC) serve as important conduits between government and the private sector. Their role in the AI ecosystem involves raising awareness, channeling industry feedback to policymakers, and potentially partnering on initiatives to promote AI adoption or digital skills development, thereby contributing to bridging the human capital and R&D gaps for their members.

[62] Jared Bissinger. (2023). Understanding the Paths to Formalization in Cambodia: An Integrated Vision. Phnom Penh: UNDP.

Box 2.3 Techo Startup Center's Multi-Faceted Support Model

TSC, under the MEF, represents Cambodia's flagship government platform for cultivating tech entrepreneurship and innovation. Its programmes span the entire startup lifecycle: The *Touring Hackathon* engages university students and grassroots innovators at the ideation stage; the *Digital Platform Accelerator* provides structured mentorship, investor connections, and product validation; and the *Reverse Innovation* programme links problem statements from established corporations with local solution providers, fostering demand-driven innovation.

To address the country's early-stage financing gap, TSC offers equity-free seed grants typically ranging from $5,000–10,000, mobilized in partnership with commercial banks and private sponsors. Beyond serving as an intermediary, TSC also develops in-house technologies for both government and private use. Its AI-powered *eKYC* platform, for example, is already deployed in the financial sector, processing thousands of identity verification requests monthly and strengthening digital trust. The Cambodia Data Exchange (CamDX) is a secure, decentralized interoperability platform that enables real-time data sharing between government agencies and private sector actors, underpinning e-government services and digital transactions without centralizing sensitive data. This dual role – as both accelerator and direct developer – enables TSC not only to nurture startups but also to demonstrate practical models of digital solutions that respond to real policy and market needs.

Source: Stakeholder interviews; Techo Startup Center. (2024). Digital Platform Accelerator – Cohort 2. Retrieved from https://dpa.techostartup.center/en/cohort-2; and CamDX. (2024). CamDX user guide. Retrieved from: https://www.camdx.gov.kh/documents/files/CamDX%20User%20Guide%20Book%20English.pdf

2.3. ACADEMIA

Cambodia's higher education landscape for AI development can be understood as a dual track system. On one track are the established public universities, which serve as the foundational pillars for science and engineering education; and on another track is a new and dynamic set of private HEIs introducing highly specialized, globally benchmarked programmes in AI at both undergraduate and postgraduate levels. This academic evolution aligns with the Royal Government of Cambodia's overarching strategic vision. Key national policies, including the *Cambodia Digital Economy and Society Policy Framework 2021–2035* and the *Pentagonal Strategy*, explicitly prioritize the development of digital talent and technology as core drivers of future economic growth and diversification. The academic sector is therefore not only responding to market forces but is also a designated instrument of national policy, tasked with cultivating the human resources necessary to achieve these ambitious goals.

Key Institutions and Programmes

RUPP, Cambodia's oldest and largest public university, is a key pillar of the nation's AI talent pipeline. The RUPP Faculty of Engineering offers undergraduate degrees in Information Technology Engineering and Data Science Engineering, providing students with the essential theoretical and practical building blocks for careers in technology. At the postgraduate level, the Master of Science in IT Engineering (MITE) programme introduces students to more advanced topics, with specific courses in AI, machine learning and natural language processing. These programmes are critical for producing a broad base of IT professionals from which future AI specialists will emerge. The university is the host of the National Incubation Center of Cambodia (NICC), positioning it at the critical intersection of education, research, and entrepreneurship (see Box 2.4). This symbiotic relationship between the university's academic departments and the incubation center is designed to foster an entrepreneurial culture and accelerate the commercialization of digital innovations.

ITC is the nation's premier public institution for engineering education and research. With a strong focus on applied science and technology, ITC plays an important role in training Cambodia's engineers and technical experts. The institute offers a comprehensive suite of relevant programmes, including Doctor and Master of Science degrees in Computer Science and Data Science, which are vital for developing advanced AI capabilities. ITC distinguishes itself through its dedicated research laboratories, which represent some of the most focused academic R&D hubs for AI in the country. These labs are crucial for building technical capacity and addressing local challenges:

- **Computer Vision and NLP Lab (ViLa Lab):** A specialized unit focusing on AI, Computer Vision, and

Natural Language Processing. Critically, it places a particular emphasis on applications for the Khmer language.[22] This focus is essential for developing inclusive AI tools and services that are accessible and relevant to the Cambodian population, from chatbots to text and speech processing systems.

- **Data Communication Lab (DCLab):** This lab pursues a broader research agenda that includes AI and data science, robotics, and the Internet of Things. Its multi-disciplinary approach indicates a capacity to undertake complex, integrated projects that mirror real-world technological systems.

Box 2.4 The National Incubation Center of Cambodia

Established at RUPP with KOICA support ($ 8 million project, 2019–2024) and inaugurated in March 2024, NICC represents Cambodia's flagship effort to foster university-based innovation and entrepreneurship. It provides physical incubation space, prototype labs, digital studios, seed funding (over $ 310,000 reported disbursed), mentorship, entrepreneurship training, and networking events connecting students, researchers, industry, and international partners (e.g. CAM–KOR Startup Exchange), serving multiple universities, not just RUPP.

While not exclusively AI-focused, NICC provides essential infrastructure and support for AI startups emerging from academic research or student projects, helping translate technical ideas into viable business models.

Despite being a promising initiative, the long-term impact of NICC will depend on its ability to provide follow-on funding and support for its incubated startups and to foster a stronger entrepreneurial culture among public university students, as well as to secure long-term financial sustainability beyond initial KOICA support.

Source: NICC official information (e.g. via RUPP news, Khmer Times, March 23, 2024); KOICA project information.

CADT is a strategic public institution established under MPTC with a mandate to be the national flagship for excellence in digital education and research. Its structure is unique, comprising three integrated institutes focused on digital governance, digital research and innovation, and digital technology. This holistic design allows CADT to address the technological, policy, and innovation dimensions of Cambodia's digital transformation in a coordinated manner. In terms of academic offerings, CADT provides one of the most advanced and specialized AI-focused degrees in the country: Its Master of Computer Science programme is explicitly designed to cultivate deep expertise in AI and data science. The curriculum covers topics such as Advanced Machine Learning, Computer Vision, Natural Language Processing, Large-Scale Data Management, and General Processing Unit (GPU) Computing.

Other relevant public institutions include the National Polytechnic Institute of Cambodia (NPIC) for technical skills and the University of Health Sciences (UHS) for medical AI applications.

From the private sector, CamTech University is the first institution in the country to offer a complete academic pathway in AI, from a bachelor's degree to a PhD, taught by dedicated full-time faculty. Further distinguishing its curriculum, CamTech is also the first university in Asia to offer a PhD in Science, Technology, and Society (STS), a programme designed to develop leaders who can operate at the intersection of innovation, ethics, and social change. The university's approach is built on three complementary initiatives:

- **The AI Lab for Education:** Launched in collaboration with MoEYS and the International Fund for Agricultural Development (IFAD), this lab focuses on integrating AI into the educational landscape to enhance teaching and learning through innovative technologies.

- **The AI Forum:** Founded in 2018, the AIF is a pioneering platform that promotes critical dialogue on AI's societal impact and fosters partnerships between academia, industry, and government.

The Center for Buddhist AI Ethics: Established in June 2023, this unique center aims to bring "ancient wisdom into conversation with cutting-edge technology", according to its website (https://camtech.edu.kh/camtech-ai-university-purpose-innovation-asia). Its vision is to guide AI development with Buddhist ethics for the well-being of humanity. The center actively explores how principles such as compassion (*Karuna*) and non-violence (*Ahimsa*) can inform the creation of ethical AI systems. It serves as a collaborative space for scholars and policymakers and hosts

a seminar series on topics like "Buddhism and AI: Reality, Ethics, and Governance" to advance this dialogue.

Moreover, the American University of Phnom Penh (AUPP) has rapidly positioned itself as a leader in specialized, market-responsive AI education in Cambodia. At the postgraduate level, AUPP's School of Digital Technologies offers a Master of Science in Computer Science with an AI Specialization. The curriculum is designed to equip students with cutting-edge skills, featuring core courses in Generative AI, Machine Learning, Deep Learning, and Reinforcement Learning. The university also provides a distinct Master of Science in Artificial Intelligence as a single-degree option, which includes unique courses such as AI Ethics and No Code AI, reflecting an understanding of both the ethical dimensions and the practical accessibility of AI tools. AUPP also offers a Master of Law in Artificial Intelligence tailored for legal professionals, addressing the critical and growing need for expertise at the intersection of technology and law. Its curriculum covers essential topics such as AI regulatory compliance, data protection and privacy, cybersecurity law, and the ethical and legal issues inherent in AI systems.

Kirirom Institute of Technology (KIT) is another English-medium institute, located inside Kirirom National Park. KIT delivers project-based, industry-linked training in software and data-intensive fields. Its flagship Bachelor of Software Engineering programme integrates modules in machine learning and data science and is structured around early internships coordinated by the campus Incubation Center, giving students hands-on exposure to real-world projects. Recent partnerships, such as with DICHI Academy for fast-track courses in full-stack development and data science, further connect students to market needs.[63]

Paragon International University and ACLEDA University of Business also offer IT and business programmes with some AI/data science elements, contributing to graduate output, though research capacity is often more limited.

Complementing the roles of the aforementioned HEIs, specialised research institutions and think tanks, such as the Cambodia Development Resource Institute, contribute to policy analysis but have limited capacity for large-scale technical R&D. The Asian Vision Institute (AVI), an independent Phnom Penh-based think tank, supports the national AI ecosystem through its Centre for Inclusive Digital Economy (CIDE), which runs programmes on digital transformation and emerging technologies. Its work stresses the importance of "cultural sensitivity and global collaboration," complementing technical discussions with a focus on

aligning AI with local values and societal well-being.[64] Sector-specific research institutes like the Cambodian Agricultural R&D Institute under MAFF focus on areas like agricultural R&D but may lack resources for cutting-edge AI research. AVI and CIDE contribute policy research and public dialogue on AI while also convening initiatives that build digital literacy and entrepreneurship, helping translate frontier technology debates into practical policy options and inclusive economic opportunities.

2.4. International and Development Partners

Cambodia's journey towards developing a national AI ecosystem is alongside supported by a diverse array of international partners and development agencies. Given resource constraints in domestic R&D funding (with foreign sources accounting for ~35 per cent of GERD in 2015)[65] and limitations in specialized human capital, these external actors play a vital role in supporting the country's ambition. They provide technical expertise, facilitate access to global knowledge, support infrastructure development (including digital, data, energy), contribute to capacity building across various national areas (such as R&D, human capital), and help align national efforts with regional and international standards.

Multilateral Organizations

Several United Nations entities operate in Cambodia, under the umbrella of the UN Country Team. The Resident Coordinator leads the UN Country Team and steers the UN Sustainable Development Cooperation Framework with the

[63] Cambodia Investment Review. "Kirirom Institute of Technology & DICHI Academy commit to developing future tech talent in Cambodia". 30 August 2024. Available at: https://cambodiainvestmentreview.com/2024/08/30/kirirom-institute-of-technology-dichi-academy-commit-to-developing-future-tech-talent-in-cambodia/ (accessed on 23 November 2025).

[64] Asian Vision Institute. (2024). AVI COMMENTARY ISSUE: 2024, No. 05 | Cambodia's AI Future: Steering Ethical and Inclusive Development. Available at https://asianvision.org/archives/publications/avi-commentary-issue-2024-no-05-cambodias-ai-future-steering-ethical-and-inclusive-development (accessed on 22 August 2025).

[65] ESCAP & MISTI. (2021). *The Science, Technology and Innovation Ecosystem of Cambodia*. (Foreign sources of GERD).

Royal Government of Cambodia, convening specialised agencies, funds and programmes to deliver demand-driven support. For STI and AI specifically, the Resident Coordinator's Office (RCO) aligns country needs with UN capacities across policy, ethics, data governance, infrastructure and human capital — ensuring coherence with the SDGs and the Government's Pentagonal Strategy.

ESCAP is the UN's regional intergovernmental platform in Asia and the Pacific. Its mandate is to promote regional cooperation for inclusive, resilient, and sustainable development by generating action-oriented knowledge and providing technical assistance, capacity-building, and policy advisory services in support of national priorities, regional agreements, and the 2030 Agenda. In Cambodia, ESCAP has emerged as an important partner for science, technology, and innovation, including AI. It has provided technical support for the formulation of Cambodia's *National STI Policy 2020-2030*, *STI Roadmap 2030*, *NRA 2025* and the other policy studies on AI. ESCAP has co-facilitated COPAI, managing the co-creation process and promoting the integration of its *Guidelines for Inclusive Technology and Innovation Policies* (see Table 1.2).

UNESCO plays a critical role in guiding the ethical and educational dimensions of AI development. It promotes its global *Recommendation on the Ethics of Artificial Intelligence* (2021) and has collaborated with Cambodian CADT on the national AI Ethics Readiness Assessment using its Readiness Assessment Methodology (RAM), supporting the development of data and AI governance capacity. UNESCO also works with MoEYS to promote AI integration in education, supporting AI competency frameworks for teachers and students, directly contributing to human capital development.

UNDP in Cambodia complements system-level efforts by operationalizing AI for immediate policy use and building institutional capabilities. In 2024, UNDP launched the Poverty/Vulnerability Mapping platform, co-developed with MoP's National Institute of Statistics and other partnerships. It combines data from the Cambodia Socio-Economic Survey with satellite-derived indicators (e.g. night-time lights, building footprints) using ML models to generate granular probability maps that help inform policy interventions across education, health, living standards and monetary dimensions at province, district and commune levels.[66]

ASEAN provides platforms for policy dialogue (ASEAN Digital Ministers' Meeting (ADGMIN), ASEAN Ministerial Meeting on Science, Technology and Innovation) and has developed regional guides like the *ASEAN Guide on AI Governance and Ethics* (2024) and an expanded guide published the following year dedicated to generative AI. These non-binding guides offer common principles that Cambodia can leverage for its data and AI governance capacity. Cambodia is part of negotiations for the ASEAN Digital Economy Framework Agreement, which aims to harmonize rules on digital trade and emerging technologies.

ADB, the World Bank and the Asian Infrastructure Investment Bank (AIIB) are major financiers and technical advisors. They provide loans for large-scale infrastructure projects (energy, transport, digital connectivity) and offer technical assistance for reforms in public financial management. While not typically funding frontier AI R&D directly, multilateral development banks play a critical role in financing foundational infrastructure and supporting necessary policy reforms that underpin national AI capacity. Examples include World Bank support for MEF's Financial Management Information System, education, and digital economy policy; AIIB support for the Fiber Optic Communication Network Project (CFOCN) initiative; and ADB support for studies on Cambodia's startup ecosystem.[67]

Bilateral Partnerships

Cambodia's bilateral partnerships form a critical layer of support for its emerging AI and digital innovation ecosystem. These collaborations extend beyond financial aid to encompass infrastructure development, human capital formation, technology transfer, and the exchange of governance practices.

The People´s Republic of China is Cambodia's largest trade and development partner, particularly through the Belt and Road Initiative (BRI) and its Digital Silk Road (DSR) component, promoting cooperation in ICT infrastructure and AI applications. Chinese technology companies are major players regionally, influencing technological options. In April 2025, the Ministries of Commerce of both countries signed a memorandum of understanding (MoU) to "to strengthen multi-disciplinary industrial and supply chain cooperation through trade, investment and technological cooperation, and further tap into the demonstration effect of economic and trade cooperation zone such as the Sihanoukville Special Economy Zone".[68] Simultaneously, three other MoUs were signed between (1) MISTI and the Ministry of Science and Technology of the People´s Republic of China on a Science and Technology People-to-People Exchange Programme

[66] United Nations Development Programme (UNDP). (2024). *Poverty and vulnerability mapping with AI and machine learning in Cambodia: Policy brief*. Phnom Penh: UNDP Cambodia. Available at: https://www.undp.org/cambodia/publications.

[67] ADB. (2020). *Cambodia's Start-up and Innovation Ecosystem*. Manila: ADB. Available at https://www.adb.org/publications/cambodia-startup-innovation-ecosystem

[68] Ministry of Commerce of the People's Republic of China. (2025). China and Cambodia signed the Memorandum of Understanding on Industrial and Supply Chain Economic Cooperation. Available at https://english.mofcom.gov.cn/News/SignificantNews/art/2025/art_a8961f2f032242dea4ce6b8f91b1a7af.html

supporting annual exchanges, co-organized workshops and institutional partnerships for joint research; (2) NCSTI and the National Development and Reform Commission (NDRC) of People´s Republic of China on an AI cooperation roadmap covering cloud and data centre infrastructure, human capital development and a Cambodian LLM, with cooperation on regulation, risk and safety; and (3) MISTI and the Ministry of Industry and Information Technology (MIIT) of the People´s Republic of China on photovoltaic cooperation in research and manufacturing, smart solar technology and PV standardization.[69]

France is another key bilateral partner for Cambodia's AI and wider digital transformation. France's AI support to Cambodia centers on higher education, research, and capacity building: the French embassy's Hubert Curien "PHC Tonlé Sap" programme funds joint projects such as an AI deep-learning "context-aware classroom" pilot at the CADT with Université Grenoble Alpes.[70] The embassy also co-finances scholarships with MoEYS and CADT (about five new awards per year since 2018), and in July 2024 renewed an MoU to send top Cambodian PhD candidates in digital technology to French universities.[71] The Institut Pasteur du Cambodge has created a Bioinformatics and Artificial Intelligence Applications unit and is applying AI methods in public-health research, including a collaboration with CADT and Calmette Hospital to address antimicrobial resistance using a machine-learning model for hospital decision-support[72].

Japan is a long-standing partner, contributing to infrastructure and human capital. Through its Japan International Cooperation Agency (JICA), the Government of Japan is financing core digital infrastructure. Examples include a grant of up to $15,6 million for Cambodia's National Data Center to anchor digital government services, and a nationwide Continuously Operating Reference Station network and data center to enable high-precision geospatial services that underpin smart cities and logistics.[73] JICA DXLab is collaborating with the National Bank of Cambodia on an AI-based liquidity-forecasting model, and with the Digital Government Committee to co-develop a last-mile delivery SaaS as a Digital Public Good.[74] Cybersecurity capacity is being built through the 42-month Project for Improvement of Cyber Resilience in Cambodia with MPTC/CamCERT, complemented by JICA-led joint cyber-defense exercises for Cambodia and regional partners. Under the Japan-Cambodia Economic Co-Creation Package, Japan is also supporting the Cambodia–Japan Digital Manufacturing Center at the Royal University of Phnom Penh, Open RAN (open radio access network architecture) demonstration experiments for secure connectivity, an OECD "AI Toolkit" co-creation workshop, and enhancements to the Cambodia–Japan Cooperation Center.

The Republic of Korea's Korea International Cooperation Agency (KOICA) has been pivotal in fostering Cambodia's innovation infrastructure, notably through a US$7.91 million project (2019–2024) to establish and operate the National Incubation Center of Cambodia (NICC) at the Royal University of Phnom Penh, a core infrastructure designed to strengthen university-industry linkages and build entrepreneurial human capital.[75] In parallel, the Republic of Korea's Science and Technology Policy Institute (STEPI) has provided technical assistance to MISTI to develop six sectoral Technology Roadmaps 2030, officially approved in March 2023.[76] Most recently, on 29 April 2025, MISTI and STEPI signed a memorandum of understanding to co-develop an industry innovation and R&D cluster in Cambodia, including the development of a national R&D management system, further institutionalizing the partnership and aiming to accelerate applied research, technology transfer and public–private collaboration.

The United Kingdom (UK), through the British Embassy, directly sponsors practical, skills-focused initiatives such as the "Generative AI for Gen Z" workshops and the Day of AI in Education 2025, delivered with Sisters of Code and IT Academy STEP, which ran in Phnom Penh, Battambang, and Siem Reap, engaging 400+ students and educators through six student workshops and three educator training sessions.[77] Additionally, institutions like the UK's National Physical Laboratory (NPL), offer expertise in metrology and standards for AI. NPL's work on trustworthy AI, the development of technical measurement standards, and its involvement in initiatives like the UK AI Standards Hub and the Alliance for Data Science Professionals provide models for building confidence and professionalizing the AI field (see Box 2.5).[78]

[69] Khmer Times. (2025, April 18). *Cambodia, China ink MoUs to boost innovation, AI and energy cooperation*. Khmer Times. https://www.khmertimeskh.com/501672062/cambodia-china-ink-mous-to-boost-innovation-ai-and-energy-cooperation/

[70] Ambassade de France au Cambodge. (2023, April 6). *Trois projets sélectionnés dans le cadre du programme « PHC Tonlé Sap »*. Available at https://kh.ambafrance.org/Trois-projets-selectionnes-dans-le-cadre-du-programme-PHC-Tonle-Sap

[71] Khmer Times. (2024, July 23). *Cambodia, France sign scholarship agreement for top Cambodian students*. Available at https://www.khmertimeskh.com/501527911/cambodia-france-sign-scholarship-agreement-for-top-cambodian-students

[72] In, P. (2025, August 29). *AI is transforming public health in Cambodia: What does it mean for developers?* LinkedIn. Available at https://www.linkedin.com/pulse/ai-transforming-public-health-cambodia-what-does-mean-panharith-in-cvhbc

[73] Japan International Cooperation Agency (JICA). (2023, November 6). *Signing of grant agreement with Cambodia: Contributing to rapid and accurate measurement through development of Continuously Operating Reference Station networks*. Available at https://www.jica.go.jp/english/information/press/2023/20231025_11.html

[74] Japan International Cooperation Agency (JICA). (2025). *PoC for National Bank of Cambodia AI-based liquidity forecasting solution*. Available at https://www.jica.go.jp/english/about/dx/project/detail/1572228_68029.html

[75] KOICA Cambodia. (n.d.). *Projects*. (Information on NICC project, e.g. "RUPP inaugurates National Incubation Centre of Cambodia." *Khmer Times*, March 23, 2024).

[76] STEPI. (2025). K-Innovation Program brochure. Science and Technology Policy Institute. Available at https://www.stepi.re.kr/site/iiccen/ex/bbs/View.do?bcIdx=41651&cbIdx=1351

[77] IT Academy STEP Cambodia Institute & Sisters of Code. (2025). *GenAI for Gen Z* [Workshop report]. Cambodia ICT. https://cambodiaict.net/wp-content/uploads/2025/02/01-GenAI-for-GenZ.pdf

[78] National Physical Laboratory (NPL). (n.d.). *Trustworthy AI*. Available at https://www.npl.co.uk/; AI Standards Hub. (n.d.). Available at

Potential for collaboration has been signaled by NPL to support the National Metrology Center of Cambodia in developing national capabilities in AI metrology, leveraging regional platforms like the Asia-Pacific Metrology Programme (APMP), of which Cambodia is a member.

Box 2.5 The Critical Role of Metrology in Trustworthy AI: Insights from the United Kingdom's National Physical Laboratory

Metrology, the science of measurement, is a critical yet often overlooked component of the national quality infrastructure essential for fostering trust and enabling innovation in AI. National Metrology Institutes (NMIs), such as the UK's National Physical Laboratory (NPL) and the National Metrology Center of Cambodia (NMCC) under MISTI, play a vital role in establishing and maintaining measurement standards.

For AI, this extends beyond physical measurements to the digital realm, encompassing:

- **Data Quality:** Developing metrics and methods to assess the quality, integrity, and representativeness of datasets used to train and test AI models.
- **Algorithmic Performance:** Creating standardized benchmarks and evaluation procedures to compare the performance, robustness, and reliability of different AI algorithms and models. This is crucial given that current AI evaluation often lacks standardized metrics.
- **Trustworthy AI Characteristics:** Establishing measurement techniques for complex AI attributes such as explainability, bias, fairness, safety, and security. This involves both quantitative and qualitative assessment methodologies.
- **Lifecycle Approach:** Applying metrological principles throughout the AI lifecycle – from design and development to deployment, testing, evaluation, verification, and validation.

NPL, for example, collaborates internationally (e.g. with National Institute of Standards and Technology (NIST) in the United States) on pre-normative research to inform AI standards and regulations, such as the NIST AI Risk Management Framework. They also work on professionalizing the data science and AI workforce. Supporting NMIs like Cambodia's NMCC to build capacity in digital and AI metrology can create a national capability that underpins confidence in the entire AI ecosystem, from R&D to deployment. This involves progression from ensuring digital readiness, to data readiness, and ultimately to AI readiness, with metrology providing the foundation for confidence at each stage.

Source: Based on insights from NPL presentations and the role of NMIs globally.

Singapore, through its national AI programme, AI Singapore (AISG), is another key regional partner. AISG's initiatives like the "100 Experiments" programme (co-funding AI MVP development for SMEs) and the AI Apprenticeship Program (AIAP) (talent development) offer established models that can serve as reference for Cambodia. Of particular relevance to Cambodia is the SEA-LION (Southeast Asian Large Language Models) project, an open and collaborative effort to build LLMs for regional languages, including ongoing work with the AI Forum to improve Khmer language capabilities. AISG also focuses on building culturally relevant evaluation benchmarks (SEABELLS) and offers a Visiting Scholars programme for regional talent development.

Australia supports Cambodia's development through the Department of Foreign Affairs and Trade (DFAT), with the Cambodia Australia Partnership for Resilient Economic Development (CAPRED) (2022–2027) being a major initiative with a budget of approximately $57 million (A$87 million).[79] CAPRED focuses on infrastructure (collaborating with MISTI on water services), trade and investment, and agriculture/agro-processing. While not having dedicated AI components, its work on strengthening infrastructure, improving the investment climate, and supporting SME development indirectly contributes to a more favorable environment for AI by improving foundational capacities.

2.5. LOCAL DEVELOPMENT PARTNERS

Cambodia's civil society, spanning non-governmental organizations (NGOs), community technology networks, social enterprises, and cultural institutions, has been stakeholders in the national AI journey. This group complements the efforts of government, industry, and academia by championing social inclusion, local relevance,

https://aistandardshub.org/; Asia Pacific Metrology Programme (APMP). (n.d.). Available at https://www.apmpweb.org/

[79] Australian Department of Foreign Affairs and Trade (DFAT). (n.d.). Cambodia-Australia Partnership for Resilient Economic Development (CAPRED). Available at https://www.dfat.gov.au/publications/development/cambodia-australia-partnership-resilient-economic-development.

and ethical principles. With only approximately 60.7 per cent of the population of Cambodia using the Internet as of 2023 and a significant rural population of around 78 per cent, there is a significant digital divide. Local Development Partners play a crucial role in ensuring that digital opportunities and AI development address the needs of underserved communities.[80] They act as a vital conduit, connecting global technologies with grassroots users and citizen voices with policymakers. By focusing on issues like Khmer language computing, digital accessibility for persons with disabilities (who represent at least 4.9 per cent of Cambodia's population), and the cultural dimensions of AI, they help steer the national AI trajectory toward equitable and trusted outcomes.[81]

Civic Technology and Developer Communities

Civic technology and developer communities are instrumental in broadening grassroots participation in the AI ecosystem, translating global discourse into local practice, and surfacing community-centric use cases. These groups demystify technology and create accessible pathways for youth, students, and early-career professionals to engage with AI.

A key actor in this space is the AI Forum Cambodia, a multistakeholder platform affiliated with CamTech University that convenes national forums, seminar series, and public dialogues on AI, and maintains an editorial platform for policy and ethics research. Since its first convening in 2018, it has continued hosting events under the AI Cambodia Forum series. Most recently, the 3rd AI Forum (2025) focused on emerging issues in AI governance, data privacy, regulatory landscapes, and societal impacts, bringing together government officials, academics, and industry experts. The Forum also launched the Center for Buddhist AI Ethics in 2023 to localize rights-based and human-centric approaches through seminars and teaching materials. Beyond dialogue, it convenes developer capacity-building events with regional partners, such as the Pan-SEA AI Developer Challenge 2025, which leverages the regional SEA-LION family of LLMs to empower AI developers across South-East Asia to build impactful solutions tailored to local contexts.[82]

Another significant grassroots initiative is Cambodia.AI, an open technology community run by volunteers focused on pro-bono projects that address pressing local needs. This group directs advanced technology toward challenges that might be overlooked by market-driven development. Notable projects include a collaboration with the NGO People In Need to enhance Cambodia's Early Warning System 1294 for flood detection, using an AI component to reduce false alarms and better predict flood risks for vulnerable rural communities.[83]

Additionally, movements such as the BarCamp Cambodia provide a crucial, informal entry point into the tech world for a wide audience, including students and provincial youth. These open, volunteer-led conferences in cities like Phnom Penh and Battambang regularly feature introductory sessions on AI topics, such as machine learning and AI in agriculture, in an accessible setting. Other developer communities and non-profits like Sisters of Code, further strengthen the ecosystem by building practical skills and fostering inclusion (see Box 2.6). By hosting hands-on workshops and coding clubs for girls, these groups create pathways to AI careers and actively work to address the gender gap in STEM fields.

Box 2.6 Lessons from the "Generative AI for Gen Z" Initiative in Cambodia

A 2024–2025 initiative by IT Academy STEP Cambodia and Sisters of Code, supported by UK Aid Direct and in partnership with MoEYS, provided crucial insights into AI adoption among Cambodian teachers and students in Phnom Penh, Siem Reap, and Battambang. Some of their key findings include:

- **High Existing Adoption:** A significant majority of participants were already using generative AI tools (84 per cent of students, 67 per cent of teachers).

[80] World Bank. (2023). Individuals using the Internet (% of population) – Cambodia. Available at https://data.worldbank.org/indicator/IT.NET.USER.ZS?locations=KH (accessed on 22 August 2025); Open Development Cambodia. (n.d.). Population and censuses. Available at https://opendevelopmentcambodia.net/en/topics/population-and-censuses/ (accessed on 22 August 2025).

[81] National Institute of Statistics. (2022). 2019 General Population Census – Thematic Report: Disability in Cambodia. pp. 17–18. Available at https://www.nis.gov.kh/nis/Census2019/Cambodia_census_report_Disability_ENG_FINAL.pdf (accessed on 22 August 2025).

[82] AI Forum Cambodia. (2025, July 28). *Press Release | Unlocking Southeast Asia's AI Potential: Cambodia Developer Meetup 2025*. Available at https://www.aiforumcambodia.org/press-release-unlocking-southeast-asias-ai-potential-cambodia-developer-meetup-2025/

[83] Pulitzer Center. (2024, July 13). Cambodia's coming AI revolution. Available at https://pulitzercenter.org/stories/cambodias-coming-ai-revolution (accessed on 22 August 2025).

- **Primary Barrier is "How-To":** The main barrier identified was not language (for this group) or access, but a lack of knowledge on how to use the tools effectively and confidently. Students in particular were concerned about the accuracy of AI-generated content.
- **Teacher Motivations:** Teachers were primarily motivated to use AI to address immediate challenges: creating better teaching resources, increasing student engagement, and managing administrative workloads.
- **Impact of Short Interventions:** A single 4-hour workshop significantly boosted confidence for over 95 per cent of participants, demonstrating that targeted, scalable, and even brief training can be highly effective.

These findings suggest that national AI literacy programmes should focus on practical skills like prompt engineering and critical evaluation of AI outputs. They should also tailor teacher training to address immediate classroom pain points, and leverage short, impactful workshop models for scalability.

Source: IT Academy STEP Cambodia. (2025). *Day of AI in Education 2025: Driving Ethical AI Adoption in Cambodia.* [Online] Available from: https://cambodia.itstep.org/blog/day-of-ai-in-education-two-thousand-and-twenty-five-driving-ethical-ai-adoption-in-cambodia

Social Interest Groups

social Interest Groups ensure that language, accessibility, human rights, and cultural values are embedded in Cambodia's AI trajectory. These groups build capacity at the local level, and provide critical thought leadership on ethical governance.

Open Development Cambodia (ODC), a local open-data NGO, champions the principle that AI should "serve indigenous voices" and not marginalize ethnic minorities. ODC curates data and knowledge products on the societal implications of AI and encourage the rights of indigenous communities in the digital age. Through its participation in regional coalitions, ODC works to infuse global AI discussions with grassroots perspectives, particularly concerning the protection of indigenous data sovereignty and ensuring community consent in AI-driven projects.[84]

The Cambodian-led NGO VBNK focuses on building the capacity of other local development partners to engage with technology. In a notable 2025 initiative, VBNK conducted training workshops in provinces like Ratanakiri to help grassroots NGOs understand and utilize AI tools for practical tasks such as planning, translation, and content creation.[85] By demystifying AI and teaching prompting skills in the local language, VBNK empowers local actors to see AI not as a distant innovation but as a practical tool, thereby enabling new participants from beyond urban tech hubs to contribute to Cambodia's AI ecosystem.

Other groups, such as the Cambodia Center for Human Rights (CCHR), can play a role of watchdogs, monitoring AI deployments for potential human rights infringements like misuse of surveillance technologies. Meanwhile, organizations representing persons with disabilities, including the Cambodian Disabled People's Organization (CDPO), advocate for inclusive design and the development of assistive AI technologies to ensure that the benefits of AI are accessible to all.

2.6. ENABLING INFRASTRUCTURE

The deployment and effective utilization of AI technologies are fundamentally dependent on the underlying digital and physical infrastructure. While Cambodia has made commendable progress in expanding basic connectivity, significant gaps remain in achieving the high-quality,

[84] Open Development Cambodia. (2023, October 13). *Seminar on Indigenous Data Sovereignty (IDS)*. Available at https://opendevelopmentcambodia.net/seminar-on-indigenous-data-sovereignty-ids/

[85] VBNK. (2025, May 20). VBNK empowers NGOs in Ratanakiri with integrating artificial intelligence (AI) into NGO activities. Available at https://www.vbnk.org/post/vbnk-empowers-ngos-in-ratanakiri-with-integrating-artificial-intelligence-ai-into-ngo-activities (accessed on 22 August 2025).

reliable, and accessible infrastructure needed for widespread AI R&I and application.

Digital Connectivity Network

Cambodia's terrestrial fibre network totals 34,500 km, operated by five licensed infrastructure companies, with international connectivity via the Asia-Africa-Europe 1 (AAE-1) and Malaysia-Cambodia-Thailand (MCT) submarine cables.[86] Mobile connectivity is also widespread, with 4G population coverage reaching 93.2 per cent by early 2025.[87] Mobile Internet subscriptions are high. However, this masks significant disparities in Internet quality, speed, and reliability, particularly between Phnom Penh and provincial/rural areas.[88] Consistent high-speed broadband access, essential for data-intensive AI, is not nationally available. Significant disparities exist in digital access, with rural and indigenous communities often facing greater challenges in obtaining reliable Internet and necessary devices. Fiber optic network expansion is ongoing, supported by projects like the AIIB-funded Cambodia: Fiber Optic Communication Network Project (CFOCN) initiative,[89] but achieving comprehensive "last mile" connectivity remains a challenge.

International connectivity is facilitated by two submarine cable landing stations in Sihanoukville: the Malaysia–Cambodia–Thailand (MCT) cable (connecting to Malaysia, Thailand, and onwards) and the Asia–Africa–Europe-1 (AAE-1) cable (connecting to China and towards Europe). Additionally, strong terrestrial fiber links exist with Thailand, Singapore, Malaysia, and Viet Nam, providing high-speed connections to regional data centers. Commercial network operators are upgrading core networks to capacities of 400 Gbps, with submarine cable upgrades aiming for 800 Gbps capabilities, and employing AI for network monitoring and maintenance.

The planned 5G rollout, pending a national master plan from MPTC, is crucial for advanced AI applications requiring ultra-low latency (sub-10ms) and massive throughput (e.g. 100 Gbps dedicated lanes for distributed Graphics Processing Unit (GPU) access), but its timeline and reach are still under discussion. Edge computing capabilities are emerging, with clusters of computing power in major cities (Phnom Penh, Siem Reap, Sihanoukville) and telecommunication operators deploying more content delivery networks (CDN) to support real-time AI applications. Current connectivity limitations, however, still act as a major barrier to equitable access to online AI tools and services for researchers, businesses, and the general public.

Computing Resources and Data Centers

AI R&D, particularly training large models, requires significant computational power, often utilizing specialized hardware like GPUs. Access to such high-performance computing resources within Cambodia is extremely limited. Universities and local research institutions generally lack dedicated HPC facilities, often forcing reliance on expensive international public cloud providers, creating cost barriers and limiting experimentation.

A significant and specific barrier constraining national computing capacity is the difficulty in sourcing advanced hardware. According to consulted stakeholders directly involved in building national AI infrastructure, Cambodia is currently unable to directly procure high-end GPUs from key international suppliers, owing to applicable export-control regimes and vendor compliance policies. This restriction presents a formidable legal and logistical challenge, forcing national institutions to explore alternative procurement channels and strategies to acquire necessary hardware legally. This constraint has immediate practical consequences, compelling Cambodian researchers to rely on international partnerships to access the computational resources required for training large-scale AI models.

MISTI has established a national HPC platform to support R&D. This facility includes 12 rack cabinets (approximately 400 rack units), around 360 virtual CPU cores, 3 TB of RAM, and 200 TB of high-speed SSD storage, with a high-speed internal network (25–100 Gbps). The HPC component features GPU servers, each capable of supporting up to 10 GPUs (NVIDIA A40 and K80 models are available), and utilizes the Proxmox hypervisor for virtualization. MISTI operates its own Internet infrastructure for this facility, with public IP addresses and direct connections to international gateways and Internet Exchange Points (IXPs). Access for researchers is managed via a web portal requiring project proposals and authentication through CamDigiKey, a mobile digital ID verification app developed by Techo Startup Center.[90] While currently able to support several machine learning projects simultaneously, MISTI acknowledges the need for further funding and collaboration to expand this capacity. The Government, through MPTC, is constructing

[86] Khmer Times. (2025, February 6). *Push to ensure universal mobile service coverage by 2027.* Khmer Times. https://www.khmertimeskh.com/501635256/push-to-ensure-universal-mobile-service-coverage-by-2027/

[87] Xinhua News Agency. (2025). Cambodia records nearly 19 mln internet subscribers: minister. Available at: https://english.news.cn/20250206/0bbb63cbc2f84944b3f393d27fadd093/c.html

[88] CamboJA News. (2023, December 5). Rural and indigenous communities still struggle with internet access. Available at https://cambojanews.com/rural-and-indigenous-communities-still-struggle-with-internet-access/ (accessed on 22 August 2025).

[89] AIIB. (n.d.). *Cambodia: Fiber Optic Communication Network*. Project Summary. Available at https://www.aiib.org/en/projects/details/2019/approved/Cambodia-Fiber-Optic-Communication-Network-Project.html

[90] MISTI. (Information on HPC from stakeholder consultations); CamDigiKey. (n.d.). Available at https://www.camdigikey.gov.kh/

the National Data Center, a high-reliability Tier IV facility scheduled for completion in 2025, primarily for secure government data hosting.

The commercial data center landscape is evolving. Several private Tier III data centers have been established in Phnom Penh since 2021, including ByteDC, Chaktomuk Data Center, and Daun Penh Data Center (DPDC), offering colocation and basic cloud services with capacities reportedly up to 3 megawatts and facilities designed for AI cloud hosting. However, these facilities may face challenges achieving profitability due to limited domestic demand and competition. Work is reportedly in progress by commercial providers to engage AI hyperscalers for co-locating AI infrastructure in Cambodia. While there's an emergence of commercial data centers, the operational strategy of major private infrastructure owners provides a key insight into market dynamics. A leading mobile telecommunications operator consulted for this study commands its own data center and employs a demand-driven scaling model. By owning the infrastructure, the company can expand its computing and storage capacity incrementally in direct response to its internal business needs, ensuring resources are always appropriately utilized without being over-provisioned or underused. This contrasts with the challenges faced by commercial data centers that must build capacity speculatively and secure external clients to be profitable. This strategy highlights a key advantage for vertically integrated firms and suggests that national infrastructure planning should consider models that support both large-scale public facilities and agile, private-sector scaling.

Energy Infrastructure

Reliable and affordable electricity is a fundamental prerequisite for digital infrastructure, including data centers and widespread device usage for AI. Cambodia's power system has expanded rapidly: total installed capacity reached 5,044 MW in 2024, while electricity consumption rose to 19.4 TWh and peak demand has recently exceeded 3 GW.[91] Access has also improved markedly: by end-2024 99.15% of villages had electricity (only 120 villages remained unserved) and 3.5 million households were connected.[92] Costs, however, remain comparatively high compared to ASEAN neighbors[93]. Supply reliability has strengthened through domestic additions and cross-border imports (about 1,030 MW contracted with plans to add 600 MW from 2026), but nationwide, consistent power quality still depends on continued grid upgrades[94].

The Power Development Plan 2022-2040 earmarks roughly US $9,228 million of investment to expand domestic generation capacity, and targets 1,005 MW solar and 200 MW energy storage by 2030, scaling to 3,155 MW solar, plus 420 MW storage by 2040, while excluding new coal plants and any mainstream Mekong dams[95]. As Cambodia pursues its Long-Term Strategy for Carbon Neutrality (2050) and implements the National Energy Efficiency Policy (NEEP) 2022-2030, prioritizing renewable-backed power and efficiency for digital infrastructure will be crucial for managing AI-era operating costs and emissions, and for advancing NRA Mission 2 on reliable, affordable energy[96].

2.7. DATA READINESS

Data Availability and Quality

A pervasive lack of accessible, high-quality, structured, and machine-readable data relevant to Cambodian contexts severely hinders AI development. There is a general scarcity of digitized data across many crucial sectors. Administrative data collected by government ministries is often siloed, may not be digitized, lacks standardization, and is rarely shared publicly. Sector-specific gaps exist for data needed for NRA mission-aligned AI applications, such as granular agricultural data, comprehensive electronic health records, detailed educational performance data, reliable real-time traffic data, and high-resolution environmental monitoring data. Existing data may also suffer from quality issues, including inaccuracies, incompleteness, and outdated information. This lack of data impacts the ability of researchers to train models, businesses to develop AI solutions, and the government to use AI for policy-related decision making. The importance of robust measurement and metrology in ensuring data quality and confidence is further elaborated in Box 2.5.

To address the pervasive data availability challenge, Cambodia has begun establishing a foundational data

[91] Khmer Times. (2025, September 8). Cambodia quietly restructuring its renewable energy goals. https://www.khmertimeskh.com/501752729/cambodia-quietly-restructuring-its-renewable-energy-goals/;

[92] Cambodianess. (2025, February 4). *Cambodia's total installed power capacity rises to 5,044 MWs in 2024*. https://www.cambodianess.com/article/cambodias-total-installed-power-capacity-rises-to-5044-mws-in-2024

[93] ESCAP and ASEAN Centre for Energy. (2020). Regional energy trends report 2020: Tracking SDG 7 in the ASEAN region (ST/ESCAP/2921). United Nations. https://www.unescap.org/publications/regional-energy-trends-report-2020-tracking-sdg-7-asean-region

[94] Cambodia. (2022). National Energy Efficiency Policy (NEEP) 2022–2030. Available at https://cdn.climatepolicyradar.org/navigator/KHM/2022/national-energy-efficiency-policy_55b655c69cf65abe4212e02cb0d7bbbc.pdf

[95] Cambodia (2022). *National Energy Efficiency Policy (NEEP) 2022–2030.*

[96] MISTI. (2023). *National Research Agenda 2025*. (Mission 2: Reliable and Affordable Energy).

infrastructure through several key government-led platforms. These initiatives, while still maturing, represent critical steps towards creating a more data-rich environment for AI development and evidence-based policymaking. They include a secure data exchange layer for inter-agency communication as well as several public-facing open data portals designed to make national data more accessible. A key component is the Cambodia Data Exchange (CamDX), a decentralized and secure interoperability layer based on Estonia's X-Road model. Managed by the Techo Startup Center, CamDX enables real-time data exchange between government ministries and the private sector without creating a centralized database, forming a crucial backbone for digital government services.

For open data, the MEF manages the Data-EF: a public data lake focused on economic and financial information. It provides clean, formatted datasets and an API, making it a valuable resource for researchers and developers. Complementing this is CamStat, the official data dissemination platform of the National Institute of Statistics, which serves as the primary source for official statistics, including census and socio-economic survey data. Another key resource is provided by Open Development Cambodia: an independent platform that aggregates a wide array of development-related data from various sources, covering topics from environmental issues to governance.

Nonetheless, the scarcity of digitized Khmer language data represents a particularly critical barrier to developing inclusive and relevant AI applications for the majority of the Cambodian population. Most state-of-the-art AI models are trained predominantly on English and other globally dominant languages. Khmer remains severely underrepresented in these datasets: he FineWeb corpus contains only about 2GB of low-quality Khmer text (much of it consisting of advertisements), compared with 141.7 GB for Indonesian.[97] This results in poor performance of AI tools when processing Khmer, cultural irrelevance or bias in outputs, and exclusion of large segments of the population who are not proficient in other languages.

To counteract the risk of biases emerging from underrepresentation of Cambodian data in the training of AI models, a major national effort to create large-scale, high-quality Khmer language corpora, digitize existing Khmer documents (e.g. National Library archives), develop Khmer NLP tools (like Optical Character Recognition (OCR), Machine Translation (MT)), and support research in Khmer language AI is required. Initiatives like MPTC's TranslateKH and the SEA-LION collaboration are positive steps but need significant scaling and sustained investment. Technical challenges include converting PDF documents effectively and capturing colloquial Khmer, as most existing digital data is formal. Table 2.1 outlines potential avenues for augmenting Khmer language data.

Table 2.1 Potential Avenues for Augmenting Khmer Language Data for AI

Method	Practical Steps	Limitations
Utilize Existing Digital Text	Web scraping of Khmer websites (news, blogs), filtering existing digital corpora (e.g. from advertisements).	Variable quality, often formal language, limited domains, potential copyright issues.
PDF and Document Conversion	OCR processing of scanned documents (e.g. from National Library, government archives), manual correction.	OCR accuracy for Khmer can be challenging, labour-intensive manual correction; costly.
Machine Translation (MT)	Translate high-quality datasets from other languages (e.g. English, Thai) into Khmer using tools like TranslateKH.	Loss of cultural nuance, potential for propagation of translation errors, requires good source data.
Colloquial Data Collection	Scraping social media (with ethical considerations), transcribing spoken language from diverse contexts.	Privacy concerns, questions on ethical use of data, significant effort for transcription and annotation, standardization.

[97] Hugging Face. (2025). *FineWeb2 dataset* (HuggingFaceFW/fineweb-2), released 24 June 2025. Available at: https://huggingface.co/datasets/HuggingFaceFW/fineweb-2

Method	Practical Steps	Limitations
Community Sourcing/Crowdsourcing	Competitions, hackathons, volunteer initiatives to collect, transcribe, or validate Khmer language data.	Requires community engagement, quality control mechanisms, potential for inconsistency.
Synthetic Data Generation	Use powerful LLMs to generate new Khmer text based on prompts, careful prompt engineering.	High risk of bias, low quality, or repetitive text if not expertly curated by native speakers; costly.
Public-Private Data Partnerships	Encourage private sector entities (e.g. media, e-commerce) to contribute anonymized Khmer language data for research purposes.	Requires trust, clear data sharing agreements, and robust anonymization techniques; addressing commercial sensitivities.

Data Governance

The absence of a comprehensive and modern legal framework for data governance creates significant uncertainty and risk for AI development and deployment. As of early 2025, Cambodia lacks an enacted Personal Data Protection Law (PDPL), which leaves ambiguities regarding rules for consent, data collection, processing transparency, data security, cross-border data transfers, and individual data rights. This legal vacuum hinders data-intensive AI applications and discourages data sharing for AI R&I. Concerns raised during consultations about potentially intrusive data access demands by regulatory bodies highlight the urgent need for a clear PDPL. Establishing a robust data governance framework, aligned with international standards but adapted to Cambodia's context, is a critical prerequisite. Clear policies on data sovereignty, cross-border data flows, and the ethical use of government data are also needed. Platforms like CamDX, which enable secure data exchange between government agencies, could potentially support federated learning approaches. Federated learning allows AI models to be collaboratively trained across multiple organizations without the need to centrally collect or transfer sensitive data, thus minimizing privacy risks and maintaining data sovereignty. In this way, CamDX could help operationalize principles of responsible data governance while Cambodia develops its comprehensive legal framework.

Beyond legal frameworks, practical data management capabilities and practices and norms around data sharing are sometimes inadequate. Data collected by different government agencies and private entities often lack common standards, hindering interoperability. Consultations indicated that a culture of data hoarding rather than responsible sharing persists, often due to perceived risks or lack of incentives. Insufficient technical capacity exists within many organizations for effective data management, including data cleaning, storage, security, and analysis. Addressing these data ecosystem challenges requires a multi-pronged strategy involving legal reform, investment in data infrastructure, promoting open data policies where appropriate, establishing clear data standards and interoperability frameworks, building national capacity in data management and Khmer NLP, and fostering a culture of responsible data sharing and use.

2.8. Skills and Workforce

Higher Education for AI

A critical challenge for tertiary education in AI is the severe shortage of qualified faculty and researchers, especially those with PhDs in AI and related STEM fields. Only 3 per cent of HEI staff held PhDs in 2015–2016, and Cambodia's researcher density (the number of researchers per million inhabitants) stands at 30. By comparison, the latest available ASEAN average (2018–2023) is approximately 1,240 researchers per million inhabitants, with Thailand (1,863) and

Singapore (7,917) significantly exceeding this average.[98] Consequently, institutions often need to rely on Master's graduates, industry professionals teaching part-time, and international experts, for academic instruction on AI-related topics, which can affect the quality of research supervision and advanced instruction.

The national human capital deficit for AI extends beyond a simple shortage of lecturers and graduates into a foundational misunderstanding of the term "Computer Science" within the national curriculum. Consulted stakeholders with experience across multiple Cambodian universities report that Computer Science programmes often prioritize practical skills in web and mobile application development over the rigorous theoretical foundations required for AI R&D. Core competencies in advanced mathematics, algorithmic theory, and deep learning, the key pillars of AI-related tertiary education internationally, are frequently underemphasized at Cambodian HEIs. This curricular focus produces graduates skilled as technicians for existing Web2 technologies but ill-equipped for core AI innovation. This misalignment represents a critical bottleneck in the talent pipeline, limiting the nation's capacity to create, rather than merely use, advanced AI systems.

In fact, senior private sector leaders in Cambodia's technology sector indicated in consultations that one of the most significant hurdles they see among data science hires lies within their mindsets. While new employees, often from software development backgrounds, arrive with a highly valuable engineering mindset – they excel at executing tasks based on a clearly defined scope of work – this approach is insufficient for data science, which is inherently exploratory. Work as a data scientist requires the ability to accept ambiguity (where the problem itself may not be fully defined and the path to a solution is unknown). Navigating cycles of hypothesis, exploration, failure, and iteration, demands not only technical proficiency but also strong business acumen to understand stakeholder needs and robust communication skills to explain complex findings. According to one industry leader, fostering this mindset shift is a significant undertaking, typically requiring six months to a year of dedicated, on-the-job mentorship and practice. This highlights that creating a national AI talent pipeline requires more than academic degrees; it necessitates structured, work-integrated programmes that can cultivate this exploratory and business-oriented mindset.

However, the internship landscape for technology students in Cambodia is highly competitive, with a distinct market dynamic influencing university curriculum design. According to consulted stakeholders, top-performing students are often recruited into full-time junior developer or engineering roles as early as their third year of study, well before formal graduation. This reality has prompted pragmatic adaptations at institutions like RUPP (see Box 2.7). In addition to these schedule changes, curricula need continuous updating to keep pace with technological advancements and industry demands, ensuring strong theoretical foundations and practical skills. Integrating AI ethics and critical thinking skills is one crucial area that is currently underdeveloped. Alignment between university curricula and national priority sector needs (NRA 2025) requires strengthening.

Box 2.7 RUPP's Adaptive AI Education Model and the Lecturer Challenge

RUPP, facing Cambodia's national shortage of PhD-qualified AI specialists and restrictive hiring policies, has adopted an adaptive model for its IT Engineering and Data Science programmes.

The programmes prioritize equipping graduates with foundational expertise and conceptual understanding, supported by skills to apply existing AI tools practically. While early years emphasize mathematical foundations, algorithmic reasoning, and conceptual mastery, AI coursework, such as machine learning, NLP, and computer vision, is integrated primarily in later academic years, where students combine foundational knowledge with practical frameworks, aligning immediate employability with deeper learning.

To overcome the PhD requirement bottleneck and lecturer shortages, RUPP employs internal upskilling of top Master's graduates to co-teach undergraduate AI courses alongside senior faculty and engages senior engineers from private companies as part-time instructors, primarily for industry-relevant practice modules. Faculty heads also step in to ensure curriculum continuity and quality.

To accommodate students who are already working, the entire fourth-year curriculum for some technology programmes has been shifted to evening classes. This allows students to gain crucial industry experience without disrupting their final year of theoretical and conceptual studies, representing a direct, market-responsive adaptation to strengthen university-industry linkages.

While RUPP's model demonstrates resourcefulness, reliance on non-PhD and part-time lecturers is explicitly an interim solution. Quality assurance is maintained through co-teaching, structured curriculum frameworks, moderated assessments, and ongoing faculty development. This adaptive model highlights a creative response to systemic constraints related to human capital for AI, but

[98] World Bank. (n.d.). *Researchers in R&D (per million people)* (indicator SP.POP.SCIE.RD.P6). World Bank Open Data. Retrieved October 12, 2025, from https://data.worldbank.org/indicator/SP.POP.SCIE.RD.P6

also underscores the urgent need for increased investment in faculty development and sustainable national capacity building aligned with STI Roadmap 2030 ambitions.

Source: Analysis based on RUPP programme information and stakeholder consultations.

Perceived Culture of Innovation

Fostering an innovation mindset requires addressing deep-seated cultural norms within the national education system and entrepreneurial practices. Beyond formal ethical codes, developing a thriving and responsible AI ecosystem is deeply contingent on the underlying educational culture. Consulted stakeholders with industry experience observe that the current pedagogical approach often excels at teaching "pattern detection," the ability to learn and apply existing knowledge. However, it falls short in cultivating "pattern creation," the entrepreneurial and creative capacity to compose something new. This focus on mastering established patterns, reinforced by textbook-based learning and standardized assignments, produces graduates skilled in using existing tools but less prepared for the exploratory, ambiguous, and inventive work required for frontier innovation in fields like AI.

This pedagogical focus is compounded by other cultural aspects of the education system. Consulted students highlighted a focus on theoretical learning followed by high-stakes testing, where failure is penalized rather than treated as a learning opportunity. This contrasts sharply with educational philosophies that encourage a "trial-and-error" process, where students are expected to make mistakes, fix them, and learn iteratively - a method fundamental to engineering and computer science disciplines underpinning AI. Furthermore, Cambodia's widespread use of student ranking systems fosters a culture of individual competition, inadvertently discouraging the collaborative spirit, peer-to-peer knowledge sharing, and teamwork essential for complex, multidisciplinary AI projects. Shifting this cultural paradigm to one valuing experimentation, resilience in the face of failure, and collective problem-solving is a long-term but essential investment. This is foundational for building not merely skilled technicians but true innovators capable of navigating complex, evolving digital-age challenges.

Consultations also indicated a significant cultural and perceptual barrier constraining Cambodia's broader innovation ecosystem, particularly for frontier technologies like AI and Web3. Unlike legal traditions where the absence of a specific prohibition implies permission, the prevailing mindset among many Cambodian investors and entrepreneurs is that a lack of explicit legal approval equates to illegality. This creates a detrimental effect on innovation, fostering uncertainty and risk aversion. Startups in unregulated domains struggle to secure funding, as investors fear backing ventures that lack formal government sanction. This transforms regulatory absence from an agile development opportunity into an obstacle, halting progress in emerging fields until formal legislative processes conclude.

Cambodia's startup ecosystem also faces a low number of visible, highly successful, and nationally celebrated technology role models. This lack shapes youth aspirations and investor risk calculations. Consulted university students reported that without a clear pathway to building globally recognized tech companies, they tend toward traditional, stable careers in fields like accounting and management. This creates a self-perpetuating cycle where the absence of ambitious tech ventures results in a lack of role models, further dampening entrepreneurial interest in technology. Moreover, stakeholder consultations indicated a disparity in career ambitions between students at major public universities, such as RUPP and ITC, and those at private institutions. Students at public universities, often from middle-income or provincial backgrounds, prioritize securing stable employment after graduation. Conversely, students from higher-income families attending private universities tend toward entrepreneurship, viewing their education as a pathway to business creation. This disparity in mindset and ambition represents a critical inclusivity challenge that must be addressed through targeted national innovation policies aimed at broadening entrepreneurial opportunities across socio-economic divides.

Breaking this cycle by nurturing and celebrating a flagship success is thus not just an economic goal but a crucial step in shifting the national mindset toward innovation. AI startups in Cambodia can flourish only if the younger generation sees entrepreneurship as a viable path. AI innovation will accelerate when individuals equipped with AI skills convert these competencies into successful business models. Cultivating these entrepreneurial skills, alongside fostering the innovation mindset outlined above, is necessary for sustained progress.

Digital Skills in the Workforce

Digital literacy levels in Cambodia remain low, which poses a major challenge to the country's AI readiness. Estimates suggest that only around one-third of Cambodians possess basic digital skills, despite more than two-thirds of the population having access to the Internet[99]. This means a large majority of people lack the fundamental ability to use computers and online tools effectively, significantly narrowing the talent pipeline for technology and reducing society's overall readiness to embrace AI.

[99] DataReportal. (2024). Digital 2024: Cambodia. Available at https://datareportal.com/reports/digital-2024-cambodia.

Beyond IT students, functional capabilities among workers remain uneven. Routine office tasks, safe online transactions, use of cloud/mobile productivity apps, and basic data handling are limited in much of the workforce, especially outside urban areas. This constrains adoption of AI-enabled workflows (search and prompting, summarization and translation, spreadsheet automation, simple scripting). International evidence shows that universal digital literacy is the foundation for inclusive use of frontier technologies, and that effective AI adoption requires both applied technical knowledge and sector-specific skills

Practical readiness is also uneven across sectors and firm sizes. MSMEs dominate employment, yet they often lack intermediate skills (data literacy, analytics, model-assisted problem solving). Closing this gap calls for mobile-first micro-learning in TVET and employer programmes, and upskilling of teachers and frontline public servants. UNCTAD highlights that progress hinges on the 5 As - availability, affordability, awareness, ability, and agency - which together determine how fast populations can adopt and adapt AI[100]. Reskilling and continuous learning should therefore be mainstreamed, not treated as one-off training.

Recognizing this need, MPTC launched in 2024 a national Digital, Media and Information Literacy framework aimed at achieving a digitally literate society by 2035, an initiative expected to gradually improve the population's capacity to adopt and adapt to emerging AI technologies[101]. It sets out eight core competency domains for "digital citizens" and provides a common reference for curriculum development, civil-service training, community programmes and assessment of literacy levels. The framework is aligned with the Pentagonal Strategy and the Cambodia Digital Economy and Society Policy Framework 2021–2035, and is intended to harmonize fragmented initiatives and standardize measurement across ministries and partners.

Another critical skill for AI adoption is foreign language proficiency, especially English. Most AI tools, educational resources, and technical documentation are in English, yet Cambodia's English proficiency ranks among the lower end of the EF English Proficiency Index 2025 (111th out of 116 countries)[102]. This language barrier means many Cambodian workers may struggle to use AI-driven tools or learn from online content that is predominantly in English. Even university students have cited limited English skills as a hindrance to their job prospects, underscoring how language limitations extend into the educated talent pool. On a positive note, English education has been expanding: it is now part of public-school curricula and widely offered by private institutes, contributing to higher fluency among younger urban Cambodians.

2.9. Conclusion on Stakeholder Landscape and National Capacity

Cambodia possesses a diverse stakeholder landscape with emerging but growing capacity across several dimensions crucial for AI R&I and sectoral application. However, significant capacity constraints across these stakeholders represent major bottlenecks that should be addressed. The most critical weaknesses, reflecting the analysis in this chapter, align with five systemic challenges:

- **Nascent and Fragmented Governance:** Coherent policy development is hampered by the fragmentation of digital and AI-related responsibilities across multiple ministries. This can hinder synergistic development and the translation of research into practical applications. While the NCSTI's coordination role is vital, it requires strengthening to be fully effective.
- **Weak Innovation Ecosystem Linkages:** A "valley of death" of innovation persists due to weak connections between academia, industry, and government, where promising research fails to become commercial products. The innovation support ecosystem requires more depth, particularly in early-stage financing and mentorship for AI ventures, limiting the economic impact of innovation.
- **Severe Resource Constraints:** Chronically low national investment in R&D (low GERD) severely limits the capacity for long-term research and the

[100] UNCTAD. (2025). Technology and Innovation Report 2025: Inclusive artificial intelligence for development. United Nations publication: Geneva.

[101] UNESCO. (2024, July 2). *Cambodia launches its first competency framework on digital, media and information literacy to empower citizens in today's digital society*. UNESCO. https://www.unesco.org/en/articles/cambodia-launches-its-first-competency-framework-digital-media-and-information-literacy-empower?hub=701

[102] EF Education First. (n.d.). Cambodia: EF English Proficiency Index. EF English Proficiency Index. Retrieved October 13 2025, from https://www.ef.co.th/epi/regions/asia/cambodia/

procurement of essential infrastructure. This directly impacts the ability of the Government to fund its agenda, of universities to conduct frontier research, and of all stakeholders to build, use and maintain adequate HPC and data center capacity necessary for large-scale AI solutions. This reality encourages a pragmatic "frugal innovation" strategy focused on context-appropriate solutions.

- **Data Ecosystem Gaps:** The development of relevant and fair AI models is critically hindered by the lack of publicly available, high-quality, digitized Khmer language data. This bottleneck affects all stakeholders, from government agencies needing data for policy design to researchers and businesses needing it for model training. The underrepresentation of Khmer data in global training datasets creates a risk of "informational dependency," and the absence of an implemented personal data protection law creates legal uncertainty that discourages data sharing.
- **Human Capital Deficits:** A shortage of specialized AI talent, including researchers, PhD-level faculty, and experienced professionals, is compounded by broader digital literacy gaps across the population. These challenges impact academia's ability to deliver advanced training, and the private sector's capacity to innovate.

Overcoming these capacity constraints requires sustained, coordinated, and substantial investment across all pillars and by all stakeholders. Prioritizing foundational elements is essential for unlocking Cambodia's potential to leverage AI for its national development ambitions. These elements include developing specialized human capital; building a robust, accessible, and well-governed data ecosystem; investing in enabling and sustainable infrastructure (including Green AI considerations); and strengthening the linkages and governance that tie the ecosystem together.

CHAPTER

3

ECONOMIC OPPORTUNITIES FOR AI APPLICATION

Cambodia's national ambition, clearly articulated in its long-term development goals and the *Pentagonal Strategy - Phase I*, is to achieve a structural transformation towards a higher-value, knowledge-based, and innovation-driven economy. AI stands as a transformative general-purpose technology with the capacity to act as a significant catalyst in this journey. AI offers a unique chance to develop targeted solutions for long-standing national challenges, including the potential for productivity leapfrogging, economic diversification beyond GFT manufacturing, enhanced competitiveness in regional markets (especially in the context of the ASEAN Digital Economy Framework Agreement), and improved public services contributing to the achievement of the Cambodia Sustainable Development Goals.

The core value proposition of strategically adopting AI in Cambodia lies in its potential to significantly enhance productivity and efficiency across the economy through technological leapfrogging, thereby accelerating progress towards becoming an upper-middle income country by 2030 and a high-income country by 2050. For Cambodia, whose economy has historically relied on labour-intensive sectors and faces challenges in moving up the value chain, AI offers a potential pathway to overcome these limitations and foster new, resilient sources of growth.

This chapter examines how AI, as a general-purpose technology, can expand Cambodia's productivity frontier and open new opportunities for economic growth and diversification through R&I efforts. It looks at how recent developments on AI makes this technology particularly suitable for technological leapfrogging, and frames AI-driven economic opportunities around Cambodia's eight missions under the NRA, AI for MSME productivity, and AI for public sector service delivery, showing how mission-oriented adoption can accelerate inclusive growth. The NRA provides a nationally agreed-upon framework for directing R&I efforts to tackle key challenges. By examining AI's potential role within each of these missions, this chapter aims to identify concrete opportunities for leveraging AI to boost productivity, enhance competitiveness, create value, and contribute to inclusive economic growth and sustainable development.

3.1. AI INNOVATION FOR TECHNOLOGICAL LEAPFROGGING

Leapfrogging is a latecomer development strategy in which countries (or firms, sectors, cities) skip intermediate stages of technological or organizational change and jump directly to newer paradigms that yield higher productivity or new capabilities. Conceptually, it is a form of catch up, but it's nonlinear: rather than moving step by step through earlier generations of technology, the latecomer reconfigures the path - often by exploiting timing, new general-purpose technologies, and organizational innovations. For instance, the adoption of KHQR in 2022 as an alternative payment mechanism has quickly enabled many in Cambodia to suddenly become part of the financial system, skipping card-centric infrastructures (see Box 3.1).

Box 3.1 KHQR: Cambodia's Leapfrog into a Digital Payment Ecosystem

In July 2022, the National Bank of Cambodia launched KHQR, a national, interoperable QR code standard that allowed any participating bank or wallet to accept payments with a single code. By standardizing retail QR payments at the national level and subsequently linking to regional systems, KHQR illustrates how a latecomer can skip card-centric infrastructures and achieve mass digital payments through mobile-first rails. In 2023, the National Bank reported a sharp rise in digital payment transactions, indicative of rapid ecosystem uptake; by 2024–2025, KHQR acceptance had expanded to millions of acceptance points across dozens of institutions and was progressively connected to cross border networks (e.g. partnerships that enabled KHQR payments in Singapore and Japan and inbound acceptance from regional wallets). The policy lesson is twofold: a common standard lowers coordination costs and accelerates diffusion, and regional interoperability multiplies network effects, improving value for users and merchants while deepening formalization and inclusion.

Sources: Khmer Times. (2025, January 23). National Bank of Cambodia, Visa agree to streamline cashless payments via KHQR codes. https://www.khmertimeskh.com/501627931/nbc-visa-agree-to-streamline-cashless-payments-via-khqr-codes/ Kapronasia. (2025). Cambodia's Bakong goes from strength to strength. Kapronasia. Retrieved from https://kapronasia.com/insight/blogs/payments-research/asia-payments-research/cambodia-s-bakong-goes-from-strength-to-strength

Several structural features of AI make it particularly suitable for latecomer advantages:

AI is a general-purpose technology: General-purpose technologies are characterized by their pervasiveness, dynamism, and capacity for innovational complementarities.[103] Their impact is not confined to a single industry but diffuses across many sectors, rewiring production processes and creating new value streams. This allows a latecomer to ride a broad technological wave rather than trying to develop a narrow, isolated niche. The dynamism of AI development in recent years means that the technological frontier is a moving target, creating persistent entry points for new actors who can adopt the latest, rather than legacy, versions of the technology. Most importantly, AI's power is magnified through its synergy with other frontier technologies like IoT, big data, and advanced robotics. For a developing economy, this means that investments in AI can simultaneously upgrade capabilities in manufacturing (smart factories), agriculture (precision farming), and services (personalized healthcare), creating a multiplier effect that accelerates structural transformation.

Software-first, intangible, and replicable: The core of the AI stack is composed of code, models, and data. Unlike the capital-intensive nature of previous industrial revolutions, which required massive investments in physical machinery and infrastructure, AI innovation can be primarily driven by intangible assets running in the cloud. Once foundational models or key software components are developed or made accessible (e.g. through open-source licenses), the marginal cost of their replication and deployment is extremely low. This structural feature dramatically lowers historical barriers to entry. Cloud computing platforms further democratize access to HPC, allowing innovators to train and run sophisticated models without owning physical supercomputers. This shift from physical to digital capital makes it easier to scale solutions rapidly once a viable use case is identified and local capability is in place. However, this also creates new dependencies on a concentrated number of global cloud service providers, a strategic vulnerability that national policies must address through investments in sovereign or regional data infrastructure and the negotiation of favourable terms for access.

Local adaptation beats pure frontier invention: The performance and utility of AI systems are heavily dependent on context-specific data and problem framing and their effective application requires adaptation and fine-tuning to local conditions. This creates a powerful competitive advantage for latecomers. They can focus on building capabilities in "last-mile" innovation, which is often more attainable and impactful than inventing entirely new model architectures. Examples of such adaptation are abundant: in agriculture, models can be trained on local soil data, weather patterns, and crop variants to provide hyper-localized advice on pest control and yield optimization, far exceeding the accuracy of generic global models. In healthcare, diagnostic tools can be fine-tuned to recognize manifestations of diseases in local populations or to function effectively in low-resource clinical settings. In governance and services, NLP models can be developed for underserved local languages and dialects, enabling the creation of inclusive digital public services, from educational chatbots to citizen feedback systems. This dynamic reframes the challenge of data scarcity into an opportunity for data sovereignty, where unique, locally relevant datasets become a strategic national asset for driving innovation and creating differentiated value.

[103] UNCTAD. (2025). *Technology and Innovation Report 2025: Inclusive Artificial Intelligence for Development*. UNCTAD/TIR/2025. Box I.1, p. 15.

Capability compression: Modern AI tools, particularly AI agents and low-code or no-code development platforms, significantly lower the skill threshold and time required to perform complex technical tasks. This phenomenon can be understood as 'capability compression': the ability for smaller, less specialized teams to achieve outcomes that previously required large teams with multiple, highly specialized roles. For a developing country, this accelerates organizational learning and human capital development. A small team of developers can use AI-powered coding assistants to build and deploy applications faster. A single data analyst can leverage automated machine learning platforms to build predictive models that once required a PhD in statistics. This compression effect is evidenced by the rapid growth of developer communities in economies like India, Brazil, and Nigeria. It opens up new space for "leap-style" progress by enabling a faster "learning-by-doing" cycle, which is fundamental for building the absorptive capacity needed to integrate and innovate with advanced technologies.

Early-stage fluidity and path reset: The global AI ecosystem, while dominated by a few large technology firms, is still in a state of high flux. Technical standards, regulatory frameworks, and dominant business models are not yet locked in. This fluidity provides a strategic window for latecomers to act. Unlike mature industries with entrenched players and rigid value chains, the AI landscape allows for differentiated positioning. A developing economy can strategically choose its entry point into the global AI value chain: it could specialize in high-quality data annotation for niche industrial applications, become a leader in "AI safety and ethics" by developing innovative regulatory sandboxes, or focus on adapting open-source models for public service delivery in the Global South. This is not merely about imitation; it is about a deliberate "path reset," where a country carves out a unique role in the emerging technological paradigm by leveraging its specific strengths and addressing its most pressing development needs.

Connecting AI leapfrogging to the broader innovation agenda requires translating AI potentialities into a national R&I strategy that is resolutely mission-oriented. In practical terms, this means: (i) using targeted R&I efforts to build domestic absorptive capacity where complementarities are strongest, (ii) aligning these efforts under the broader NRA implementation plan so they reinforce sectoral modernization, and (iii) assuring that diffusion pathways are inclusive, addressing not only technological supply but also the demand-side conditions for uptake. This section treats AI not only as an end in itself but also as an instrument to compress development stages by coupling research-led capability building to concrete service and productivity gains in priority sectors.

3.2. AI Application for National Research Agenda Missions

NRA Mission 1: "Local food": 70 Percent of Cambodia Food Consumption Is Produced Locally

Agriculture remains a cornerstone of the Cambodian economy, employing a significant portion of the population. However, the sector faces challenges in food security, diversification beyond rice, low value-addition, and high vulnerability to climate change. Achieving the NRA mission of 70 per cent local food production requires significant improvements in productivity, sustainability, and resilience. AI offers numerous opportunities to modernize the sector, aligning with the strategic goals of MAFF.

Key application areas include:

- **Precision Agriculture and Crop Monitoring:** AI, combined with data from sensors, drones, and satellites, enables precision agriculture. Farmers can receive tailored recommendations on irrigation, fertilization, and planting times based on real-time analysis of soil conditions, weather patterns, and crop health. This leads to optimized resource use, increased yields, and reduced environmental impact. For instance, AI can analyse satellite imagery to monitor crop growth across large areas and make early identification of stress factors.
- **Pest and Disease Detection:** Early detection of pests and diseases is critical for preventing crop losses. AI-powered systems can analyse images of plants to identify signs of infection, often before they are visible to the human eye.[104] Mobile applications equipped with AI can allow farmers to upload photos of affected crops and receive instant diagnoses and treatment recommendations, as demonstrated by ChivCheat (see Box 3.2).
- **Supply Chain Transparency and Efficiency:** AI, potentially combined with blockchain technology, can enhance transparency and efficiency in agricultural supply chains. By tracking produce from farm to consumer, these technologies can improve traceability,

[104] FAO. (2024, October 28). *AI can be a game-changing solution for farmers: FAO Innovation Chief*. FAO Newsroom. Available at www.fao.org/newsroom/detail/ai-can-be-a-game-changing-solution-for-farmers--fao-innovation-chief/en.

ensure food safety, and reduce losses. The Oxfam BlocRice project in Cambodia previously piloted blockchain to monitor production conditions and farmer payments, demonstrating the potential for trustworthy, farmer-centric data exchange.[105]

Box 3.2 ChivCheat, AI Chatbot for Cambodian Cashew Farmers

Cashew is a key cash crop in Cambodia, but yields are often impacted by diseases and pests, with farmers lacking easy access to timely advice. ChivCheat, a Cambodian agri-tech startup founded in February 2024, is developing an AI-powered chatbot to support these farmers. Accessible via Telegram, a popular messaging app in Cambodia, the chatbot allows users to interact in Khmer using images, voice messages, or text.

Leveraging Google's Gemini API, ChivCheat analyses the information provided by the farmer to diagnose problems and provide research-proven recommendations. For instance, if a farmer sends a photo of a diseased cashew tree, the chatbot can diagnose the issue and suggest solutions, or provide tips for optimizing growth to improve yields.

The platform aims to increase productivity, build stronger farming communities through knowledge sharing, promote environmental sustainability, and bridge the digital divide by making advanced technology accessible in rural areas. This initiative, part of the Dak Dam Innovators program, demonstrates a model for delivering accessible, localized, and frugal AI-driven agricultural extension services.

Source: CGIAR (2024). *Turning cashew dreams into reality: ChivCheat's AI chatbot on its way to transform Cambodian agriculture*. Available at: https://www.cgiar.org/news-events/news/turning-cashew-dreams-into-reality-chivcheats-ai-chatbot-on-its-way-to-transform-cambodian-agriculture/

The economic impact includes increased productivity, reduced crop losses, higher value addition through better quality control, improved farmer incomes, and enhanced national food security. Realizing this potential requires collaboration between MAFF, technology ministries (MISTI, MPTC), research institutions like the Cambodian Agricultural R&D Institute, agri-tech startups, and farmer cooperatives. Critical needs, as detailed in Chapter 2, include improving rural connectivity, enhancing farmer digital literacy, and building accessible, high-quality agricultural datasets.

NRA Mission 2: "Reliable Energy Supply": 90 Percent of Energy Consumption is Generated Locally

Cambodia aims to reduce its reliance on imported energy and achieve 90 per cent local generation by 2030. Challenges include diversifying energy production and renewable energy sources, improving grid stability, and ensuring a reliable electricity supply for its growing economy. AI is a crucial technology for modernizing the energy grid, with local companies already developing innovative solutions (see Box 3.3). At the same time, training and running AI models also have high electricity costs, so strategic balancing and efficiency considerations are needed.

AI can contribute through:

- **Smart Grid Management:** AI is essential for developing smart grids that can efficiently manage electricity supply and demand in real-time. AI algorithms can optimize load balancing, predict and prevent outages, and reduce energy losses, enhancing overall grid reliability.[106]
- **Renewable Energy Forecasting and Integration:** A major challenge with renewables, such as solar, is their intermittency. AI models can analyse vast amounts of weather data to improve variable renewable energy forecasting, with some estimates suggesting accuracy can be increased by up to 31 per cent.[107] This allows for better planning and integration of renewables into the national grid.
- **Predictive Maintenance:** AI-driven predictive maintenance can analyse sensor data from power infrastructure (e.g. transformers, transmission lines) to anticipate failures before they occur. This minimizes costly downtime and improves service reliability.

[105] Oxfam Cambodia. (n.d.). BlockChain For Livelihoods From Organic Cambodian Rice (BlocRice) Project. Available at https://cambodia.oxfam.org/BlocRice (accessed on 10 October 2025).

[106] Xavier Zane. (24 April 2025). *AI powering Cambodia's energy future: A technological revolution*. BytePlus. Available at www.byteplus.com/en/topic/421949 (accessed on 10 October 2025).

[107] Smart4RES. (2023). *Smart4RES – Data science for renewable energy prediction*. Available at www.smart4res.eu/wp-content/uploads/2023/05/Smart4RES_Rollup_template_WP3.pdf.

Box 3.3 VP.Start Technology, Local Innovation in Smart Grids

Founded in 2014, VP.Start Technology Co., Ltd. exemplifies indigenous technological innovation in Cambodia's energy sector. Primarily serving Electricité du Cambodge (EDC), VP.Start develops both hardware (Distribution Remote Control, DRC devices) and software (RPM–Grid Supervisory Control and Data Acquisition, SCADA system) in-house with a team of predominantly Cambodian engineers.

VP.Start focuses on frugal innovation by creating solutions to retrofit and modernize existing medium-voltage grid infrastructure rather than requiring costly full replacement. Their IoT-enabled devices, combined with their SCADA software, enable remote monitoring, control, and fault detection, transforming traditional grids into smart grids. This approach significantly reduces outage times and operational costs.

As of early 2025, VP.Start was actively transitioning towards integrating AI and machine learning into their products. Having established data collection infrastructure, the company is exploring AI applications such as predictive analytics for load forecasting and risk assessment for network maintenance. However, when interviewed, VP.Start highlighted key ecosystem challenges, including difficulty accessing external finance for scaling and critical need for advanced talent to deepen R&D.

Source: VP.Start Technology website; Stakeholder consultations.

The economic impact includes increased grid reliability, reduced energy losses, lowered operational costs for utility providers such as the state-owned Electricité du Cambodge, improved integration of domestic renewable resources, and enhanced energy security. This requires collaboration between the Ministry of Mines and Energy, EDC, technology providers, and international partners. Key needs include investment in smart grid infrastructure, access to granular grid and weather data, and supportive regulatory frameworks for data sharing and new energy solutions.

NRA Mission 3: "Quality Education": Education Meets International Quality Standards

Cambodia faces persistent challenges in educational quality, equity, and relevance to the needs of a modern economy. AI offers significant opportunities to address these issues and support the NRA mission of achieving international quality standards. UNESCO stresses a human-centred approach to AI in education, with concrete policy steps such as mandating data privacy protections, setting age limits for independent use of generative AI, and adopting age-appropriate, human-in-the-loop pedagogical design and validation of tools.[108] These measures help systems integrate AI safely and equitably while protecting learners' rights.

AI applications in education include:

- **Personalized Learning:** AI-powered adaptive learning platforms can tailor educational content to individual student needs, learning pace, and style. By analyseing student performance data in real-time, these systems can identify knowledge gaps and provide targeted support, such as additional exercises or alternative explanations, to help students master concepts at their own pace. AI tutors or virtual assistants can offer students instant feedback and 24/7 support, reinforcing learning outside the classroom. This approach fosters a more engaging and effective learning environment, moving beyond a one-size-fits-all model.

- **Teacher Support:** AI can significantly reduce the administrative burden on educators by automating tasks like grading, tracking attendance, and managing communications. This allows teachers to dedicate more time to high-value instruction, mentorship, and one-on-one student support. AI-driven analytics can also provide teachers with deep insights into student performance trends, helping them to identify individuals or groups who may be struggling and to adjust their teaching strategies accordingly. Furthermore, AI can assist in lesson planning and curriculum development by generating ideas for classes, suggesting resources, and creating assessment materials.

- **Content Creation and Accessibility:** Gen AI can assist in the rapid creation of diverse and high-quality educational materials, including textbooks, quizzes, and interactive simulations. This can help address the need for more digital educational content in Khmer language. AI-powered translation tools, such as MPTC's TranslateKH, are crucial for making international educational resources more accessible. AI also plays a vital role in improving accessibility for students with disabilities by powering assistive technologies like text-to-speech, speech recognition, and content simplification tools, thereby creating more inclusive learning environments.

Cultivating Purpose-Driven Talent: A key goal of integrating AI into education is to develop a new generation of

[108] UNESCO. (2023). *Guidance for generative AI in education and research*. Paris: UNESCO.

professionals who combine technical skills with the ethical and contextual understanding necessary to apply AI for social impact (see Box 3.4). This involves fostering critical thinking about the societal implications of AI and providing students with opportunities to work on real-world challenges. By integrating AI ethics and human-centric design principles into the curriculum, Cambodia can cultivate a workforce prepared to leverage technology responsibly for national development.

Box 3.4 The data.org Model for Social Impact

As Cambodia seeks to leverage AI for national development, it needs more than just coders and engineers. The global platform data.org advocates for a "new kind of data and AI talent" specifically cultivated for social impact, a model highly relevant to the country's context. Global analysis by data.org highlights a significant, underserved demand for such purpose-driven data professionals in low and middle-income countries, identifying an opportunity to shape and support a pool of 3.5 million such jobs over the next decade.

This new talent model moves beyond purely technical proficiency to emphasize a more holistic and context-aware skill set:

- **Interdisciplinarity:** This approach combines advanced data and AI skills with deep domain knowledge in sectors critical to Cambodia's development, such as public health, climate-resilient agriculture, and economic inclusion. This ensures that technological solutions are grounded in the realities of the sector they aim to serve.
- **A Sociotechnical Approach:** Professionals are trained to understand not just the technology, but also the cultural context, ethical implications, and human-centric aspects of its deployment. This includes a focus on responsible data use, management, and governance to ensure solutions are equitable and protect vulnerable communities.
- **Local Proximity and Ownership:** The model prioritizes cultivating talent from within local communities. This ensures that AI-driven solutions are context-aware, inclusive, and designed to address real, on-the-ground needs, fostering sustainable local innovation rather than relying on external expertise.

The Capacity Accelerator Network, powered by data.org, operationalizes this vision by creating a global "network of networks" that is globally informed but locally grounded. Their model brings together academic institutions, social impact organizations, and governmental agencies to build a robust data ecosystem. It provides comprehensive training in data analysis, stewardship, and ethics, alongside fellowships and collaborative, real-world projects. Additionally, its Asia Pacific Data Capacity Accelerator aims to produce cohorts of data practitioners and develop training models that can be scaled across the region.

Source: data.org. (n.d.). *Capacity Accelerator Network (CAN)*. Retrieved September 12, 2025, available at: https://data.org/initiatives/capacity-accelerator-network/ and data.org. (2022). *Workforce Wanted: Data Talent for Social Impact*. Available at: https://data.org/reports/workforce-wanted/

Improved pedagogy strengthens student outcomes, which feeds into a digitally literate workforce, in turn supporting innovation and broader economic transformation. As such, the economic impact includes improved learning, the development of a future-ready workforce with critical digital skills, and increased efficiency for educators. This requires strong leadership from MoEYS and collaboration with technology partners. As detailed in Chapter 2, critical needs include ensuring equitable access to devices and Internet in schools, developing high-quality digital educational content in Khmer, and providing comprehensive teacher training on AI pedagogy and ethics, a process already underway.

NRA Mission 4: "Electronic and Mechanical Spare Parts": Cambodia Exports 70 Percent of the Electronic and Mechanical Spare Parts Produced in the Country

Cambodia's manufacturing sector, while a vital contributor to the economy, remains heavily concentrated in lower value-added segments like GFT.[109] Diversification into higher-value areas like electronics and mechanical components is a key objective of national industrial policy and the *STI Roadmap 2030*. The NRA mission to export 70 per cent of locally produced parts by 2030 requires substantial upgrades in productivity and quality.

AI can be a key driver of this transformation through:

[109] BetterWork. (2025). *Better Factories Cambodia Annual Report: An Industry and Compliance Overview for 2022-23*. International Labour Organization & International Finance Corporation. Available at https://betterwork.org/reports-and-publications/better-factories-cambodia-annual-report-an-industry-and-compliance-overview-for-2023-2023/.

- **Quality Control and Defect Detection:** To compete in the global electronics and mechanical parts market, Cambodian products must meet international quality standards. AI-powered visual inspection systems can significantly elevate quality control beyond the capacity of manual inspection, which is prone to human error and fatigue. These AI systems use high-resolution cameras and machine learning algorithms to analyse components like printed circuit boards in real-time.[110] They can detect microscopic defects such as misaligned components, soldering issues, broken traces, and surface contamination with a level of precision and speed unattainable by human inspectors. By identifying flaws early in the production process, these systems reduce waste, minimize costly rework, and ensure consistent high-quality output, which is essential for building a reputation for reliability in export markets.

- **Predictive Maintenance:** Unplanned equipment downtime is a major impediment to manufacturing productivity and can lead to significant financial losses.[111] AI-driven predictive maintenance shifts the paradigm from reactive or scheduled repairs to a proactive strategy. By integrating IoT sensors into manufacturing equipment, companies can continuously monitor parameters like vibration, temperature, and power consumption. AI algorithms analyse this real-time data to identify patterns that precede equipment failure, allowing maintenance to be scheduled before breakdown occurs.

- **Process and Supply-Chain Optimization:** Cambodia's reliance on imported raw materials and components makes its manufacturing sector particularly vulnerable to supply chain disruptions. AI can provide critical tools for mitigating these risks and optimizing the entire supply chain. AI-powered models for demand forecasting can analyse vast datasets, including historical sales, market trends, and economic indicators, to predict future demand with far greater accuracy than traditional methods. This allows for more efficient raw material procurement and inventory management, reducing the costs associated with overstocking and the production delays caused by stockouts.[112]

Robotics and Automation: Integrating robotics and automated guided vehicles is a crucial step in modernizing assembly lines for electronic and automotive components. Robots can handle repetitive and physically demanding tasks, such as component placement, soldering, and screwing, with high precision and speed, operating 24/7 with minimal human intervention. This not only boosts productivity but also improves workplace safety by taking over hazardous tasks. Guided vehicles automate the transportation of materials, parts, and subassemblies between workstations and storage areas, optimizing workflow and reducing bottlenecks. These technologies can be integrated into electronics and auto part factories to raise productivity (see Box 3.5).

Box 3.5 AI FARM Robotics: Fostering a "Robotic Nation"

AI FARM Robotics Factory is a private Cambodian initiative at the forefront of the nation's push towards high-value manufacturing. The company's vision is to establish Cambodia as a "robotic nation," aiming to become a leading robotics factory in Asia by 2050 and fostering technological independence. Based in Phnom Penh, AI FARM is actively engaged in the design, development, and production of robotics and automation solutions tailored for industrial and educational applications.

The company's operations are structured through a series of specialized labs, each with a distinct focus on building Cambodia's technological capacity:

- **AUTOBOT X:** This lab functions as a robotic micro-factory, with the ambitious goal of developing autonomous systems capable of producing other robots, a concept the company calls "Create a Living Code – Robot Makes Robot." Products listed under this lab include various robotic models like the "Mini-Invisible One" robotic arm, indicating a focus on developing tangible robotic hardware.

- **Factory i/o:** This division is dedicated to the automation of SMEs, with a stated mission to automate 750,000 SME factories in Cambodia. This aligns directly with the need to enhance productivity in the country's industrial backbone.

[110] Ash Lei. (24 April 2025). *Best AI tools for manufacturing in Cambodia: Transforming industry through intelligent technology*. BytePlus. Available at www.byteplus.com/en/topic/421929 (accessed on 10 October 2025).

[111] Deloitte. (2022). *Asset Optimization: Predictive Maintenance - Connecting machines to reliability professionals*. Available at www.deloitte.com/us/en/services/consulting/services/predictive-maintenance-and-the-smart-factory.html (accessed on 10 October 2025)

[112] Soon Ghee Chua, Nikolai Dobberstein. (October 2020). *Racing toward the future.*

- **Factory AI:** The focus of this lab is on developing the software and algorithms that power industrial automation. Its mission is to create a vast library of AI algorithms, circuits, and mathematical models for industrial applications.
- **FABLABx:** This unit provides end-to-end services for production and manufacturing, including consultation, product design and development, testing, and maintenance support. This positions AI FARM not just as a product manufacturer, but as a comprehensive solution provider for industrial upgrading.

Source: AI FARM Robotics Factory public information; Stakeholder consultations.

The economic impact includes increased manufacturing productivity, improved product quality, reduced production costs, and enhanced competitiveness in global value chains. This requires collaboration between MISTI, TVET institutions under the Ministry of Labour and Vocational Training, private manufacturers, and technology providers. Critical needs include investment in advanced manufacturing technologies and a concerted effort to upskill the workforce.

NRA Mission 5: "Cloud-Based Services": Cambodia's Cloud-Based Services Development is on Par with ASEAN

Cambodia's development of cloud-based services is advancing as the Government prioritizes the construction of national data centres and the expansion of local cloud services. As detailed in Chapter 2, Cambodia's cloud market is emerging, with several private Tier III data centers now in operation and the Government's Tier IV National Data Center under construction. Moreover, achieving parity with ASEAN in cloud-based services requires not just building physical infrastructure but also fostering a vibrant ecosystem of services. Cloud computing provides the essential foundation for developing and deploying AI applications.

AI can be a key driver of this transformation through:

- **Stimulating Demand for Advanced Infrastructure:** Modern AI systems require significant computational power and large datasets. Cloud-based GPUs offer scalable infrastructure, enabling developers to train complex models without the high cost of on-premises hardware. This pay-as-you-go access lowers the entry barrier for start-ups and researchers, thereby boosting demand for domestic cloud capacity.

The economic impact of a robust cloud-AI infrastructure includes enabling digital public services, attracting tech investment, and fostering innovation across key sectors.

- **Enabling AI-as-a-Service:** Local and regional cloud providers can offer specialized AI services tailored to Cambodia's needs. Platforms can host pre-trained models and APIs for Khmer language processing, computer vision for local industries, or predictive analytics.
- **Optimizing Data Centre Efficiency:** AI can significantly enhance the energy efficiency and resource management of data centres. For instance, AI algorithms can autonomously adjust cooling systems, with some companies reporting a reduction on energy consumption for cooling of about 40 per cent.[113] This AI-driven optimization lowers electricity costs and allows operators to expand capacity more sustainably.
- **Enhancing Service Delivery with Predictive Scaling:** AI enables cloud platforms to anticipate demand and allocate resources proactively. By using deep-learning forecasting and reinforcement-learning schedulers, systems can predict workloads and make real-time adjustments. This intelligent resource allocation can lead to substantial improvements in resource utilization, faster response times, and lower operational costs.
- **Bolstering Security and Reliability:** AI-powered monitoring systems can analyse network traffic and user behaviour in real-time to detect anomalies and potential cyberattacks faster than human teams. Furthermore, predictive analytics can identify potential hardware failures before they occur, allowing for preventative maintenance that improves uptime and builds client trust.

[113] Richard Evans, Jim Gao. (20 July 2016). *DeepMind AI reduces Google data centre cooling bill by 40 per cent*. Google DeepMind Blog. Available at https://deepmind.google/discover/blog/deepmind-ai-reduces-google-data-centre-cooling-bill-by-40/ (accessed on 10 October 2025).

NRA Mission 6: "Electricity and Potable Water": All Cambodians Have Access to Reliable Electricity and Safe Potable Water

Ensuring universal access to reliable electricity and safe water is a fundamental development goal and an NRA mission. While Cambodia has made significant progress in electrification, with the World Bank reporting 95 per cent of the population having access to electricity in 2023, challenges remain.[114] The country's grid is aging and struggles to meet rapidly growing demand, leading to issues with power quality and reliability. Furthermore, electricity prices in Cambodia are among the highest in the region.

Access to safe water and sanitation lags further behind. According to the United Nations Children's Fund (UNICEF), one in three Cambodians uses water from a non-improved source. A 2022 UNICEF report noted that 30 per cent of people in rural areas lack access to at least basic drinking water, compared to only 6 per cent in urban areas.[115] These gaps are particularly acute in schools, where, as of 2019, 27 per cent had no water service and 38 per cent had no sanitation service.[116] Such deficiencies not only hinder development but also pose significant public health risks, making the application of advanced technologies like AI a critical consideration.

AI can contribute significantly to improving the management and delivery of these essential services in several ways:

- **Smart Grid Optimization and Predictive Maintenance:** For electricity, AI is crucial for smart grid management, as detailed under Mission 2. AI algorithms can analyse data from smart meters and sensors to optimize energy dispatch, forecast load, and detect faults, thereby improving reliability and efficiency. For both electricity and water utilities, AI can analyse operational data to predict equipment failures. This allows for proactive maintenance that reduces service disruptions for citizens and businesses. However, it must be noted that AI systems themselves are resource-intensive. Data centres require significant electricity for computation and substantial amounts of water for cooling; for every kilowatt-hour of energy consumed, roughly two litres of water are used. Therefore, for AI deployments to generate net benefits, the efficiency gains and service improvements must outweigh their considerable energy and water costs.

- **Water Resource Management and Leak Detection:** For water, AI can optimize allocation, monitor quality, and predict floods and droughts. AI-powered systems analysing data from sensors and satellite imagery can detect leaks in urban and rural distribution networks. This helps to reduce non-revenue water, water that is produced and treated but lost through leaks, theft, or metering inaccuracies before it reaches the customer. Managing non-revenue water is highly cost-effective; the World Bank estimates that halvingthese losses in developing countries could supply water to an additional 90 million people.[117]

- **Sanitation and Public Health:** AI-based surveillance, such as digital twin models of wastewater networks, can detect contamination events early. This supports targeted interventions to reduce the prevalence of diarrheal diseases, which are a leading cause of child mortality in Cambodia.

The economic impact of leveraging AI in this mission includes improved reliability of essential public services, enhanced public health outcomes, reduced operational costs for utilities, better management of natural resources, and increased climate resilience. This requires close collaboration between the Ministry of Mines and Energy, EDC, the Ministry of Water Resources and Meteorology (MOWRAM), and technology providers. MOWRAM is already advancing cooperation with international bodies; recent national strategies on drought management and integrated water-resource management were developed with support from the World Meteorological Organization (WMO) and Global Water Partnership (GWP) Southeast Asia.[118] Critical needs for success include investment in smart infrastructure, transparent data-sharing agreements, and robust capacity-building for local technicians.

[114] Trading Economics. (2025). *Cambodia - Access to Electricity (per cent of population)*. Available at https://tradingeconomics.com/cambodia/access-to-electricity-percent-of-population-wb-data.html (accessed on 10 October 2025).

[115] Cristyn Lloyd. (21 March 2022). *Cambodia's hardest to reach welcome piped water*. UNICEF. Available at www.unicef.org/cambodia/stories/cambodias-hardest-reach-welcome-piped-water.

[116] Karen Birdsall. (March 2021). *Cambodian schools aim for the stars*. German Federal Ministry for Economic Cooperation and Development. Available at https://health.bmz.de/stories/cambodian-schools-aim-for-the-stars/.

[117] Bill Kingdom, Gerard Soppe, Jemima Sy. (2016, August 31). What is non-revenue water? How can we reduce it for better water service? World Bank Blogs: The Water Blog. Available at https://blogs.worldbank.org/en/water/what-non-revenue-water-how-can-we-reduce-it-better-water-service.

[118] Smart Water Magazine. (2024). *Cambodia launches national strategies to address drought and climate resilient water management*. *Available at* https://smartwatermagazine.com/news/global-water-partnership/cambodia-launches-national-strategies-address-drought-and-climate.

NRA Mission 7: 'Carbon Neutrality': Cambodia Becomes a Carbon Neutral Country

Cambodia is highly vulnerable to climate change and has committed to ambitious climate goals, including carbon neutrality by 2050, as outlined in its Long-Term Strategy for Carbon Neutrality (LTS4CN).[119] AI is a critical enabling technology for achieving this NRA mission, but its application requires a balanced approach. While AI can support climate goals, it also has a significant environmental footprint. AI models require vast computational power, leading to high energy consumption in data centers, which are often powered by fossil fuels. These data centers also consume large amounts of water for cooling and contribute to a growing problem of electronic waste from specialized hardware. Therefore, policymakers must carefully weigh the benefits of deploying AI for climate action against its own environmental costs to ensure a net positive impact.

With this in mind, AI can support Cambodia's climate goals in several ways:

- **Optimizing Energy Systems:** AI is crucial for managing the intermittency of renewable energy and optimizing energy consumption in buildings, industry, and transport. By creating more efficient and reliable energy systems, AI directly contributes to reducing greenhouse gas emissions.
- **Environmental Monitoring:** AI analysis of satellite imagery and sensor data can monitor deforestation, illegal logging, and changes in land use in near real-time. This enables timely interventions by authorities and supports sustainable forest management.
- **Climate Modeling and Adaptation:** AI can enhance the accuracy of climate models to better predict extreme weather events and long-term impacts. This improved forecasting allows for more effective climate adaptation strategies. It can also support climate-resilient agriculture through precision farming techniques and drought/flood prediction, safeguarding food security and rural livelihoods.
- **Corporate Sustainability Reporting:** AI can simplify and automate the process for businesses to measure and report their environmental and climate impact. For example, Singapore's Gprnt platform uses AI to help companies, especially MSMEs, generate trusted ESG (Environmental, Social, and Governance) reports (see Box 3.6). Adopting similar tools in Cambodia could help businesses meet regulatory requirements, attract green investment, and access new markets.

Box 3.6 Singapore's Gprnt Platform for AI-Powered Sustainability Reporting

Gprnt is an integrated Environmental, Social, and Governance (ESG) data platform engineered to automate and streamline sustainability reporting. Developed by the Monetary Authority of Singapore, its core technical function is to serve as a centralized data aggregator and calculation engine. The platform utilizes AI and smart data integrations, to automatically pull information from diverse corporate data sources. This process allows for the extraction of relevant metrics from both structured and unstructured data, which are then mapped to specific ESG indicators, significantly reducing the manual data collection and processing burden on businesses.

The platform's architecture is designed for interoperability and scalability, connecting to a wide array of enterprise systems through APIs. It can integrate directly with utility providers for energy and water consumption data (Scope 2 emissions), logistics and supply chain management software for transportation data (Scope 3 emissions), and other corporate financial systems. This data is then standardized according to a unified data model, ensuring consistency and comparability across different internationally recognized reporting frameworks, such as the GHG Protocol and standards from the International Sustainability Standards Board (ISSB). This technical foundation of data harmonization is critical for producing auditable, high-integrity ESG reports.

The application of AI is most evident in the platform's advanced analytical capabilities. AI-powered algorithms automate the complex calculations required to quantify Scope 1, 2, and particularly the data-intensive Scope 3 greenhouse gas (GHG) emissions across a company's entire value chain. By processing vast datasets, the AI can identify emission hotspots, suggest decarbonization strategies, and generate tailored reports that meet specific regulatory or financial stakeholder requirements. This automation not only enhances

[119] Cambodia. (December 2021). *Cambodia: Long-Term Strategy for Carbon Neutrality.* Phnom Penh. Available at https://ncsd.moe.gov.kh/sites/default/files/2022-01/LTS4CN_Report_Cambodia_2021_En.pdf.

the accuracy and verifiability of ESG disclosures but also democratizes access to sustainability reporting, enabling MSMEs without specialized teams to access green financing and participate in global sustainable supply chains.

Source: Gprnt. (2025). *gprnt | Sustainability starts with a Greenprint*. https://www.gprnt.ai/

These AI applications directly contribute to positive economic outcomes. For instance, enhanced climate resilience and more accurate risk modeling can attract green investment. A more efficient, renewable-based energy grid reduces costs and creates new opportunities in sustainable technologies, driving the transition to a green economy. The ability for businesses to easily report on their climate impact can unlock access to green financing. Achieving this requires strong coordination between the Ministry of Environment (MoE), other government agencies, the private sector, civil society organizations, and local communities. Success also depends on access to high-quality environmental data and building local AI modeling capacity.

NRA Mission 8: 'Digitally-Enhanced Health': All Cambodians Have Access to Digitally-Enhanced Health Services

Cambodia's health sector faces challenges in access, quality, and workforce shortages, which AI) can help address, aligning with the NRA mission for digitally-enhanced health and the national goal of universal health coverage. The Royal Government of Cambodia has identified HealthTech as a priority sector, rolling out a roadmap to support the adoption and application of new technologies.[120] The World Health Organization (WHO) recognizes AI's potential to augment the capabilities of healthcare workers, improve health systems management, and help address skilled workforce gaps and resource limitations.

Key application areas include:

- **AI-Assisted Diagnostics:** AI algorithms can analyse medical images (X-rays, CT scans, retinal scans) to detect diseases like tuberculosis, cancer, or diabetic retinopathy with high accuracy. This can assist healthcare professionals, particularly in rural or underserved areas where specialists are scarce, in making faster and more reliable diagnoses. An initiative in this area is a pilot project between the Cambodia-China Friendship Preah Kossamak Hospital and the Guizhou Provincial Health Commission using AI to enhance diagnostic accuracy for diabetes patients.[121] This approach not only improves the quality of healthcare but also reduces the risk of misdiagnosis.

- **Public Health Surveillance:** AI can analyse diverse data sources (e.g., health records, environmental data, news reports) to predict disease outbreaks, monitor public health trends, and optimize resource allocation during health emergencies. This is particularly relevant for tackling significant public health threats like antimicrobial resistance, where AI can help analyse surveillance data to identify resistance patterns and inform treatment protocols (see Box 3.7).

- **Operational Efficiency:** AI can be used to optimize hospital operations, such as patient scheduling, bed management, and supply chain logistics for medical supplies, leading to improved efficiency and cost savings. In Cambodia, clinics are already adopting Electronic Medical Record (EMR) systems, which streamline processes, improve management of medical supplies, and allow for better tracking of disease trends.[122] These digital systems shorten workflows and enhance the effectiveness of patient care.

Box 3.7 AI for Antimicrobial Resistance Mitigation in Cambodia

Antimicrobial resistance is a significant and growing threat to public health in Cambodia, driven by factors including the misuse and overuse of antibiotics, which are often available without a prescription. When common medicines no longer work on infections, it increases the risk of disease spread, severe illness, and death.
To combat this challenge, a collaborative project is leveraging AI to promote the optimal use of antibiotics. The "CAMbodia Predictive Resistance Application" (CAMPRA) is a partnership between the Cambodia Academy of Digital Technology (CADT), Calmette Hospital, and French researchers. The project's primary goal is to provide Cambodian doctors with a digital tool that can effectively guide their choice of antibiotics while they await laboratory test results.

[120] Kiripost. (2023, January 30). Digitizing Cambodia's health sector. Available at https://kiripost.com/stories/digitizing-cambodias-health-sector (accessed on 10 October 2025).

[121] Ben Sokhean. (2024, October 21). Cambodia's AI efforts highlighted at Health Forum. Khmer Times. Available at https://www.khmertimeskh.com/501577078/cambodias-ai-efforts-higlighted-at-health-forum/ (accessed on 10 October 2025).

[122] Kiripost. (30 January 2023). *Digitizing Cambodia's Health Sector*.

Using machine learning models trained on local data from Calmette Hospital, the project team developed a web-based application that predicts the probability of a bacteria being resistant to various antibiotics. This allows clinicians at the bedside to make more informed, evidence-based decisions for empirical prescriptions, reducing the reliance on broad-spectrum antibiotics and minimizing the risk of treatment failure. By integrating local data, the AI tool is tailored to the specific resistance patterns found in Cambodia, offering a powerful new approach to antimicrobial stewardship and helping to preserve the effectiveness of essential medicines.

Sources: Lim, J. M., Chhoun, P., Tuot, S., Om, C., Krang, S., Ly, S., Hsu, L. Y., Yi, S., & Tam, C. C. (2021). Public knowledge, attitudes and practices surrounding antibiotic use and resistance in Cambodia. *JAC-Antimicrobial Resistance*, *3*(1), dlaa115. https://doi.org/10.1093/jacamr/dlaa115; and World Health Organization. (2023). *Cambodia harnesses youth innovation to combat antimicrobial resistance*. WHO Western Pacific. https://www.who.int/westernpacific/newsroom/feature-stories/item/cambodia-harnesses-youth-innovation-to-combat-antimicrobial-resistance

The economic impact includes improved health outcomes for the population, increased healthcare system efficiency, enhanced access to care, and the potential for growth in a domestic health-tech industry. This requires strong leadership from MoH, robust digital health infrastructure, and, critically, the development of strong health data governance frameworks to ensure patient privacy and data security, as detailed in chapter 2.

3.3. AI FOR MSME PRODUCTIVITY

Enhancing private sector productivity, particularly among the MSMEs that form the backbone of Cambodia's economy, is a central objective for sustainable growth. While large corporations may have the resources to invest in bespoke AI solutions, the primary challenge lies in making AI accessible, affordable, and relevant for smaller enterprises operating with significant constraints.

Opportunities exist to develop or adapt AI tools that address common MSME pain points:

- **Process Automation:** AI tools can assist with automating repetitive administrative functions, data entry, scheduling, and basic accounting, freeing up human employees for more strategic and value-added activities.

- **Marketing and Customer Engagement:** AI enables businesses to deliver more personalized customer experiences. AI can power targeted marketing campaigns, and AI-driven chatbots can provide 24/7 customer support. For Cambodian MSMEs, accessible tools for generative AI can help automate marketing content creation and enhance customer engagement with relatively low investment.

- **Logistics and Inventory Management:** AI can help MSMEs optimize inventory management to reduce costs and streamline basic logistics. For the broader logistics sector, AI is crucial for intelligent route planning, warehouse automation, and improved demand forecasting, which is vital for a trade-dependent economy.

- **Access to Finance and Financial Literacy:** AI-powered platforms can streamline the process of applying for loans and other financial services, making it faster and more accessible for MSMEs. These platforms can also provide valuable financial education, helping business owners make more informed decisions (see Box 3.8).

Box 3.8 Boost Capital: a Chatbot for Financial Services and Education

A prime example of an AI-driven solution tailored for the Cambodian market is Boost Capital, a company that offers financial services through a chat-based platform. Their AI-powered chatbot enables MSME owners to apply for loans and other financial products directly from their smartphones, eliminating the need to download a new application and making the process significantly more convenient than traditional methods.

This approach directly addresses a critical pain point for small businesses: access to finance. By simplifying and accelerating the application process, Boost Capital helps Cambodian entrepreneurs secure the capital they need to expand their operations.

Moreover, the platform extends beyond financial transactions by offering chat-based financial education, which has already reached over 50,000 students. This highlights how AI can empower MSME owners with crucial business knowledge. Boost Capital's use of a

chatbot on popular messaging platforms is a "frugal innovation" that ensures the service is accessible, user-friendly, and impactful for a diverse range of entrepreneurs.

Sources: Boost Capital. (2023). *Boost Capital – Fair financial services*. Retrieved from https://www.boostkh.com

The economic impact of adopting these models is substantial and multi-faceted. At the firm level, these tools drive a direct increase in MSME productivity by automating routine tasks, which cuts operational costs and reduces human error. This newfound efficiency translates into enhanced competitiveness, allowing smaller enterprises to offer better prices, faster services, and compete more effectively with larger corporations, both domestically and in the international market. Furthermore, the adoption of AI leads to an improved quality of goods and services. AI-driven analytics can refine production processes, while AI-powered customer service tools can elevate the customer experience, fostering loyalty and expanding market share.

On a broader, macroeconomic scale, these advancements facilitate the enhanced integration of MSMEs into national and regional value chains. AI-optimized logistics and inventory management enable them to meet the demanding standards of larger partners, opening up new markets and creating more stable revenue streams. This integration strengthens the entire economic ecosystem, fostering innovation and contributing to overall economic resilience and GDP growth. Ultimately, making AI accessible and affordable for the MSME sector is not just about modernizing individual businesses; it is a strategic imperative for driving inclusive and sustainable economic development.

3.4. AI FOR PUBLIC SECTOR SERVICE DELIVERY

Applying AI within the public sector offers significant opportunities to improve the efficiency, effectiveness, accessibility, and quality of government services, contributing directly to several NRA missions and aligning with Cambodia's Digital Government Policy 2022–2035.

Potential application areas include:

Citizen-Facing Services: AI-powered chatbots and virtual assistants, operating in Khmer, can offer citizens 24/7 access to government information and services. These tools, such as Singapore's LifeSG App (see Box 3.9), can handle frequently asked questions, guide users through complex administrative processes, and reduce waiting times, thereby improving service quality. A significant step in this direction is the pilot launch of the "DG SuperApp" by MPTC.[123] This unified platform integrates various digital services and AI applications to support government officials, businesses, students, and the general public.

- **Improving Core Public Services:** As detailed under the NRA missions, AI can be a powerful tool within essential public services. In healthcare, AI can assist with diagnostics in public clinics, such as through AI-powered analysis of medical images, and help in predicting disease outbreaks. In the education sector, AI tools can support teachers in public schools by personalizing learning experiences for students and automating administrative tasks.

- **Evidence-Based Policymaking:** AI tools have the capacity to analyse large and complex government datasets from sources like economic surveys, health information systems, and environmental monitoring. This analysis can identify trends, predict outcomes, and provide robust insights for more effective and evidence-based policymaking.

[123] Phuong Sothiny. (14 February 2025). *MPTC launches a new 'DG SuperApp'*. Khmer Times. Available at www.khmertimeskh.com/501664786/mptc-launches-a-new-dg-superapp/ (accessed 10 October 2025).

Box 3.9 Singapore's LifeSG App

A leading example of an integrated public service platform is Singapore's LifeSG app, which provides citizens with a single, user-friendly interface for over 100 government services. Initially launched to support citizens during key life moments, such as birth registration and elder care, the app has expanded to become a comprehensive tool for daily interactions with the government.

The LifeSG platform demonstrates the power of bundling services. For instance, when registering a child's birth, parents can simultaneously apply for related benefits like the "Baby Bonus" and even a library membership in one seamless transaction. This "life-event" based approach simplifies what would otherwise be multiple, separate processes.

AI plays a crucial role in personalizing the user experience. The app uses AI algorithms to analyse user data and provide personalized recommendations for services and government schemes for which a citizen might be eligible. This proactive approach ensures that citizens are aware of the support available to them. Furthermore, AI-powered features like chatbots and enhanced feedback mechanisms help to improve citizen engagement and service delivery.

Sources: Government Technology Agency of Singapore. (n.d.). *LifeSG*. Retrieved from https://www.tech.gov.sg/products-and-services/lifesg/; Gerard, C. (2023, September 21). *What does it take to build a government superapp?* GovInsider. https://govinsider.asia/intl-en/article/what-does-it-take-to-build-a-government-superapp

The economic impact of these applications includes increased efficiency and reduced costs in public administration, improved quality and accessibility of public services, enhanced government transparency, and better resource management. The successful realization of these benefits hinges on strong leadership from the DGC, which is tasked with leading and coordinating the implementation of the digital government policy.

CHAPTER

4

ENABLING INCLUSIVE AND ETHICAL AI RESEARCH AND INNOVATION ECOSYSTEM

The formulation of a coherent and ethically sound direction for Cambodia's AI R&I ecosystem necessitates grounding in established global and regional standards. These frameworks provide a baseline for ethical legitimacy, foster international collaboration, and ensure that national efforts align with universally recognized human values.

The UNESCO Recommendation on the Ethics of Artificial Intelligence stands as the most comprehensive universal standard. It articulates core values such as respect for human rights, environmental flourishing, diversity, and peaceful coexistence. These are operationalized through key principles including proportionality, safety and security, fairness and non-discrimination, sustainability, privacy, human oversight, transparency, accountability, and multi-stakeholder governance.

This global standard is complemented by overarching UN frameworks. The Pact for the Future, adopted in September 2024, emphasizes that inclusive research and innovation are critical for achieving the Sustainable Development Goals (SDGs) and mandates global cooperation to bridge the digital divide. Its annexed Global Digital Compact (GDC) aims to ensure AI serves all humanity by promoting universal access, equal representation in governance, technology transfer, and capacity development. Nonetheless a significant global talent gap of approximately 3.5 million data and AI professionals focused on social impact needs to be addressed to ensure these benefits are equitably shared.[124]

Crucially for regional integration, Cambodia's ethical framework must also align with standards developed within ASEAN. The *ASEAN Guide on AI Governance and Ethics* provides a practical, regionally contextualized framework emphasizing principles such as transparency, fairness, security, and human-centricity. The subsequent *Expanded ASEAN Guide focusing on Generative AI* further addresses specific risks associated with LLM.

Adopting these frameworks is insufficient without deep contextualization. As established in chapters 1 and 2, Cambodia's unique socio-economic landscape, characterized by a large informal economy, a youthful demographic, and significant rural-urban disparities, demands a tailored application of these principles. A successful ethical direction requires interpreting and integrating these multi-level standards within the nation's specific context to address its unique challenges and leverage its cultural strengths.

4.1. ETHICAL CHALLENGES AND RISKS

While the development of a national AI ethics framework is a strategic priority, it is crucial to recognize the current baseline of awareness within the country. According to stakeholders directly engaged in AI development, there is presently a very low level of public and even corporate consciousness regarding the importance of AI ethics. In the absence of formal national guidelines or policies, the topic does not command significant attention from either the general populace or the private sector. This assessment suggests that companies are not proactively integrating ethical considerations into their development processes. This gap between the strategic aspiration for ethical AI and the current reality on the ground underscores the urgent need for foundational public literacy and awareness campaigns to run in parallel with policy formulation.

The "black box" nature of many sophisticated AI models, where even their creators cannot fully explain their

[124] data.org, Patrick J. McGovern Foundation, and Dalberg. (2022). Workforce Wanted: Data Talent for Social Impact.

reasoning, creates significant hurdles for establishing clear accountability when AI systems cause harm. This opacity makes it difficult to assign responsibility, seek redress, or prevent future failures. Recommendations to address this include mandating transparent AI impact assessments for high-risk applications and establishing clear liability rules that apportion responsibility between the developers, deployers, and users of AI systems. Moreover, AI systems, trained on globally skewed or historically biased local data, possess the capacity to inherit, amplify, and automate existing societal inequalities in Cambodia.

The critical underrepresentation of the Khmer language and Cambodian cultural context in the global datasets used to train major AI models also poses a foundational ethical risk. Most state-of-the-art systems are trained on datasets overwhelmingly dominated by English and other high-resource languages, resulting in poor performance when processing Khmer. This can lead to outputs that are culturally irrelevant, perpetuate harmful stereotypes, or are simply inaccurate. This creates a risk of *digital homogenization*, where global recommender algorithms on social media and content platforms systematically suppress local Cambodian content in favor of globally dominant media, marginalizing Cambodian perspectives and culture in a global digital conversation increasingly mediated by AI. Examples of potential consequences include:

- **Recruitment and Labour:** Algorithmic bias poses a significant threat to Cambodia's GFT sectors, which employ a predominantly female workforce. An AI tool trained on historical hiring or performance data could learn to associate female-specific attributes (such as career breaks for childcare) with lower-value roles. This could lead to algorithms that systematically downgrade applications from women for promotion, creating a digital "glass ceiling" that entrenches gender-based wage gaps and makes it harder for women to advance into leadership roles.

- **Financial Services:** AI-driven credit scoring presents a dual potential. While it offers a promising path to financial inclusion for the large rural and informal workforce lacking formal credit histories, it also carries a significant risk of creating new, opaque forms of discrimination. Given Cambodia's urban-rural digital divide, an AI model trained predominantly on data from urban customers could easily misinterpret the distinct socio-economic patterns of rural life, such as different mobile data usage or informal economic activities, as indicators of high risk. This could result in a new form of "digital redlining," where AI systems inadvertently exclude the very rural and female populations they are intended to serve, thereby deepening financial exclusion rather than alleviating it.

- **Content moderation:** The technology's ability to create and disseminate deepfakes and disinformation at near-zero cost is made exceptionally acute due to the status of Khmer as a "low-resource language" in the world of AI. This data deficit leads to a systemic, dual failure of content moderation systems: AI-powered tools are less effective for Khmer language content as they lack sufficient training data to grasp the nuances of colloquialisms, political satire, or code-switching, thus failing to detect sophisticated hate speech and disinformation. And when content is flagged for human review, the process often fails as well, as outsourced moderators may lack the deep cultural and linguistic context required to make accurate judgments, leading to either the wrongful removal of legitimate content or the failure to remove genuinely harmful material.

Without substantial and targeted intervention, the economic benefits of AI are likely to flow disproportionately to privileged, urban populations, deepening the already significant digital divide. Cambodia faces profound urban-rural gaps in Internet connectivity, device affordability, and digital skills, with consistent high-speed broadband largely unavailable outside of Phnom Penh. Rural students are disproportionately affected by this gap and possess lower levels of digital literacy than their urban counterparts.

The country's main economic activities are also highly vulnerable to automation due to their reliance on routine, manual tasks. Already in 2016, a study by ILO warned that a staggering 88% of workers in Cambodia's textile, clothing, and footwear industries are at high risk of displacement due to automation in the coming decades.[125] This threat is driven by powerful economic pressures, including rising minimum wages and intense regional competition, compelling factory owners to increase productivity. While the transition may be phased due to the need for significant capital investment and Cambodia's high energy costs, the direction is clear. This requires proactive national strategies for accessible reskilling programmes and adaptive social safety nets.

Cambodia also faces a pre-existing gender gap that creates a vulnerable foundation for the integration of AI. The country ranked 102nd out of 146 in the 2024 Global Gender Gap Index, with educational attainment and political empowerment being areas of particular concern.[126] This

[125] Jae-Hee Chang, Phu Huynh. (July 2016). *ASEAN in transformation: The future of jobs at risk of automation* (Bureau for Employers' Activities, Working Paper No. 9). Geneva: International Labour Organization.

[126] Kusum Kali Pal and others. (2024). *Global Gender Gap Report 2024*. Geneva: World Economic Forum.

disparity is especially stark in technology-related fields. Women are severely underrepresented in STEM fields at the university level, accounting for only 17% of students in tertiary education for these subjects.[127] This educational gap translates directly into the workforce, where women make up only about 10% of the ICT sector.[128] The GSMA's Mobile Gender Gap Report highlights that even when women own mobile phones, they often use a narrower range of services, indicating a gap in digital skills and confidence that could hinder their ability to benefit from AI.[129] This fundamental inequality in access and skills creates a critical barrier, preventing rural populations and many women from accessing AI-powered services, participating in the digital economy, and seizing new job opportunities that AI might create, thereby ensuring that the gains from this technological revolution are concentrated in the hands of a few.

There are also emerging risks to individual well-being concerning mental health and social harms. As AI chatbots become more sophisticated, the risk of emotional dependency arises, a particular concern for Cambodia's large and digitally native youth demographic. Over-reliance could lead to negative mental health outcomes and social isolation. Furthermore, the malicious use of generative AI enables new and scalable forms of personal harm, including automated online harassment and the creation of non-consensual deepfake pornography. This form of digital violence poses a profound threat to individual security and dignity, with a disproportionate and devastating impact on women and girls.

4.2. Integrating Buddhist Ethics for Culturally Resonant Directions

Cambodia's deep-rooted Theravada Buddhist heritage offers a sophisticated ethical system that can guide AI innovation towards holistic well-being (*sukha*) and societal harmony. This potential has been extensively explored within multi-stakeholder dialogues, converging on the viability of integrating core Buddhist principles to cultivate a national AI approach that is uniquely Cambodian. This framework emphasizes leveraging AI not as a neutral tool, but as a technology whose design, development, and deployment are guided by wisdom (*paññā*) and ethical virtue (*sīla*) to proactively promote societal good and alleviate suffering (*dukkha*).

A fundamental tenet informing this integration derives from the Buddhist analysis of consciousness (*viññāṇa*) and moral agency. According to core Buddhist doctrines, AI systems, as technologically constructed artifacts, fundamentally lack consciousness, subjective awareness, and genuine intention (*cetanā*). This definitively places the full weight of ethical accountability upon the human actors involved throughout the AI lifecycle. It reframes the ethical challenge as one of ensuring human ethical conduct through AI, underscoring the profound responsibility humans bear. This understanding has given rise to a unique ethical framework within COPAI initiative (see Box 4.1).

Box 4.1 Generous AI: an Ethical Framework and Code of Conduct for the COPAI Initiative

In the absence of formal national AI regulations, COPAI initiative developed its own ethical framework, Generous AI, to guide its work and provide a moral safeguard for its diverse volunteers. This framework, born from the COPAI experience and inspired by ESCAP's blog post of the same name, translates high-level Buddhist principles into a practical code of conduct, ensuring that all collaborative R&I activities are grounded in wholesome intentions and a commitment to collective benefit.

The framework is built on the understanding that AI development is a form of action (*kamma*), whose ethical quality is determined by the intention (*cetanā*) of its human creators. Generous AI thus emphasizes the practice of digital altruism and merit-making (*puñña*), where contributing knowledge, skills, and time to create beneficial, open, and accessible AI tools is considered a virtuous act. The spirit of generosity is embodied by the volunteers – students, professionals, and experts – who dedicate their time without financial compensation, and by the initiative's commitment to creating open-source solutions and sharing knowledge freely.

[127] UNICEF East Asia and Pacific Regional Office (EAPRO). (2023). *Girls' digital literacy in the East Asia and Pacific region: Spotlight on Cambodia, Indonesia, Lao PDR, Timor-Leste and Viet Nam*. Bangkok: UNICEF EAPRO.

[128] Digital Transformation Center Cambodia. (n.d.). *Women in Tech*. https://dtc-cambodia.com/women-in-tech/

[129] Nadia Jeffrie and others. (2023). *The Mobile Gender Gap Report 2023*. GSMA. Available at www.gsma.com/r/wp-content/uploads/2023/07/The-Mobile-Gender-Gap-Report-2023.pdf.

This ethos is operationalized through the COPAI Code of Conduct, which draws inspiration from the Five Precepts of Buddhism. It requires participants to commit to:

- **Non-harm:** Prioritizing AI applications that do not harm people or communities.
- **Non-taking of what is not given:** Upholding IP, data privacy, and transparently acknowledging all sources.
- **Right conduct and communication:** Maintaining professional integrity and engaging in respectful, constructive dialogue.
- **Heedfulness:** Remaining mindful and vigilant when handling sensitive data and considering AI's social impacts.
- **Collective good:** Designing AI solutions and policies for collective benefit, reflecting the spirit of generosity.

The Generous AI framework thus serves as a living ethical compass for the COPAI community, demonstrating how a project can be guided by deeply held cultural values, fostering a safe and responsible space for innovation even before formal regulations are in place.

Source: ESCAP. (2025, March 14). *Generous AI: Integrating Buddhism to push the frontiers of inclusive innovation in Cambodia*. https://www.unescap.org/blog/generous-ai-integrating-buddhism-push-frontiers-inclusive-innovation-cambodia

The Four Brahma *Vihāras* as a Compass for Compassionate AI

The concept of Compassionate AI, a central theme in these discussions, is directly rooted in the Four Brahma Viharas (Divine Abidings).[130] In Buddhism, these are four sublime states of mind to be cultivated through meditation and daily practice, representing the highest social attitudes. Their application to AI provides a powerful ethical compass:

***Mettā* (loving-kindness):** For a Buddhist, *mettā* is an attitude of unconditional friendliness and goodwill extended to all beings. In AI, this can translate to designing systems with a "human-first" principle that aligns with the principle of human-centricity, ensuring that interactions with AI are helpful, non-adversarial, and promote psychological well-being.

***Karuṇā* (compassion):** This is the heart of Compassionate AI. *Karuṇā* is the active wish for others to be free from suffering. In AI R&I, this could be an encouragement to the development of solutions that directly address societal pain points, such as AI-powered diagnostic tools that improve healthcare access in rural areas, assistive technologies for persons with disabilities, or climate models that help farmers adapt to environmental changes.

***Muditā* (sympathetic joy):** This is the practice of delighting in the happiness and success of others, without envy. In the context of AI, this encourages the creation of empowering tools like open-source Khmer language models, which allow local developers and SMEs to build their own applications without prohibitive costs, thereby fostering a vibrant and collaborative innovation ecosystem. This aligns with the goal of creating digital public goods (DPGs) that enable others to succeed and innovate.

***Upekkhā* (equanimity):** This is a state of balanced impartiality and mental stability, free from attachment and aversion. In AI, this is the foundation of fairness and non-discrimination (a key UNESCO and ASEAN principle). A practical application would be the meticulous de-biasing of a Khmer-language credit-scoring model to ensure it does not unfairly discriminate against rural applicants or women, thereby providing equitable and fair access to finance.

Practicing the Eightfold Path for AI Development

The Noble Eightfold Path, the Buddha's practical guide to ending suffering, offers further operational directives for those involved in AI R&I activities, providing a comprehensive and profound guide for ethical AI development:

Right View (*Sammā Diṭṭhi*): In Buddhism, this means having an accurate understanding of the nature of reality, including the laws of *kamma*, dependent origination and the nature of consciousness. When interpreted to the context of AI, Right View could mean having a clear-eyed view of the technology's capabilities and limitations. It involves recognizing that AI is a tool, not a conscious entity, and understanding that its outputs are conditioned by its training data. A critical insight here is that most AI models are trained on data reflecting non-Buddhist worldviews. Right View, therefore, compels developers to acknowledge this inherent bias and actively work to counteract it. This could involve the practical strategy of "weighting" models to give greater influence on data reflecting local Cambodian and Buddhist values, ensuring they are not "swamped" by globally dominant narratives and that the AI's perspective aligns with the long-term well-being of the society it serves.

[130] Kieth Rethy Chhem. (17 December 2024). *The Idea of Compassionate AI: Embodying Buddhist Ethics in Technology*. AIF Insights, No. 3. Phnom Penh: AI Forum Cambodia. Available at: www.aiforumcambodia.org/publications/aif-insights-no-3-2024-the-idea-of-compassionate-ai-embodying-buddhist-ethics-in-technology (accessed on 11 October 2025).

Right Intention (*Sammā Saṅkappa*): This is the cultivation of wholesome motivations, specifically intentions of renunciation, non-ill will, and harmlessness. For AI developers, this translates to a profound responsibility: since AI lacks consciousness and cannot form its own intentions, all ethical weight (*kamma*) falls upon its human creators, users and sponsors. This is not merely a burden but a tremendous opportunity to generate positive societal impact. Right Intention guides developers to create AI not just for economic gain, but for the explicit purpose of enhancing human value, including individual spiritual growth and collective harmony.

Right Speech (*Sammā Vācā*): This involves abstaining from false, divisive, harsh, or idle speech. For AI, this principle is not just about avoiding harmful outputs. It is about actively designing AI to be an exemplar of ethical communication. Because humans are influenced by their environment through social learning, an AI that consistently communicates with truthfulness, gentleness, and unifying language can have a positive formative effect on its users and society at large, promoting harmony and constructive dialogue.

Right Action (*Sammā Kammanta*): This entails refraining from actions that harm, such as killing, stealing, or sexual misconduct. In the AI context, this extends beyond preventing direct harm. It means designing systems that respect data privacy as a form of not-stealing, ensuring algorithmic actions do not cause physical or financial harm, and upholding IP rights. This aligns with the ASEAN principles of security, safety, and privacy. Like Right Speech, an AI that consistently embodies right action can serve as a positive model in the digital realm.

Right Livelihood (*Sammā Ājīva*): This means engaging in a profession that does not bring harm to oneself or others. For AI professionals, this is a call to work on projects that are ethically sound and contribute positively to society, aligning with SDG-8 (Decent Work and Economic Growth). It encourages a conscious choice to develop AI for beneficial applications – such as in education, healthcare and environmental protection – while avoiding working on systems designed for manipulation, surveillance, or weaponry.

Right Effort (*Sammā Vāyāma*): This is the energetic striving to prevent unwholesome states and cultivate wholesome ones. In the context of AI, this is the continuous, active work of de-biasing algorithms, patching security vulnerabilities, updating systems to prevent misuse, and steering research towards solving pressing societal problems rather than trivial ones. It is the diligent practice of ethical maintenance and improvement.

Right Mindfulness (*Sammā Sati*): This is the practice of maintaining clear, non-judgmental awareness of the present moment. For an AI developer or policymaker, it means being constantly mindful of the ethical dimensions and potential unintended consequences of their work at every stage of the lifecycle – from data collection and model design to deployment and long-term societal impact.

Right Stillness (*Sammā Samādhi*): This is the development of deep mental focus, a cornerstone of Buddhist meditation. While AI cannot meditate, its most profound contribution to this path may be indirect but transformative. By automating the mundane, repetitive, and burdensome tasks of ordinary life, AI can liberate vast amounts of human time and cognitive energy. This creates the societal space and individual opportunity for deeper contemplative practice, wisdom cultivation, and the development of compassion. In this view, AI's ultimate service to humanity is not just in what it does, but in what it enables humans to become.

This integration of Buddhist ethics provides a robust foundation for an AI R&I direction that is both uniquely Cambodian and universally relevant. A key insight from this approach is the use of traditional parables as modern ethical tools (see Box 4.2).

Box 4.2 The Three Kinds of Innovators: a Buddhist Parable for Ethical AI

A powerful tool for translating Buddhist ethics into a practical framework is the parable of the "Three Kinds of Children," found in the Putta Sutta (*Khuddaka-nikāya,* Itivuttaka 74). This ancient teaching, which describes children who can surpass, equal, or fall below their parents in virtue, can be reframed as an ethical maturity model for assessing the disposition of AI creators and their innovations.

The *Atijāta* (Surpassing-Born) Innovator: This archetype represents the ideal of Generous and Compassionate AI. The *atijāta* creator goes beyond mere compliance to proactively design AI for the public good.

- **Intention:** Pro-social design; actively seeking to alleviate suffering and enhance well-being.
- **Illustrative actions:** Building high-quality datasets for low-resource languages like Khmer; developing open-source AI tools for education and healthcare; coding bias-mitigation and fairness directly into models; proactively addressing environmental impact by optimizing model efficiency, utilizing renewable energy sources for computation, and focusing on data efficiency to reduce extensive processing.

The *Anujāta* (Equal-Born) Innovator: This represents the compliant professional who adheres to established norms and standards.

- **Intention:** Risk-aware neutrality; focused on "do no harm" and meeting legal and ethical baselines.
- **Illustrative actions:** Conducting thorough data privacy impact assessments; publishing model cards and datasheets for transparency; implementing "privacy-by-design" principles.

The *Avajāta* (Inferior-Born) Innovator: This archetype, described with the interpretive flourish of a "gangster mind" in discussions, represents the unethical or reckless actor.

- **Intention:** Exploitative, malicious, or negligent.
- **Illustrative actions:** Designing manipulative recommender algorithms to spread disinformation; creating deepfake-as-a-service platforms for malicious purposes; deploying biased AI systems without due diligence.

This typology provides a culturally resonant yardstick for policymakers, developers, and educators. It allows for the classification of AI projects based on their ethical intent and impact, helping to incentivize *atijāta* innovation, enforce *anujāta* compliance as a baseline, and identify and sanction *avajāta* behaviours.

4.3. Applying an Inclusive Lens to AI Innovation

To build an ethical and effective AI R&I ecosystem, Cambodia must systematically embed inclusivity as a core operational principle. This section applies the four dimensions of the ESCAP inclusive innovation framework to analyse the Cambodian context, assessing not only the stated goals of its policies but also the practical realities that shape them. This approach moves beyond abstract principles to examine the concrete choices that determine who benefit from AI, whose needs are prioritized, who gets to participate in its creation, and how its development is governed. By grounding this analysis in Cambodia's unique cultural values, such as the Buddhist principle of universal compassion (Karuṇā), its national development aspirations, and its global commitments under frameworks like the Pact for the Future, we can identify strategic pathways to ensure AI becomes a force for broad-based, equitable prosperity.

A. Overall Objectives: Do the Aims of Innovation Policy Involve More Than Economic Growth?

This dimension challenges policymakers to define the ultimate purpose of AI innovation beyond narrow economic metrics like GDP growth. For Cambodia, this means consciously aligning its national AI strategy with broader human development goals. It involves asking critical questions: Is AI being developed to primarily boost export competitiveness, or is it also being steered to improve public health outcomes in rural provinces, enhance educational access for marginalized youth, support greener growth, and build resilience for smallholder farmers? An inclusive approach requires that social and environmental well-being are treated not as secondary benefits but as primary objectives of the national AI agenda, ensuring that technological progress translates into tangible improvements in people's lives.

Cambodia's digital and STI policy architecture already articulates goals beyond GDP growth – spanning human development, public service delivery and social inclusion. The *Cambodia Digital Economy and Society Policy Framework (2021–2035)*, *Digital Government Policy (2022–2035)* and *STI Roadmap 2030* commit to building an enabling "digital ecosystem" and directing research resources through the *National Research Agenda 2025* toward national priorities, not just competitiveness. Read through an inclusive lens, these strategies provide an explicit mandate to link AI to broader welfare outcomes and access to services, particularly for youth and underserved communities comprising a large share of the population.

At the same time, the evidence shows structural constraints that shape how far these inclusive aims can travel in practice. Public and private R&D spending is low, while access gaps persist: only 4.6 per cent of primary students used the Internet for pedagogical purposes in 2022; women remain starkly underrepresented in STEM tertiary education (17 per cent female, 83 per cent male). These are not generic deficits: they are the binding conditions that constrain the ability to pursue social missions alongside economic growth and determine who can benefit from AI and how fast inclusive gains can materialize.

Challenges:

- Translating inclusive policy intent into funded instruments with measurable inclusion outcomes (e.g. disaggregated access, usage and benefit metrics).
- A persistent "resource gap": students and MSMEs report relying on free tools, but premium AI capabilities (and credits) remain out of reach, creating a two-tier skills pipeline.
- Limited R&D and constrained compute make long-horizon, high-risk inclusive AI projects difficult to sustain.

Opportunities:

- Specify inclusion targets and indicators inside existing strategies (e.g. youth, rural, disability, women, MSMEs) and couple them to open, disaggregated administrative data already flowing through national platforms (such as CamDX, CamStat, DataEF).
- Expand "shared national infrastructure" access (e.g. high-performance computing) through cohort-based programs that lower entry costs for underrepresented innovators (students, rural entrepreneurs).
- Build measurement into projects from the start using the inclusive innovation guidance in ESCAP's *Frontiers* report to monitor who benefits, who participates and what tradeoffs are being managed.

B. Direction of Innovation: Whose Needs are Being Met?

This dimension focuses on the deliberate choices made to steer R&D and investment toward solving specific problems for particular groups. In the Cambodian context, it means prioritizing the development of AI solutions that address the needs of the majority, rather than importing technologies designed for other markets. This requires a strategic focus on challenges faced by the informal economy, the agricultural sector, and MSMEs. Crucially, it involves directing innovation toward those who are linguistically and culturally excluded by mainstream AI, ensuring that technology serves the needs of Khmer speakers in their own language and context. This is a choice to build for relevance and impact over novelty.

The most acute "direction" choice for Cambodia's AI journey is linguistic: Khmer remains dramatically underrepresented in global training corpora, which depresses model performance for the majority and risks cultural irrelevance and bias. The national evidence base points to practical responses already underway – Khmer OCR/MT efforts (e.g. TranslateKH), open data platforms (DataEF, CamStat) and early regional collaborations (e.g. SEA-LION) that can be oriented toward public good Khmer resources. Framed inclusively, this turns "language first" into "people first."

Stakeholder inputs reinforce this direction: prioritizing MSME productivity, smallholder agriculture, literacy, and rural service delivery over showcase systems, and accepting "frugal AI" design (smaller models, offline/edge, tolerance for latency) as a feature, not a flaw, for low connectivity contexts. These choices directly align with ESCAP's inclusive lens on directing innovation toward underserved needs.

Challenges:

- Khmer data scarcity (text, speech, colloquial usage) remains the single largest bottleneck for inclusive AI utility.
- Global trends toward resource-intensive LLMs are poorly matched to local connectivity and compute realities.
- Building viable business cases for AI tools serving low-income users (e.g. rural Khmer speakers) is hard when benefits are diffuse or non-monetized.

Opportunities:

- Treat Khmer datasets and tools as DPGs: prioritizing open corpora, benchmarks and baselines that lower entry barriers for local developers.
- Pursue a frugal AI pathway: finetuning smaller/open models with curated Khmer data; design for intermittent connectivity and on device inference.
- Leverage regional and cross border collaborations to coproduce language resources and evaluation sets for Mekong languages, sharing costs and standards.

C. Participation in Innovation: Who Participates in Innovation?

This dimension examines who is actively involved in the creation and design of AI, moving beyond their role as passive users. For an AI ecosystem to be truly inclusive, the teams building it must reflect the diversity of the society it serves. In Cambodia, this means creating intentional pathways for underrepresented groups – such as women and girls in STEM, youth from outside the capital, persons with disabilities, and innovators from the informal sector – to become AI creators, developers, and entrepreneurs. Fostering their participation is not only a matter of equity: it is essential for developing solutions that are contextually relevant, avoiding inherent biases, and unlocking the full creative potential of the nation. This requires treating assets like shared compute infrastructure and standardized evaluation tools (metrology) not just as technical resources, but as policy levers to widen participation.

Evidence from programme activities and interviews shows that inclusive participation improves when gatekeeping is reduced: open calls, hybrid delivery and remote engagement

expanded involvement beyond Phnom Penh, increased women's participation, and reduced cost barriers. During COPAI hubs, youth cohorts gained visibility and confidence via "field reports" presentations and hands-on roles; critically, direct access to national compute resources fostered organic mentoring links with officials – an example of how infrastructure access can double as a participation policy.

Yet, structural participation gaps remain. Women are underrepresented in STEM tertiary education, and affordability constraints limit meaningful, hands-on use of advanced AI tools by students and grassroots innovators even when free versions are available, creating capability "ceilings." For rural users and the informal sector, connectivity and device constraints further narrow participation unless content, tools and delivery are localized and lightweight.

Challenges:

- Persistent gender disparities in STEM pathways and in applied AI roles.
- Time, resource and channel barriers that exclude informal sector and rural innovators from co-design processes.
- Cost of premium software/credits and limited local devices hinder hands-on learning and prototyping.
- Limited evaluation know-how (in bias, fairness, and safety) makes it hard for smaller teams to demonstrate trustworthy results.

Opportunities:

- Institutionalize hybrid, low-cost participation formats (provincial cohorts, Khmer-first materials) to sustain diverse pipelines of contributors and users.
- Expand "learn-by-doing" access to shared infrastructure (compute, datasets, mentors) for youth and MSMEs; cultivate youth-led DPGs.
- Provide open, student-friendly access to the MISTI-HPC (with transparent criteria) and lightweight sandboxes for community projects to broaden who can build and test AI.
- Build community-driven data programs that reward contributors fairly and surface dialectal/colloquial Khmer.

D. Governance of Innovation: Who Sets Priorities, and How are Outcomes Managed?

This dimension addresses the rules, processes, and institutions that shape AI development and deployment. It asks who gets to set the agenda, define ethical red lines, and ensures that the benefits and risks of AI are managed responsibly. For Cambodia, inclusive governance means establishing clear and fair regulations for data protection and use, creating standards for AI safety and quality, and, most importantly, ensuring these processes are not confined to government ministries. It requires building durable, multi-stakeholder platforms where academia, the private sector, civil society, and community representatives have a meaningful voice in shaping the nation's AI trajectory and holding decision-makers accountable.

Cambodia's data governance stack is maturing but incomplete. On the asset side, the country has built critical digital public infrastructure (CamDX for secure interagency data exchange; CamStat and DataEF for open statistics and economic data). On the rule setting side, core elements remain nascent: comprehensive personal data protection, standardized AI quality/testing protocols and coordinated oversight. For an inclusive lens, what matters is how quickly and safely disaggregated data can be shared for public good, and how AI systems are validated for fairness, safety and performance before they touch citizens' lives.

Inclusive governance also means broadening who gets to define priorities and safeguards. Multistakeholder formats lowered logistical barriers and widened voice, while international metrology bodies show how national quality infrastructure can underwrite trustworthy AI (e.g. measurement methods for bias, explainability and safety). Anchoring public trust in widely shared Buddhist ethics of care and non-harm – used sparingly and alongside legal instruments – can help socialize responsible practice while formal laws and standards are finalized.

Challenges:

- Key regulatory pillars (personal data protection, open data policy implementation) are still emerging, creating uncertainty for data sharing and rights protection.
- Limited national standards/testing capacity for AI systems (part of broader National Quality Infrastructure gaps).
- Sustaining an inclusive, authoritative multistakeholder mechanism beyond project cycles.

Opportunities:

- Use CamDX/DataEF/CamStat as the backbone for accountable, privacy-respecting data collaboratives that power inclusive AI use cases (health, agriculture, MSMEs).
- Build capacity in digital/AI metrology at the National Metrology Center to operationalize fairness, safety and performance testing across the AI lifecycle.

- Align with ASEAN AI governance guidance and participate in regional evaluation efforts to shape context-appropriate norms and avoid becoming a "rule-taker."
- Establish an enduring, inclusive advisory mechanism that links government, academia, industry and civil society to iteratively steer priorities and monitor outcomes using ESCAP's inclusive innovation framework.

CHAPTER

5

STRATEGIC DIRECTIONS FOR CAMBODIA'S AI FUTURE

The preceding chapters of this report have meticulously mapped Cambodia's journey into the age of AI. Chapter 1 established the context: a nation at a pivotal economic and technological crossroads, with AI recognized as a fundamental enabler for achieving its 2050 development vision. Chapter 2 provided a granular analysis of the stakeholder landscape, revealing a dynamic but fragmented ecosystem of government bodies, academic institutions, private sector actors, and international partners, each operating with emerging but often siloed capacities. Chapter 3 illuminated the significant economic opportunities AI presents for Cambodia, particularly within the priority missions of the NRA 2025, while also highlighting the profound risk of exacerbating inequalities if deployment is not managed inclusively. Finally, chapter 4 articulated a unique, culturally resonant ethical direction for AI, grounded in both universal principles and Cambodia's Buddhist heritage, yet underscored the critical absence of formal governance frameworks to translate this vision into practice.

Collectively, these findings paint a picture of profound paradox: a nation with the ambition, demographic advantage, and demonstrated pockets of innovation, yet constrained by entrenched gaps in human capital, data availability, funding, and coordination. To bridge this divide and transform potential into broad-based, sustainable prosperity, the country requires more than just a collection of projects. It needs a coherent, comprehensive, and actionable national AI strategy.

This concluding chapter serves as that strategic blueprint. It synthesizes the report's findings into a set of ten interconnected recommendations, enriched with technical foresight from expert consultations. These recommendations are designed to be more than a list; they form a logical pathway for action, moving from establishing a high-level national vision to building the foundational pillars of data, talent, and trust, and finally, to driving innovation across the economy and society. This is the roadmap for building a sovereign, resilient, inclusive, and verifiably trustworthy AI ecosystem, tailored for Cambodia's unique context and aspirations.

5.1. FOSTERING PRIVATE SECTOR PRODUCTIVITY

Fostering private sector productivity is crucial for Cambodia's economic growth and 2050 vision. With digital transformation already embedded in national policies, particularly in the *Pentagonal Strategy Phase 1*, as a key driver for promoting efficiency and competitiveness, AI presents a unique opportunity to augment and automate processes, enable customization and enhance innovation across industries. Even though efforts toward digital transformation have been introduced, the systematic AI integration remains low, while collaboration gaps between government, universities and private sector are considerable. Cambodia can create an ecosystem where SMEs, startups, and large companies actively integrate AI to increase productivity, optimize efficiency, and enhance marketing and logistics, especially in prioritized and strategic sectors. However, for this to happen, it is required strong government-academia-industry partnerships backed up by supporting mechanisms and guided by a well-defined policy framework. Regulatory sandboxes could be introduced to allow controlled experimentation, while private sector partnerships can accelerate the co-development of tools for licensing, tax administration, and social services. Ultimately,

normalizing AI use across the private sector will align with the country's national development priorities, address the national challenges, and ensure that AI-driven productivity is both sustainable and inclusive.

Recommendation: Cambodia should establish a National AI Task Force charged with developing and championing a national vision for promoting innovation and private sector productivity.

- **Establish a high-level national AI task force:** This inter-ministerial body must have an expanded mandate beyond mere coordination. It must be empowered to drive the national strategy, secure political will, and oversee implementation.

- **Pilot and scale high-impact use cases:** To accelerate private sector productivity in prioritized sectors, Cambodia could implement pilot projects where AI can generate immediate and measurable impacts. The Government can provide funding and technical support to scale the successful pilots.

- **Foster agile governance and innovation:** To compete with larger economies, Cambodia must increase its agility and adaptability. The Task Force could oversee the creation of regulatory sandboxes, providing a safe and legally clear space for startups and researchers to innovate. This must be complemented by a "light-touch" regulatory approach that develops clear standards for high-risk applications (e.g. healthcare and justice) and mandates future-proofing the nation's digital infrastructure with technologies like quantum-safe encryption for data in transit.

- **Promote strong industry collaboration and partnership:** To increase productivity through AI requires strong partnership among private sector, academia and government, supported by agile policy framework that promotes learning and innovation exchange. Building up a strong network in national innovation ecosystem shall be key to encourage joint research and accelerate AI adoption for SMEs and industries.

- **Embed "green AI" and "AI for resilience" as core principles:** The strategic goal to champion Green AI is not only an environmental and economic choice but also a direct response to a critical geopolitical reality. Embracing a Green AI approach which prioritizes developing and deploying more efficient, lightweight models that can run on less powerful, more accessible hardware is a pragmatic necessity. Moreover, this approach aligns with Cambodia's climate commitments, reduces long-term operational costs, and allows the nation to leapfrog the energy-intensive trap of data centers that are not sustainable in the local context. Such strategy transforms a potential weakness into a strength, steering Cambodia towards a more sustainable, cost-effective, and resilient AI development path that is better suited to its infrastructure and resource context.

- **Prioritize a vision of "Sovereign AI":** The national AI strategy could have digital sovereignty as a core tenet. This involves developing clear policies for data residency and championing the creation of a sovereign AI cloud, ensuring sensitive Cambodian data is governed, stored, and computed within national borders. This is not only a matter of national security but a prerequisite for building trust with citizens and businesses, and for developing a domestic AI industry that is not entirely dependent on international platforms.

5.2. Strengthening AI Infrastructure and Data Ecosystems

Strengthening infrastructure and data ecosystems is critical for enabling Cambodia to transition towards an AI-driven economy. The Government's ongoing efforts to expand telecommunications, improve Internet coverage, and establish a national data center provide a strong foundation for robust AI development. However, current limitations, including inadequate high-speed Internet in rural areas and insufficient computing resources, among others, pose significant challenges to the adoption AI nationwide. Current existing networks do not yet meet the requirement of data-intensive and cybersecurity of AI applications. To address these issues, Cambodia should invest in critical supporting

infrastructure such as high-performance computing, data centers, cloud-based infrastructure, and LLMs tailored to Cambodia's specific needs. Public-private partnerships (PPPs) and international funding are the means to secure investment, while clear regulatory frameworks should guide technology transfer, incentivize private investment, and avoid redundant efforts. Furthermore, establishing data governance, fostering public trust, and promoting local-language datasets will strengthen the digital infrastructure needed to ensure the national capabilities required to support AI adoption across industries and sectors.

The ambitions for a data-driven economy and advanced AI applications are entirely dependent on the underlying physical infrastructure. Gaps in connectivity, computing, and energy remain critical constraints.

Recommendation: Pursue a coordinated national strategy to build AI-ready digital and energy infrastructure.

- **Accelerate "last-mile" connectivity:** While backbone networks are improving, the focus must be on expanding reliable, affordable high-speed Internet to rural and underserved areas to close the digital divide.
- **Adopt a realistic, phased infrastructure timeline:** Set a 2–3 years' timeline projected for mature national data center and cloud infrastructure. The immediate focus should be on deploying AI-ready edge computing nodes in key economic hubs (Phnom Penh, Siem Reap, Sihanoukville) to enable low-latency applications in critical sectors like smart agriculture and logistics, while the national core infrastructure is being built.
- **Integrate energy and digital planning:** Ensure that the development of digital infrastructure, particularly energy-intensive data centers and HPCs, is planned in concert with the national energy strategy, prioritizing renewable power sources to support a Green AI vision.

5.3. Develop AI Human Capital and Workforce

Cultivating AI-ready human capital is central to Cambodia's ambition to harness AI for sustainable growth and competitiveness. Building on national objectives to increase STEM graduates by 2030 and strengthen ICT human resources, the country must embed AI across all levels of education, provide technical training, and promote digital inclusion. While HEIs such as ITC, RUPP, AUPP, CADT and KIT already offer AI-related courses, Cambodia currently faces a shortage of AI experts, limited R&D, and ongoing brain drain, compounded by the absence of clear national directives on AI application. Moreover, AI-oriented curricula remain sparse, and short-term pilot training projects have yet to scale. By 2030, Cambodia envisions developing a robust and future-ready workforce equipped with the knowledge, skills, and competencies necessary to advance and responsibly apply AI, integrated into key industries in the prioritized sectors, with the support of continuous learning programmes, clear career pathways, and an active AI community connected through domestic and international collaborations. To achieve this, existing science, technology, engineering and mathematics and Information and communication technology (ICT) initiatives should be leveraged to integrate AI into national curricula and teacher training, while fellowships, scholarships, and university-industry linkages must be expanded to strengthen practical skills. Attracting foreign AI expertise, establishing global partnerships, and creating AI-focused career incentives will further boost local capacity. Additionally, organizing policy labs where government, academia, and private sector stakeholders co-design workforce development initiatives will ensure that training programmes align with market needs. These coordinated efforts will nurture a skilled AI workforce, reduce talent outflow, and solidify Cambodia's position in the AI-driven global economy.

Recommendation: Design and implement a comprehensive national AI human capital development plan that creates a pipeline from foundational literacy to world-class expertise, inspired by proven international models.

- **Replicate the "AI Apprenticeship" model:** Adopt AI Singapore's highly successful model to create a paid and nation-wide AI apprenticeship programme. This structured programme would place aspiring AI professionals into 6 to 9-month deployments on real industry or government projects (such as those in the "100 Experiments" programme), providing invaluable hands-on experience and creating a direct pathway to employment.[131]
- **Leverage international training and mobility:** Actively promote and provide funding for Cambodian researchers and students to participate in elite international programmes, such as AI

[131] AI Singapore. (2025). *AI Apprenticeship Programme (AIAP)*. Available at https://aisingapore.org/talentdevelopment/aiap/ (accessed on 11 October 2025). Ibid. *100 Experiments*. Available at https://aisingapore.org/innovation/100e/ (accessed on 11 October 2025).

Singapore's Visiting Scholars Programme. This provides access to world-class infrastructure and expertise, with a clear mandate and incentive structure for participants to return and build local capacity.

- **Scale the COPAI Innovation Lab model:** The success of the COPAI Innovation Lab was explicitly tied to its supportive ecosystem of mentors. This model of connecting students with a network of experts could be formalized and scaled through universities and national innovation hubs like the NICC.

- **Adopt agile educational frameworks:** To accelerate curriculum development and ensure industry relevance, MoEYS could champion the adoption of agile educational frameworks, empowering universities to innovate in their programmes. This could be combined with For Cambodia, adopting an educational sandbox model to empower local HEIs to partner directly with the private sector, bypass bureaucratic hurdles, and rapidly scale up the production of an AI-ready workforce equipped with both technical and soft skills.

5.4. Strengthening AI Research and Development

Strengthening R&D capacity on AI is crucial for building an advanced innovation ecosystem in Cambodia. To achieve this, the country must invest in both fundamental and applied AI research while fostering strong collaboration between academia, industry, and government. Providing funding and infrastructure for AI labs and research centers will be essential to nurture innovation and support the development of AI solutions that address national and regional challenges. Cambodia also aims to cultivate a vibrant AI innovation ecosystem by supporting entrepreneurs and startups through promoting technology transfer and research commercialization. The supporting programmes such as access to finance, market opportunities, and tailored incubation and acceleration programmes shall be critical for realizing this vision. Mobilizing funding sources, including venture capital and international grants, will help scale these efforts and attract cutting-edge research activities. Engagement in ASEAN and global AI initiatives further amplifies these goals by enabling knowledge transfer, joint research projects, and co-funded R&D collaborations with regional and international partners. The Cambodia's *STI Roadmap 2030*, particularly on the Research pillar, and *NRA 2025* already provide a defined path to harness STI and R&D, leveraging the applied research outcomes, supporting startups, and contributing to entrepreneurship in prioritized sectors. Early actions could focus on launching joint R&D projects under ASEAN frameworks, establishing reciprocal fellowships, and creating mechanisms for talent exchange to strengthen local expertise. Through these integrated efforts, Cambodia can position itself as an emerging leader in AI research and innovation, driving economic growth while aligning with its cultural values and development priorities.

Recommendation: Design and implement a structured "lab-to-market" AI innovation pipeline that uses proven mechanisms to de-risk innovation and create clear pathways for translating research into viable products and services.

- **Adopt a "100 Experiments" co-funding program:** Mirroring AI Singapore's flagship initiative, the Government, through MEF and MISTI, could launch a programme where it co-funds the development of AI MVPs for local companies, particularly MSMEs. By fostering government-backed engineering talent, this model dramatically lowers the financial and technical barriers to AI adoption.

- **Evolve MISTI's HPC into a national prototyping hub:** MISTI's HPC is a proven national asset. The critical next steps are to formalize its role as the central hub for pre-commercial AI prototyping. This requires (1) developing a transparent, merit-based prioritization mechanism for allocating its limited compute resources to projects with the highest potential impact, and (2) actively seeking dedicated funding and international partnerships (e.g. with JICA, ASEAN partners) to strategically expand its GPU and storage capacity to meet the clearly identified and growing demand.

- **Digitize and automate the R&D lifecycle:** A centralized platform could be create to digitize and streamline R&D processes from end-to-end: managing grant applications, facilitating peer review, monitoring project progress with automated reporting, and tracking research outputs and impacts. This would reduce administrative overhead for both researchers and government agencies like MISTI.

- **Leverage AI for strategic insight:** An AI-enabled national R&D system could be more than a simple

database. It could employ AI tools to: (i) Use agentic AI solutions to analyse research proposals, identifying potential collaborations or overlaps to prevent redundant funding; (ii) Develop recommendation engines to connect researchers with relevant expertise, potential industry partners, or funding opportunities; and (iii) Create dynamic, real-time dashboards for policymakers, providing a clear overview of the national R&D landscape, tracking progress against NRA 2025 missions, and enabling evidence-based decision-making for future funding allocations.

- **Build on a foundation of metrology and trust:** For this system to be credible, the data it manages must be trustworthy. This directly links to the need to empower the National Metrology Centre (NMC) to develop standards for R&I metrics. The NMC would define how to measure research quality, impact, and other key performance indicators, ensuring the data fed into the AI management system is robust, verifiable, and comparable. This synergy between the management system and a national metrology framework creates a true "infrastructure of trust" for the entire R&D ecosystem.[132]

- **Explore innovative finance mechanisms:** To overcome the systemic mismatch between traditional investor expectations and the needs of innovation-driven enterprises, innovative financial mechanisms could be explored, such as leveraging Web3 technologies to create a token-based crowdfunding model. Such novel approaches could unlock a new, broad-based pool of domestic capital that is currently untapped. However, its viability is entirely dependent on a supportive regulatory environment, including its inclusion within a proposed national regulatory sandbox, which would provide the necessary legal clarity and security for both the startups and the small-scale investors.

5.5. Driving Public Sector AI Adoption

Driving public sector AI adoption is a critical step toward enhancing government efficiency, transparency, accountability and service delivery to the public. While several ministries have begun exploring AI applications, these initiatives remain fragmented, with limited scale without measurable impact. The absence of coordinated data governance, local datasets, and clear implementation frameworks further exacerbate and impede the progress. By strategically embracing AI, the Government can modernize administrative processes, optimize resource allocation, and better address national priorities in prioritized sectors including manufacturing, agriculture, healthcare, education, and social protection. Looking ahead to 2030, Cambodia could aim to deliver AI-driven public services that are seamless, efficient, and accessible to all citizens (particularly the marginalized groups). Transparent governance structures must ensure ethical and culturally acceptable utilization. Achieving this vision requires the establishment of an AI governance task force to streamline governance, the integration of AI into existing e-government and digital ID systems, and the deployment of flagship AI pilot projects to build institutional capacity and public trust. The establishment of clear procurement guidelines, strong privacy protection, and effective monitoring and evaluation framework of AI initiatives will be pivotal for widespread AI adoption and application.

The scarcity of high-quality, digitized Khmer language data is the greatest technical barrier to developing a truly inclusive and relevant AI ecosystem in Cambodia. Such a challenge is too large for any single entity to solve and could be elevated to a national mission.[133] As such, a national AI task force could launch and secure dedicated funding for a multi-year, multi-pronged initiative to create a comprehensive, high-quality corpus for training and validating Khmer language models.

Recommendation: Develop and implement a roadmap for responsible AI adoption in the public sector, coordinated by the Digital Government Committee (DGC).

- **Prioritize high-impact use cases:** The roadmap could prioritize AI applications in areas of high public value, such as public health diagnostics, agricultural extension services, and educational support tools. The AI-enabled R&D management system should be considered a flagship pilot project for this roadmap.

- **Utilize pilot projects and sandboxes:** Implement pilot projects for public sector AI applications within

[132] UK AI Standards Hub. (n.d.). The AI Standards Hub. Available at https://aistandardshub.org/the-ai-standards-hub/ (accessed on 11 October 2025).

[133] Allen Institute for AI. (2024). *The FineWeb-Edu Dataset*. Available at https://huggingface.co/datasets/HuggingFaceFW/fineweb-edu (accessed on 11 October 2025). The FineWeb dataset, a large public web corpus, contains over 13 trillion tokens, but analysis shows a very small fraction, estimated at ~2GB, is Khmer language content.

the proposed regulatory sandbox to test for efficacy, fairness, and security before large-scale deployment.

- **Build civil servant capacity:** Provide targeted capacity-building programmes for civil servants on AI fundamentals, ethical deployment, and the use of data for evidence-based policymaking.

- **Develop procurement policies for AI digital services:** Enable startups and digital SMEs to provide services directly to the government, while ensuring ethical guidelines and trust mechanisms are respected.

- **Prioritize and fund the digitization of the national archives:** This remains the most critical first step. A dedicated, well-funded project using advanced Optical Character Recognition (OCR) and human-in-the-loop validation is the fastest way to create a high-quality, foundational Khmer corpus that reflects the nation's history and formal language.

- **Execute a parallel data augmentation strategy:** Recognizing that formal text alone is insufficient, the mission could pursue three parallel tracks to build a rich and diverse dataset: (i) Machine translation: Invest in building a state-of-the-art, high-quality Khmer translation engine. This will unlock the ability to translate vast global datasets into Khmer, rapidly increasing the volume of available training data; (ii) Synthetic data generation: Carefully explore the use of advanced LLMs to generate synthetic Khmer text. This process must include a critical, non-negotiable step of curation by native-speaking experts to ensure quality, cultural nuance, and to prevent the propagation of biases; and (iii) Colloquial data sourcing: Launch national initiatives to ethically scrape and transcribe informal Khmer from social media, public forums, and spoken sources. This is essential for building models that can understand and serve the real-world communication needs of the Cambodian public.

5.6. Establish Ethical Principles to Guide AI R&I and Promote Responsible Practices

As established in Chapter 4, there is strong stakeholder interest in grounding AI development in ethical principles that reflect both international standards and local values. However, without a formal framework, ethical considerations risk becoming an afterthought.

Recommendation: Formulate and adopt a national AI ethics framework or code of conduct to serve as the moral compass for the national vision.

- **Integrate global standards and local values:** The framework must be built through multistakeholder consultation and integrate the core principles of established international guidelines (e.g. UNESCO Recommendation, ASEAN Guide on AI Governance) with the culturally resonant values of compassion, non-harm, and fairness derived from Cambodia's Buddhist heritage.

- **Promote "ethics-by-design":** The framework should mandate and provide guidance for "ethics-by-design" methodologies, requiring that ethical considerations be integrated from the very beginning of the AI project lifecycle, not just as a final compliance check.

- **Require ethical impact assessments:** For AI projects deemed high-risk or with significant societal implications (e.g. public sector applications in law enforcement, social benefits, or critical infrastructure), the framework should require the completion of an ethical impact assessment before deployment.

- **Foster public literacy on AI ethics:** The framework must be supported by public awareness campaigns that educate citizens not only on the benefits of AI but also on its risks, their digital rights, and the ethical principles governing its use in Cambodia.

5.7. Promote AI Awareness and Literacy for Responsible Application

The effective and ethical adoption of AI across society is impossible without a digitally literate populace. As consultations revealed, there is a significant gap between the rapid, informal adoption of AI tools and the critical understanding required to use them safely and productively.

Recommendation: Launch a national AI awareness and literacy campaign based on evidence of local usage patterns and concerns.

- **Target real-world needs:** The campaign's design should be informed by the findings of local initiatives, which show that users are already active but need guidance on effective use and accuracy verification.
- **Focus on practical skills:** The campaign should go beyond abstract concepts to teach practical skills like prompt engineering, critical evaluation of AI-generated content, and digital safety protocols.
- **Tailor content for key groups:** Develop specific modules for students, teachers, civil servants, and SME owners, addressing their unique motivations and concerns. For example, teacher training should focus on how AI can solve immediate classroom challenges like resource creation and administrative workload.

5.8. Foster Strategic International Collaboration

Engaging in ASEAN and global AI initiatives is critical for Cambodia to accelerate its AI adoption and development through investment, technology transfer, knowledge and skillset exchange, and strategic partnerships. Active participation in regional cooperation such as ASEAN Committee on Science, Technology and Innovation and international cooperation could provide opportunities to build capacity, attract investment, and integrate Cambodia into the regional digital economy. At present, international dialogues are limited with few MoUs, limited funding, and challenges such as language and cultural barriers and geopolitical tensions, all of which impede comprehensive partnerships. By 2030, Cambodia could aspire to more strategic and purpose-oriented partnerships, focusing not only on knowledge exchange but also in joint project initiatives, co-funded R&D, and talent mobility schemes that strengthen domestic expertise. Additionally, establishing fellowships and visiting expert programmes will address talent shortages while presenting the regional and global partners opportunities in Cambodia's emerging AI market. These efforts will position Cambodia as an active contributor to the regional AI ecosystem while maintaining autonomy and reflecting its cultural values.

Recommendation: Develop a strategic international collaboration plan for AI to systematically leverage global expertise and resources.

- **Align partnerships with national priorities:** Ensure that all international collaborations are explicitly aligned with the NRA 2025 missions and address identified capacity gaps in data, talent, and infrastructure.
- **Leverage ASEAN frameworks:** Actively participate in and leverage ASEAN initiatives, including the implementation of the AI Guide, negotiations for the Digital Economy Framework Agreement, and collaborative R&D projects like the SEA-LION LLM initiative.
- **Cultivate purpose-driven talent:** Seek partnerships with organizations like data.org to cultivate the "new kind of data and AI talent" that combines technical skills with domain expertise and a focus on social impact.

5.9. Drive Inclusive Innovation for Shared Prosperity

To ensure that AI does not widen existing societal divides, its development and deployment must be guided by a deliberate and proactive commitment to inclusivity.

Recommendation: Embed inclusivity and frugal innovation principles throughout the national AI strategy.

- **Design for the margins:** Prioritize and incentivize the development of AI solutions that address the specific needs of women, rural populations, persons with disabilities, and SMEs in traditional sectors.
- **Promote frugal innovation:** encourage the creation of low-cost, accessible AI tools suitable for Cambodia's resource-constrained environments, such as those with Khmer language interfaces, offline capabilities, and mobile-first designs.
- **Empower community co-design:** Establish mechanisms (e.g. through NICC or KE) to support participatory approaches where end-user communities co-design AI solutions relevant to their own contexts, such as tools for local agricultural challenges or community health monitoring.

5.10. Champion Open and Verifiable AI to Build Trust and Preserve Culture

The ultimate success of Cambodia's AI journey hinges on trust. This trust must be earned through transparency, verifiable evidence, and a demonstrated commitment to serving the national interest. In a world of opaque algorithms, championing openness is a strategic choice that can become a national competitive advantage.

Recommendation: The national AI strategy could champion open and verifiable AI as a core principle to build confidence and ensure technology serves national interests.

- **Promote open-source models:** Actively support the development and adoption of open-source AI models, particularly for Khmer language, following the example of the SEA-LION initiative. This fosters transparency, allows for local adaptation, and reduces dependency on proprietary "black box" systems.
- **Link metrology to verification:** Use the national AI metrology capabilities to independently audit and verify the performance, fairness, and safety of AI systems deployed in the country, especially in the public sector.
- **Establish a "Trustworthy AI Certification" Program:** This "Trustmark" could be made mandatory for high-risk AI systems used in the public sector. Certification would involve rigorous, independent testing against national benchmarks for accuracy, robustness, fairness, and bias, providing a verifiable guarantee of quality and safety.
- **Take ownership to preserve culture:** The most effective way to counter fears of AI eroding local culture is for Cambodians to take ownership of building their own AI. By combining this with a commitment to open, auditable models and rigorous measurement, Cambodia can build a brand of AI that is not only culturally relevant but also verifiably trustworthy, fostering both local pride and international confidence.

ANNEX

1

ENGAGED STAKEHOLDERS

The following list includes organizations whose representatives were engaged in the COPAI process, either by participating in at least one Hub session, serving as volunteers, speakers or expert contributors, or being interviewed individually as part of this study's research methodology. Engagements were recorded through Hub attendance, speaker rosters, interview schedules and direct contributions to COPAI activities.

NATIONAL PARTICIPANTS

Government Ministries, Agencies and State Bodies

- Economic, Social and Cultural Council
- Ministry of Agriculture, Forestry and Fisheries
- Ministry of Commerce
- Ministry of Cults and Religion
- Ministry of Industry, Science, Technology & Innovation
- Ministry of Interior
- Ministry of Labour and Vocational Training
- Ministry of Mines and Energy
- Ministry of National Defence
- Ministry of Planning
- Ministry of Post and Telecommunications
- Ministry of Public Works and Transport
- Ministry of Social Affairs, Veterans and Youth Rehabilitation
- Ministry of Tourism
- Office of the Council of Ministers
- Techo Startup Center

Cambodian Universities and Education Institutions

- ACLEDA University of Business
- Cambodia Academy of Digital Technology
- Cambodia University of Technology and Science
- Institute of Technology of Cambodia
- National University of Management
- Paragon International University
- Royal University of Agriculture
- Royal University of Phnom Penh
- TUX Global Institute
- University of Puthisastra
- University of South-East Asia (Siem Reap)

Cambodian Business, Startups and Civil Society

- AI Farm Co., Ltd.
- AI Forum

- Brighton Academy (Cambodia)
- Codingate Technology
- Impact Hub Phnom Penh
- IT Academy STEP Institute
- Platform Impact
- Sisters of Code
- Smart Axiata
- Telcotech (Cambodia)
- Young Entrepreneurs Association of Cambodia

INTERNATIONAL PARTICIPANTS

Foreign Government Bodies and International Organizations

- AI Singapore
- National Physical Lab, United Kingdom
- Ministry of Education and Sports, Lao PDR
- Office of National Higher Education, Science, Research and Innovation Policy Council, Thailand
- Thailand Science Research and Innovation
- United Nations Children's Fund (UNICEF), Office of Innovation
- United Nations Economic and Social Commission for Asia and the Pacific
- UN Women

International Universities and Academic Institutions

- China University of Geosciences
- Erasmus University Rotterdam
- National University of Laos
- Sungkyunkwan University, Republic of Korea
- University College London, United Kingdom
- University of Melbourne, Australia

International NGOs, Initiatives and Private Sector

- Bodhinyana Monastery, Australia
- CivicDataLab, India
- Data.org
- Kasikorn Business Technology Group, Thailand
- SEACrowd
- Young Entrepreneur Assembly Hub Association, Thailand