TECH FOR GOOD INSTITUTE

Abridged Report

Advancing Digital Sustainability in Southeast Asia

May 2025

Research Partner

CIIP Centre for Impact Investing and Practices

Data Partner

IPOS INTERNATIONAL

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Acknowledgements

We appreciate the contributions of **84 capital providers, companies, intermediaries, and philanthropic and nonprofit organisations** that participated in our survey and interviews, providing valuable insights into the role of digital innovation in advancing the Sustainable Development Goals (SDGs) in Southeast Asia (SEA).* We also acknowledge additional contributions from organisations who shared case study inputs, which further enriched the findings and practical illustrations featured in this report. Their inputs have been instrumental in shaping this report, including actionable recommendations for policymakers, funders, and innovators across the region.

Funders and Capital Providers		Philanthropic and Nonprofit Organisations	Companies and Intermediaries
• 500 Global • ABC Impact • ADB Ventures • ADM Capital • AC Ventures • Antares Ventures • B Current Impact Investment • British International Investment (BII) • Bintang Capital Partners • Circle Capital • Circulate Capital • Do Ventures • Daya Selaras Group • Earth Venture Capital • Elevar Equity • Envisioning Partners • Eurazeo • Fuping Social Venture • Garden Impact Fund VCC • GenZero • Golden Gate Ventures • Happiness Capital • Helicap • Incofin Investment Management • Insitor Partners • Integra Partners • Invesco Limited • LeapFrog Investments • JG Digital Equity Ventures	• Lendable • MYSC • Mirova • Mistletoe • NH Absolute Return Partners • NIO Capital • Openspace • Proparco • Quantedge Advancement Initiative Ltd • Quona Capital • Save the Children Global Ventures • SIIF Impact Capital, Inc. • SOSV • Sweef Capital • The Rise Funds, TPG • Temasek • Toll Group • Touchstone Partners • Tsao Family Office • Unreasonable Group • UntroD Capital Asia Pte Ltd • UOB Venture Management • Wavemaker Impact • Vertex Ventures SEA & India	• Artificial Intelligence Institute for Progress (AIIP) • Cartier Women's Initiative • Ishk Tolaram Foundation • Mastercard Center for Inclusive Growth • Quantedge Foundation • Temasek Foundation • The Rockefeller Foundation • Hyundai Motor Chung Mong-Koo Foundation	• BillEase • d.camp • Dashlabs.ai • Doctor Anywhere • EPIC World Private Limited • Grab • HELIX • MiyaHealth • Rize • RSPO • Singtel

*Some organisations have requested to remain anonymous.

Furthermore, we would like to acknowledge the United Nations Development Programme (UNDP), particularly the Private Finance for the SDGs team, for their analysis of the digital potential of SDG Investor Maps in Southeast Asia. We also extend our gratitude to the UNDP local country offices for their valuable insights into the philanthropy and impact of the regulatory landscape in Southeast Asian markets.

This study was conducted in collaboration with the Centre for Impact Investing and Practices (CIIP), our research partner who co-led the survey and interviews with funders and solution providers and contributed valuable insights on financing innovation and impact capital, along with IPOS International, who provided specialised patent analytics and data insights. Special thanks are due to Citra Nasruddin, Dawn Chan, Hiu Chii Fen, Huang Jin Quan, Jonathan Chan, Ludwinardo Putra, Ming Tan, Muhammad Lutfi, Peh Zhen Yu, Seah Hui San and Talitha Amalia.

Last but not least, this study was also made possible by TFGI's founding donor, Grab. We are grateful to Grab for supporting TFGI's mission of leveraging the promise of technology and the digital economy for inclusive, equitable and sustainable growth in SEA.

Funders do not determine research findings nor the insights and recommendations of research.

ATXSUMMIT

This is a special report supported by Infocomm Media Development Authority of Singapore for ATxSummit, a part of ATxSG.

About the Tech for Good Institute

The Tech for Good Institute is a non-profit organisation working to advance the promise of technology and the digital economy for inclusive, equitable and sustainable growth in Southeast Asia (SEA). With a population twice the size of the US and having strong demographics, SEA's digital economy is evolving rapidly. At the same time, the region's trajectory is unique, shaped by its diverse cultural, social, political and economic contexts. The Tech for Good Institute serves as a platform for research, conversations and collaborations focused on Southeast Asia, while staying connected to the rest of the world. Our work is centred on issues at the intersection of technology, society and the economy, and is intrinsically linked to the region's development. We seek to understand and inform policy with rigour, balance and perspective by using research, effective outreach and evidence-based recommendations.

The Institute was founded by Grab, to advance the vision of a thriving and innovative Southeast Asia for all. We welcome opportunities for partnership and support, financial or in-kind, from organisations and individuals committed to fostering responsible innovation and digital progress for sustainable growth in the region.

More information about the Institute can be accessed at www.techforgoodinstitute.org

About the Centre for Impact Investing and Practices

The Centre for Impact Investing and Practices (CIIP) was established in 2022 as a non-profit entity by Temasek Trust to foster impact investing and practices in Asia and beyond by building and sharing knowledge, bringing together stakeholders in the community, and bringing about positive action that accelerates the adoption of impact investing principles and practices. CIIP is the anchor partner for UNDP's Private Finance for SDGs, providing investors and businesses in Asia with clarity, insights and tools that support their contributions towards achieving SDGs. Temasek and ABC Impact are CIIP's strategic partners.

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Executive Summary

Seizing Southeast Asia's digital sustainability opportunity

Rapid digitalisation, an entrepreneurial surge and appetite for investment present the opportunity for Southeast Asia (SEA) to develop as a global living lab for **Digital Sustainability—where innovative digital solutions are designed, tested and scaled for Sustainable Development Goals (SDGs)**.

The United Nations estimates that **digital technologies could accelerate progress on over 70% of SDG targets**, offering scalable, cost-effective solutions to complex global challenges. The region's persistent development gaps create both an urgent challenge and a unique opportunity. Financial exclusion, agricultural inefficiency and healthcare accessibility gaps, for example, have constrained inclusive growth to date, but also demonstrate great potential for digital transformation. Currently, **225 million** adults in SEA remain outside formal financial systems, **100 million smallholder farmers** lack access to affordable finance and sustainable farming practices and physician density in major SEA economies is just **0.7–0.9 per 1,000 people compared to a global average of 1.7**.

This study by the Tech for Good Institute (TFGI), in partnership with the Centre for Impact Investing and Practices (CIIP) and IPOS International, draws on:

- A regional survey of **72 capital providers;**
- In-depth interviews with **28 funders and innovators;**
- Patent analytics across priority sectors, and;
- Sector-specific insights into digital sustainability

How digital technologies unlock sustainable growth

Digital solutions can accelerate sustainable outcomes through several value pathways, including:

- **Affordability and accessibility:** Lowering barriers to essential services through mobile-first, low-cost platforms;
- **Trust and transparency:** Building secure, accountable systems to foster user confidence in digital ecosystems,
- **Real-time insights:** Enabling timely, data-driven interventions across agriculture, healthcare, finance and more, and;
- **Mass customisation:** Tailoring services at scale through AI, IoT and advanced analytics to meet diverse community needs.

Digital sustainability is not achieved through technology alone but through the integration of **technology, business, policy and financing innovations**. While 94% of capital providers that were surveyed allocate part of their portfolio toward impact and 92% allocate specifically toward digital sustainability solutions, SEA attracts only 3% of global impact investing assets, despite rising investor interest. This gap between need, opportunity and capital deployment highlights the urgency for targeted interventions. In particular, 40% cite unclear return on investment and 39% cite regulatory uncertainty as major barriers to scaling investments.

Singapore's strategic role in enabling SEA's development as a regional living lab for digital sustainability

Singapore's advanced digital infrastructure, regulatory agility and active investment ecosystem can support SEA's living lab for scaling digital sustainability innovations within SEA and globally. Specifically, Singapore can act as a hub to:

- Work with partners across the region to **prototype** fit-for-purpose digital solutions in finance, agriculture and healthcare;
- **Lead** cross-border initiatives for regulatory harmonisation and trusted data flows, and;
- **Anchor** catalytic capital and regional co-investment platforms and **aggregate** reporting and data.

Catalysing collective action for scalable impact

Achieving regional scale and impact requires coordinated action across stakeholders:

Stakeholder	Priority Actions
Community groups	Facilitate grassroots engagement, strengthen digital literacy and trust, and ensure feedback mechanisms that localise and adapt solutions over time.
Innovators	Design right-sized, right-priced digital solutions that integrate human trust-building mechanisms and local market knowledge.
Capital providers	Allocate catalytic capital to high-impact sectors, support blended finance mechanisms and mainstream digital sustainability into investment theses.
Governments	Invest in interoperable digital public infrastructure, foster regional regulatory alignment, and incentivise innovation through sandboxes and blended finance mechanisms.
Regional bodies	Accelerate initiatives like the ASEAN Digital Economy Framework Agreement and cross-border sustainability standards to reduce regulatory fragmentation and enable regional scaling.

Such coordinated actions also contribute to building a safe, trusted and inclusive digital economy. Corresponding application of technology, business, policy and financing innovation can therefore contribute to a digital economy that reflects the development ambitions of the region and establish SEA as a leader for digital sustainability.

Note:

1. A detailed explanation of our research methodology is provided in **Appendix A**.
2. A full version of this study, containing detailed analysis, sector deep-dives and appendices, is available separately.

1. Southeast Asia: Momentum for Digital Sustainability

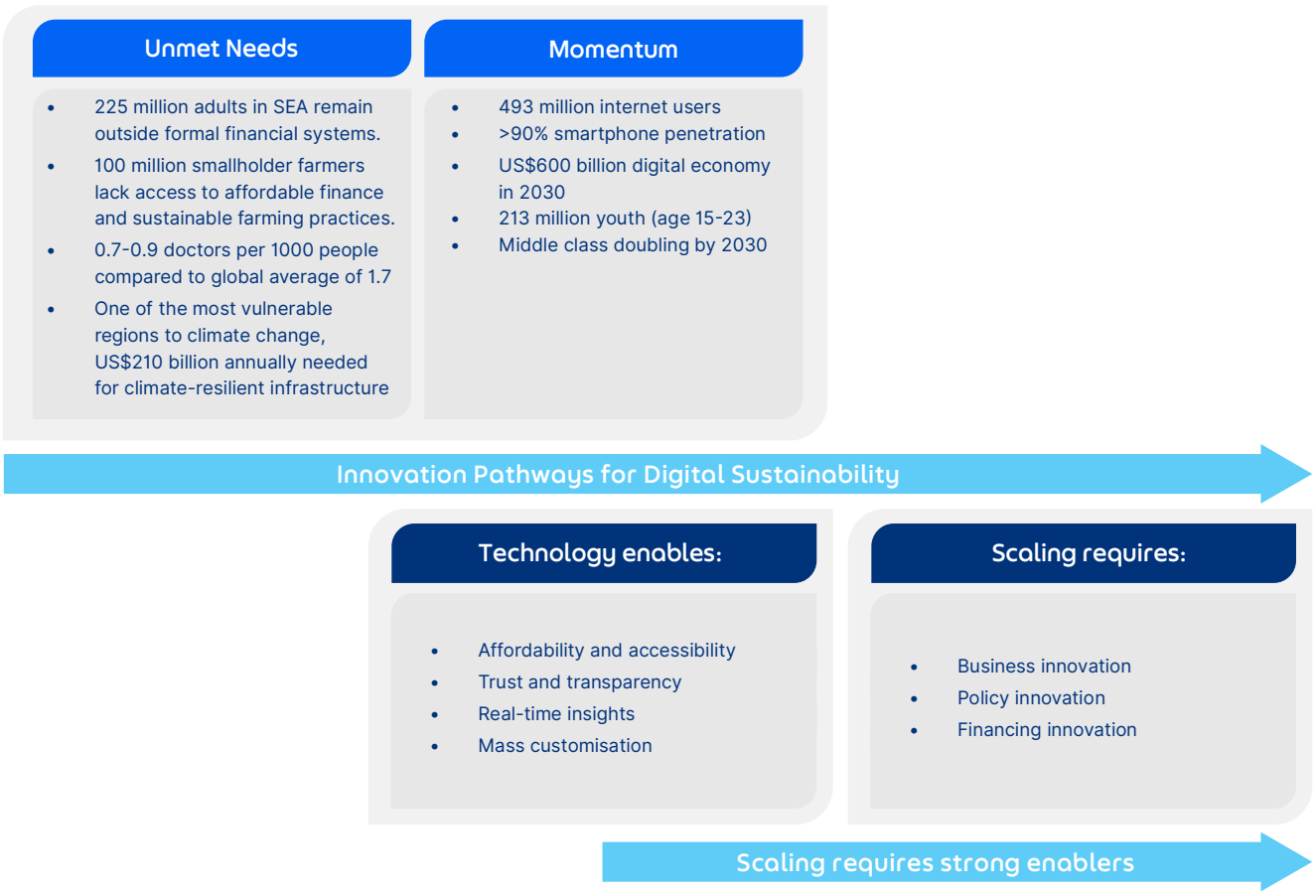
1.1 Southeast Asia's Digital Momentum

Southeast Asia (SEA) is undergoing a rapid digital transformation. Between 2019 and 2022, nearly 100 million new internet users came online, bringing the total to over 493 million.[1] The region's digital economy is projected to reach US$600 billion by 2030, powered by e-commerce, digital financial services, transport, travel and online media.[2]

Demographic and economic shifts underpin this momentum. SEA is home to 213 million youth aged 15–35 and its middle class is set to more than double from 200 million in 2020 to 472 million by 2030.[3] Smartphone penetration is projected to reach over 90% by 2026, surpassing rates in developed markets, which creates strong demand for digital solutions.[4]

> **Digital Sustainability** extends beyond making digital systems more efficient or environmentally friendly—it is about harnessing technology to advance inclusive and sustainable development.

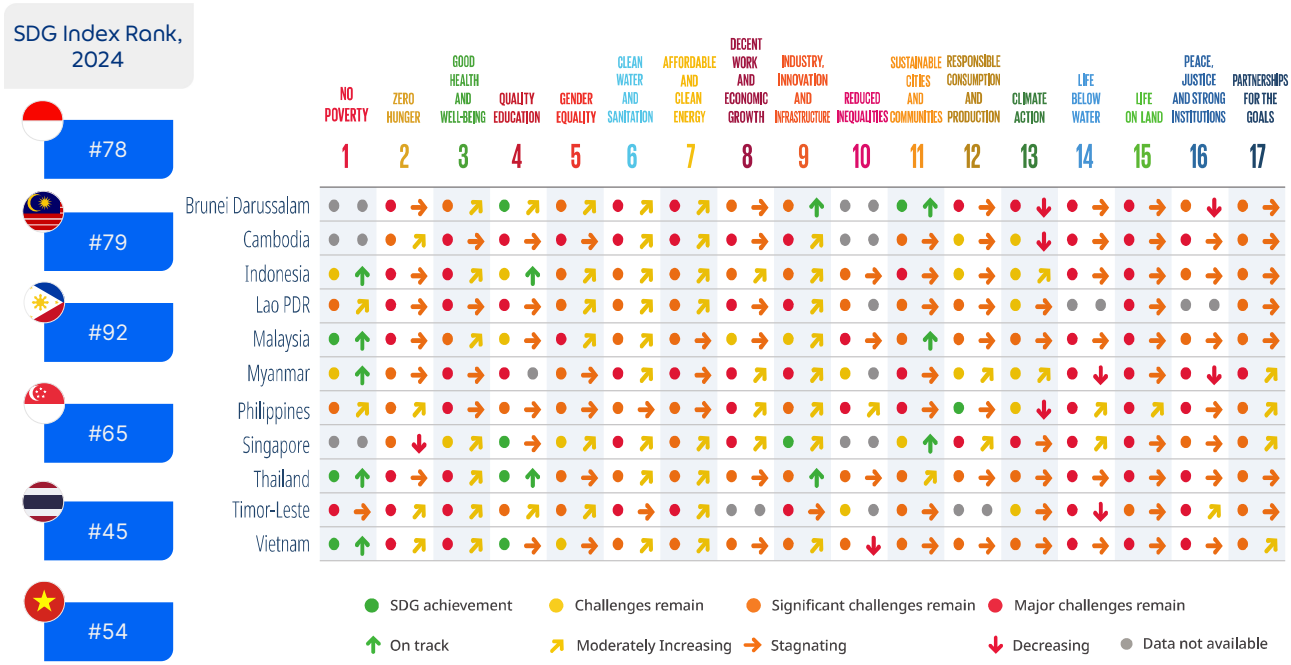
Figure 1: Overview of SEA's Digital Sustainability Opportunity



Source: Tech for Good Institute analysis for this report, 2025

Despite SEA's remarkable digital momentum, exclusion remains deeply entrenched across key sectors, threatening progress towards the region's sustainable development goals (SDGs). According to the 2024 SDG Index, Thailand ranks highest in the region at 45th globally, while other countries continue to struggle with deep-rooted challenges such as poverty, inequality and infrastructure deficits (Figure 2). Over 225 million adults remain excluded from formal financial systems and more than 350 million lack access to credit, underscoring the potential for digital financial inclusion.[5] In agriculture, more than 100 million smallholder farmers are in need of greater financial and sustainable business practices, and other forms of support and empowerment, perpetuating cycles of rural poverty and vulnerability to climate shocks.[6] Meanwhile, healthcare access gaps widen. Physician density is just 0.7 to 0.9 per 1,000 people in major markets like Indonesia, the Philippines, Thailand and Vietnam—well below the global average of 1.7.[7] These sectoral challenges are compounded by systemic barriers. An estimated US$210 billion in annual infrastructure investment is required to build resilient transport, energy and digital systems, without which digital inclusion remains uneven.[8] At the same time, capital remains disproportionately concentrated elsewhere–only 3% of global impact investment assets currently reach SEA, constraining the scale-up of digital sustainability solutions that could drive regional transformation.[9]

Figure 2: SEA's SDG Index Performance



Source: SDG Index Score Dashboard[12] and based on Sustainable Development Report (Figure 2.8) on 2024 SDG Dashboard by Region and Income Group (Levels and Trends). Analysis on SEA conducted by this study's research team.[10]

The United Nations highlights that digital solutions could accelerate progress on over 70% of SDG targets globally.[11] Global leaders increasingly recognise that digitalisation must be purposefully designed to drive inclusive, sustainable outcomes, not simply economic growth. The UN's proposed Global Digital Compact calls for responsible digital ecosystems that embed sustainability at their core.[12]

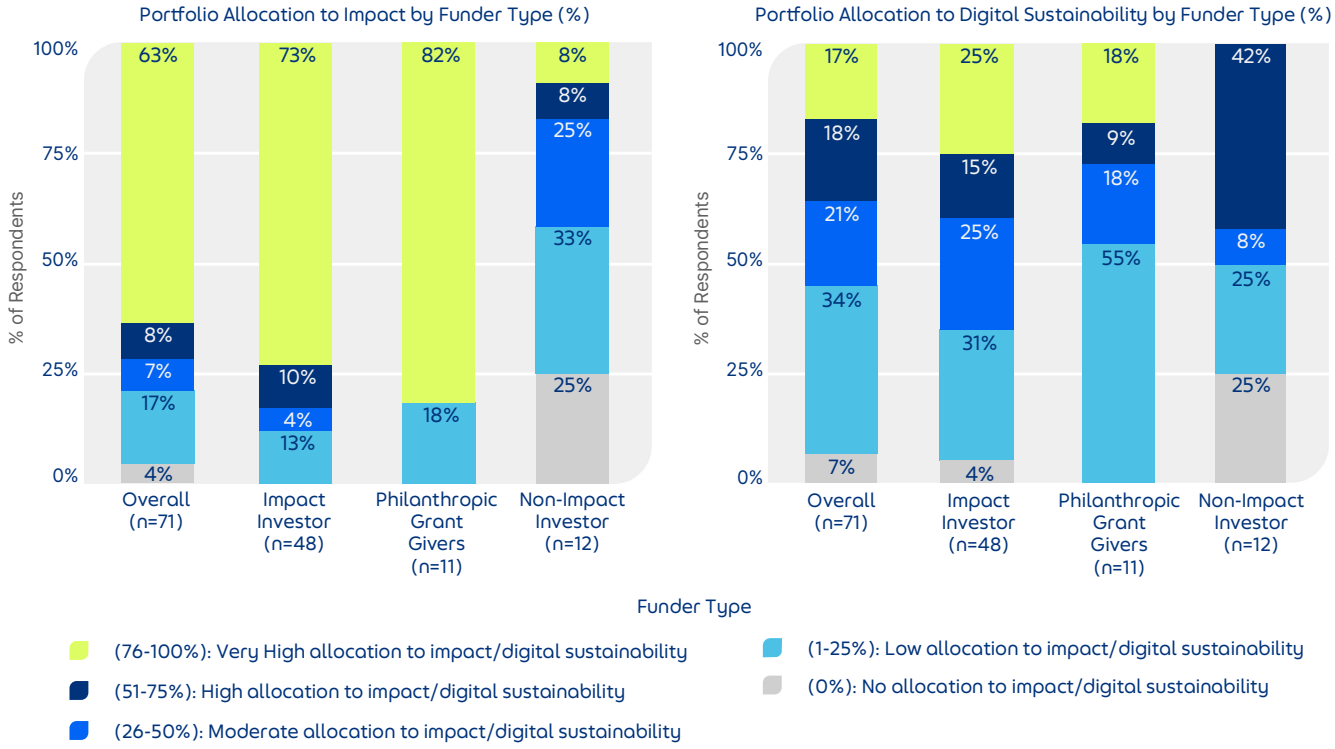
SEA's digital momentum can contribute to this global movement, but only if innovation is intentionally aligned to close critical development gaps and drive scalable, inclusive impact.

> "To truly accelerate Southeast Asia's transition towards a sustainable future, the strategic adoption and innovative application of digital tools are indispensable. These technologies offer unprecedented opportunities for enhanced monitoring, data-driven decision-making and the fostering of collaborative solutions across the region."
>
> **- Prof. Lawrence Loh, Centre for Governance and Sustainability, National University of Singapore**

1.2. Potential for Digital Sustainability

As part of this study, we surveyed 72 capital providers including impact investors, venture capital firms, development finance institutions, philanthropic funders and family offices across SEA.[13] Investor momentum is already shifting towards impact and digital sustainability. In this study, **94% and 92% of capital providers surveyed allocate some portion of their portfolio to impact and to digital sustainability, respectively, even those who do not identify as impact investors**. 71% of capital providers in our sample allocate more than half of their portfolio towards impact (Figure 3). This suggests that a significant share of investors is making impact a core part of their financial strategy—not just a niche or secondary priority.

Figure 3. Allocation to Impact and Digital Sustainability by Funder type (N=71)



Source: Survey conducted by TFGI and CIIP, 2025 with one respondent choosing to exclude the question

2. Enabling Innovation for Digital Sustainability in SEA

2.1. Technology Innovation

> "Science is what we need to help us deal with complex problems like climate change, but digitalisation is critical to create direct value to customers and expand impact across Emerging Asia."
>
> **- Tien Nguyen, Founding Partner, Earth Venture Capital**

The appetite for digital solutions in SEA is strong and growing. Investors surveyed identified four ways in which digital technologies have enabled innovation and growth, which are highly applicable to realising digital sustainability:

- **Affordability and Accessibility:** Digital technologies fundamentally restructure cost models for service delivery by removing costly intermediaries from value chains and eliminating physical infrastructure requirements for end-users to reduce barriers to essential services. For instance, mobile banking and digital wallets have dramatically reduced the cost of delivering financial services by reducing minimum transaction sizes, eliminating branch requirements and offering simplified user experiences. Telemedicine platforms mentioned in our interviews such as Doctor Anywhere and Halodoc have restructured healthcare delivery, enabling consultations at lower cost than traditional visits while extending reach to underserved areas. In Indonesia, Halodoc has connected over 20,000 doctors with millions of patients in remote areas, providing consultations at a lower cost than traditional care while maintaining quality standards.[14]

- **Trust and Transparency:** Implementing immutable record systems enhances security and reliability in sensitive transactions. Blockchain technologies, in particular, have strengthened transaction security and enabled novel approaches to microfinance that were previously impractical due to trust deficits and high verification costs.

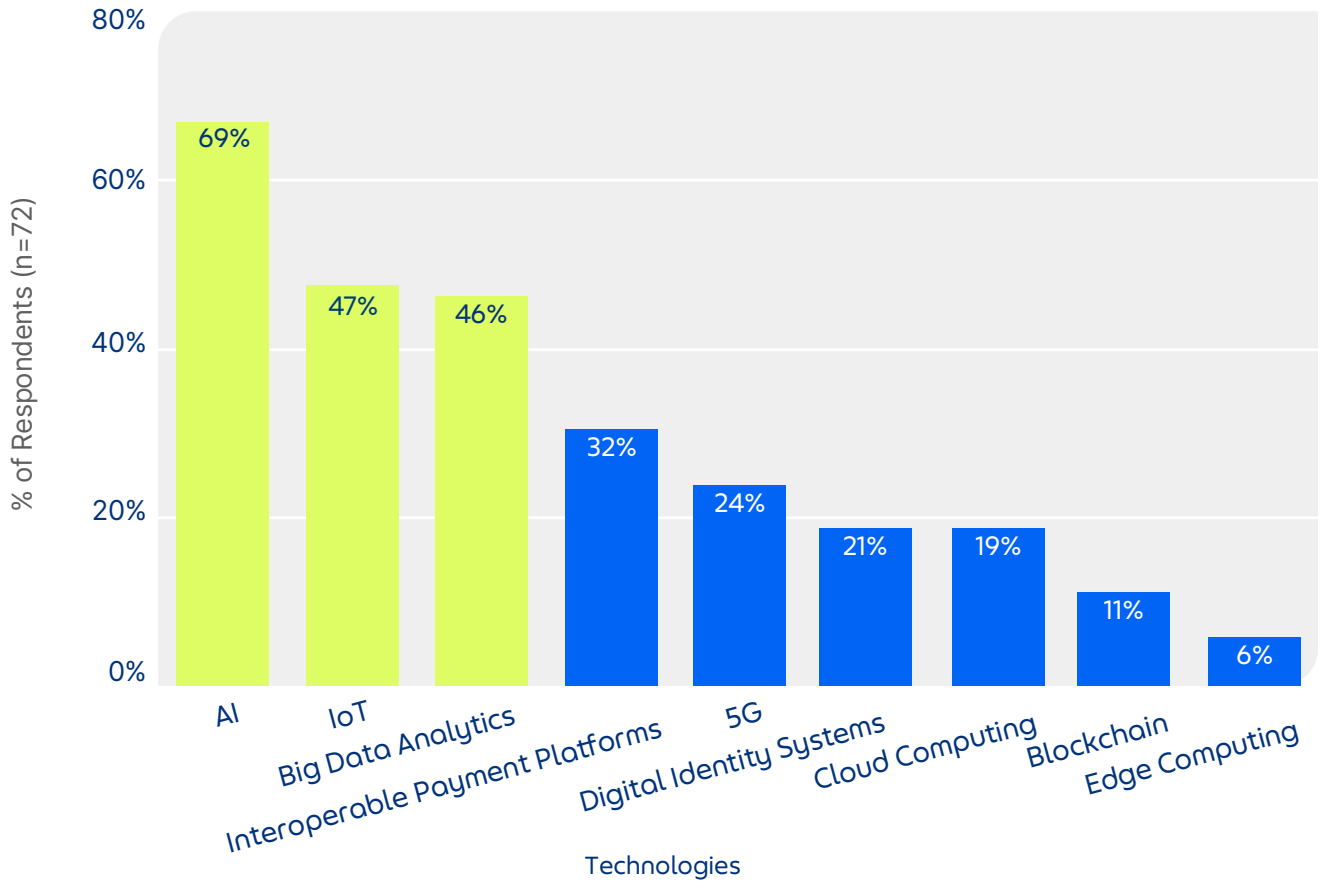
- **Real-time Insights:** Transitioning from retrospective to real-time data analysis has enabled data-driven decision-making for more efficient resource allocation. This represents a paradigm shift in domains such as agriculture, where predictive agronomy and climate analytics now optimise farming decisions, and in supply chains, where blockchain ensures unprecedented levels of traceability.

- **Mass Customisation:** Perhaps most significantly, these technologies enable service tailoring to meet individual needs at scale, a capability previously impossible without prohibitive cost structures. Mass customisation through digital technologies have been employed to achieve contradictory goals of scale and personalisation, creating solutions appropriate for SEA's heterogeneous markets.

> "Technology is playing a transformative role in expanding access to insurance for low- and middle-income consumers. Companies like bolttech and PasarPolis are not only reducing operational costs through automation but also using AI to better predict and manage risk. This allows them to price policies more accurately, making insurance more affordable and driving both scale and social impact."
>
> **- Fernanda Lima, Partner, LeapFrog Investments**

Building on these value pathways, capital providers are already signalling which technologies they believe will be most instrumental in enabling them: artificial intelligence (AI), Internet of Things (IoT) and Big Data Analytics (**Figure 4**).

Figure 4: Capital Providers' Perspectives on Technologies with the Highest Digital Sustainability Potential



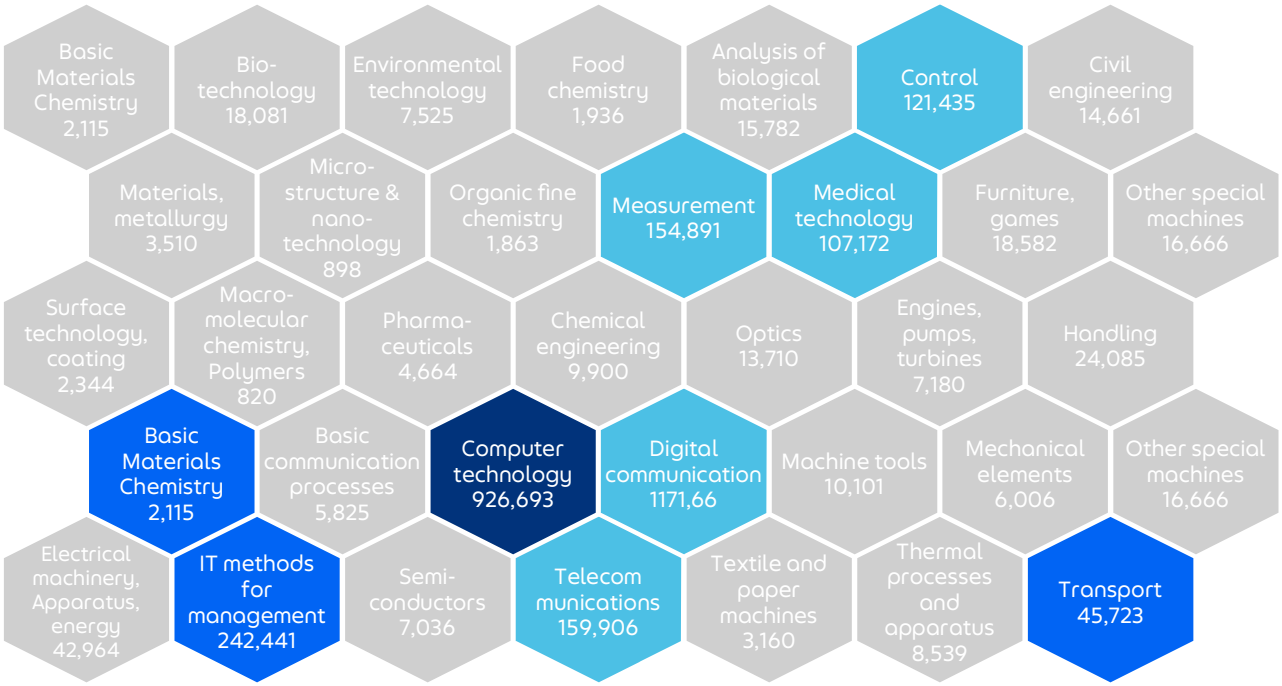
Source: Enabling technologies with greatest potential to accelerate sustainability, according to survey respondents (N=72). Survey respondents were asked to select the top three enabling technologies with greatest potential.

As a general enabling technology, AI was selected by 69% of respondents, particularly for its abilities to support mass customisation and trust-building systems through advanced decision models and risk profiling were highlighted by capital providers as promising. IoT (47%) was seen as critical for expanding real-time insights, particularly in agriculture, energy and logistics. Big Data Analytics (46%) enables more responsive and precise interventions—especially in financial inclusion, food and agriculture and healthcare sectors. These technologies do not operate in isolation; together, they form the digital backbone for delivering real-time, data-driven and personalised solutions.

2.1.1. Artificial intelligence and data analytics

Rather than representing a single technology, AI encompasses a diverse ecosystem of technologies, tools and techniques that are increasingly integrated across digital applications. This integration enhances automation, enables real-time data processing and transforms decision-making across industries. AI's general enabling capabilities are evident from patent data, with AI innovation in all tech domains. Thus, the cross-sector applicability of AI technologies means that its impact on digital sustainability will be both broad and deep, potentially transforming even traditionally low-tech sectors (**Figure 5**).

Figure 5: Patent Activity of AI Across Technology Domains Between 2015-2024



Source: Patent data was retrieved from the Questel FAMPAT database and analysed by IPOS International for this project. **The colour intensity reflects the level of innovation activity within each technology domain.** The number in each domain represents total inventions published from 2015 to 2024. The technology domains are defined based on the World Intellectual Property Organization's (WIPO) IPC-Technology Concordance.[15]

AI applications hold much potential for digital sustainability across many fields, such as:

- **Machine learning for resource optimisation:** Algorithmic approaches to reducing waste in agriculture, energy and manufacturing to directly address environmental sustainability challenges.
- **Natural Language Processing (NLP) for inclusive services:** These technologies address accessibility challenges in linguistically diverse regions by breaking language barriers in education, healthcare and financial services.
- **Computer vision for environmental monitoring:** Automated tracking of deforestation, pollution and climate impacts creates unprecedented capabilities for environmental protection and climate action.

2.1.2. Internet of Things (IoT) and Big Data Analytics

IoT technologies were identified by 47% of capital providers surveyed for this report as potentially transformative for digital sustainability, especially in traditionally resource-intensive sectors. The combination of IoT sensors, cloud computing, Big Data Analytics and machine learning can translate information into actionable insights that support sustainable decision-making by individuals, businesses and communities. This supports adaptive services across multiple sustainability dimensions including:

- **Smart Agriculture:** Quantitative assessment of precision farming systems demonstrates multiple efficiency gains such as water usage reduction by up to 20%, fertiliser application reduction by 7% and yield improvements by 4%.[16] These figures represent significant resource efficiency improvements in a sector that traditionally struggles with sustainability metrics. Companies like Cropin, which is expanding across SEA, provide farmers with customised recommendations based on real-time soil, weather and crop data, and optimising resource use while increasing yields and resilience.

- **Healthcare Monitoring:** Remote patient monitoring systems generate dual benefits of expanded healthcare access while simultaneously reducing delivery costs—a combination that addresses both social and economic dimensions of sustainability.

- **Predictive Healthcare:** AI-powered predictive analytics from companies like Holmusk are enabling earlier interventions and personalised treatment plans for chronic diseases and mental health conditions, which are particularly valuable in underserved areas with limited specialist access.

- **Energy Management:** Smart grids and building management systems optimise energy usage by enabling dynamic response to demand fluctuations, addressing a critical environmental sustainability challenge.

Integrating IoT with cloud computing and edge analytics is particularly noteworthy, as it creates a technological synergy especially suited for resource-constrained environments. This integration enables sophisticated data collection and analysis in areas with limited connectivity, a crucial capability for extending digital sustainability benefits to underserved regions.

2.2. Business Innovation

> "If technology solutions are implemented, they need to be right-sized and right-priced."
>
> **- Wingee Sin, Global Programme Director, Cartier Women's Initiative**

While technology innovation has significant potential for digital sustainability within SEA, business innovation is essential for developing and deploying products and services that meet the needs of underserved populations.

2.2.1. Market knowledge for solution development and deployment

Sustainable innovation starts with identifying the right problems to solve, then fostering adoption through context-appropriate business models. Innovators embedded within local markets are uniquely positioned to execute this critical function—identifying needs, developing context-sensitive products and ensuring adoption through such appropriate business models.[17]

Our interviews with solution providers consistently revealed that business innovation plays a critical role in overcoming on-the-ground challenges that inhibit technology adoption and impact delivery. New products, modes of service delivery or a variety in pricing models help make technology accessible to low-resource and underserved populations. Digital solutions that have gained traction in SEA are not necessarily the most advanced, but rather those that are most effectively adapted to local contexts. Factors such as infrastructure limitations, diverse user capabilities and cultural contexts, can be regarded as design parameters, rather than constraints:

1. **Infrastructure limitations** create non-ideal conditions, such as intermittent internet connectivity, power outages and basic device incompatibilities. Resilient solutions in low-resource settings include offline-first design, local agents or decentralised service hubs to maintain continuity.

2. **Diverse user capabilities, access and confidence** form persistent barriers to uptake. Varying levels of digital literacy and a lack of access to affordable devices and data are further compounded by language diversity, and generational and gender-based access gaps. Their market knowledge is particularly valuable given SEA's extraordinary diversity: 655 million people comprising over 100 ethnic groups who speak more than 1,000 languages and dialects, with economic fragmentation across at least 71 million micro, small and medium-sized enterprises (MSMEs).[18] This heterogeneity demands business models that can adapt to vastly different contexts while maintaining economic viability.

3. **Cultural preferences and trust norms** significantly shape adoption patterns. In many contexts, interpersonal trust remains more influential than institutional trust. Local communication styles, community validation and face-to-face engagement, such as through agent networks or local champions, have demonstrated the ability to drive adoption.

As with technology, business, product and service innovations do not exist in siloes but holistically reinforce one another. For example, online-offline solutions, tiered service models and trust-building mechanisms have demonstrated, and will likely continue, to be particularly effective in SEA:

1. **Online-offline solutions:** Combining digital tools with in-person engagement is often needed to reach underserved markets beyond urban centers, and is especially critical to build trust and drive inclusive adoption. For example, fintech companies like GCash, OVO and MoMo serve previously unbanked populations through agent networks to build confidence and trust. Interview insights from this study highlight that digital technologies are most effective when complemented with traditional and physical methods. In soil carbon measurement, for instance, satellite technology can continuously track changes, but a physical "true-up" sample is still essential during carbon credit issuance to validate digital data.

2. **Tiered service models:** Tiered service models address various affordability levels and digital capabilities, with basic services for users with feature phones, intermittent connectivity and minimal digital literacy, standard services for smartphone users with moderate connectivity and digital skills, and premium services with advanced functionality for digitally-proficient users with reliable connectivity. In this way, companies can broaden their market reach, ensuring that each customer segment receives a level of service that aligns with their needs and capabilities, while designing for user satisfaction.

3. **Trust-building mechanisms** can demystify digital services and create progressive engagement strategies to foster consumer confidence. The former uses clear communication processes, such as with real-time mapping, pricing and data usage, while the latter begins with small, low-risk interactions before requiring significant commitments.

SEA’s population diversity demands continued experimentation with new customer journeys, service models and other business interventions to deliver impact.

2.3 Policy Innovation

> "Government support can play a vital role in ecosystem development—particularly by fostering an investment-friendly environment and facilitating collaboration among key stakeholders."
>
> **- Pang (Thitirat) Sittakaradej, from ADB Ventures**

Across the region, governments are increasingly embedding sustainability and digital transformation into national strategies. As shown in **Table 1,** Indonesia, Thailand and Vietnam have explicit SDG roadmaps or action plans, while Malaysia, the Philippines and Singapore have national development plans that align with SDG goals without necessarily being explicitly SDG-labeled. These frameworks are complemented by specific environmental strategies that address key sustainability challenges in each country.

Table 1: An Overview of Sustainability Policy Frameworks Across SEA-6

Country	Overall National Sustainability or SDG Roadmap	Environmental Strategy or Roadmap
Indonesia	• National Action Plan (RAN) for Sustainable Development Goals (2018) • Sub-national Action Plan for SDGs (RADs) (2018) • Roadmap of SDGs Indonesia (2019)	• Circular Economy Roadmap and National Action Plan Indonesia for 2025-2045 (2024)
Malaysia	• National SDG Roadmap • Shared Prosperity Vision 2030 (SPV 2030) (2019)	• Malaysia's Roadmap Towards Zero Single-Use Plastics 2018-2030 (2018)
The Philippines	• Ambisyon Natin 2040 (2016) • 10-Point Socio-economic Agenda (2016)	• Philippines' National Climate Change Action Plan (2011-2028) (2011)
Singapore	• Sustainable Singapore Blueprint (2015)	• Singapore Green Plan 2030 (2024)
Thailand	• 20 Year National Strategy Framework (2017-2036) (2016) • Thailand's SDGs Roadmap	• Thailand's Climate Change Master Plan (2015-2050) (2015)
Vietnam	• National Action Plan for the Implementation of the 2030 Agenda (2017) • Socio-economic development plan for 2021-2025 (2021)	• National Action Plan on Green Growth for 2021-2030 (2021)

Source: Compiled by Tech for Good Institute, 2025[19]

Policy intent, however, is not enough. **39% of capital providers who participated in this study cited regulatory uncertainty as a significant barrier to investing in digital sustainability**, only second after uncertain return on investment (**Figure 6**). Our interviewees further emphasised that fragmented regulatory approaches across SEA complicate efforts to scale innovations and mobilise cross-border capital.

Case Study 1

Singapore's Green Data Centre Roadmap: An example of sustainable digitalisation[20]

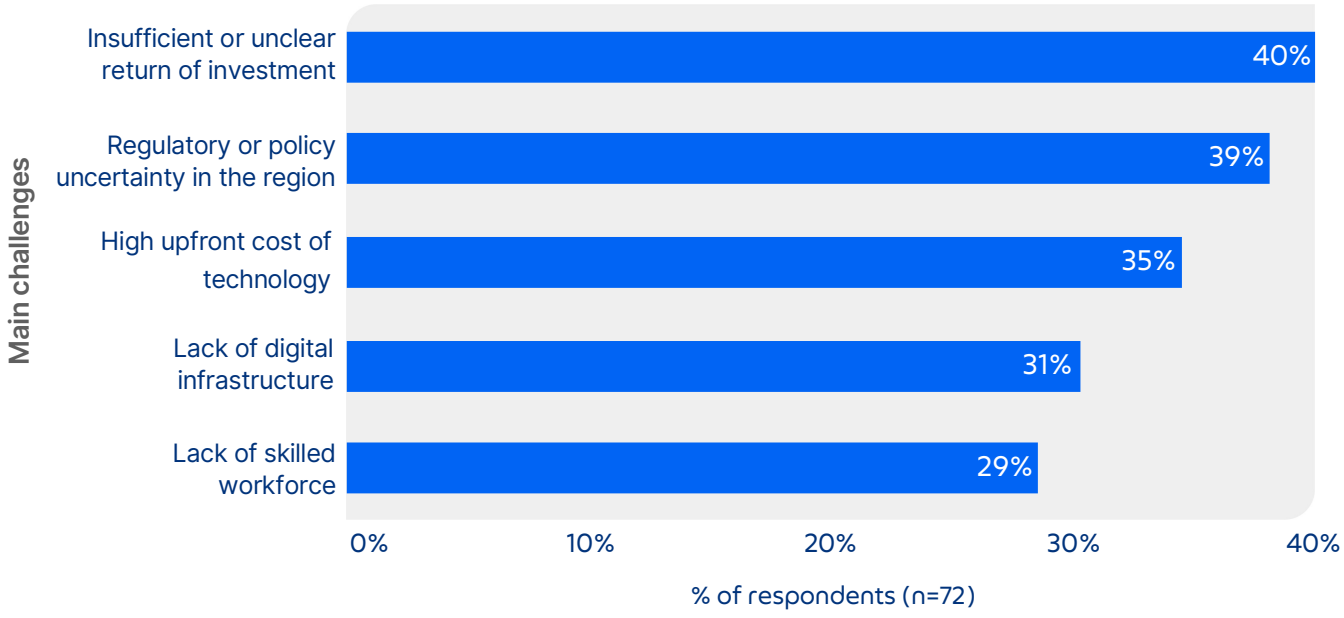
Singapore's Green Data Centre Roadmap is a comprehensive framework for sustainable data centre growth as the nation-state aims to add at least 300 megawatts of capacity through green energy deployments.

The roadmap prioritises accelerating facility-level energy efficiency enhancement through actions such as implementing advanced thermal management systems and intelligent energy optimisation algorithms, complemented by the use and operation of energy-efficient computer/IT equipment. It also simultaneously prioritises accelerating the use of low-carbon energy solutions.

The roadmap outlines the ways in which the public sector supports these priorities, including by introducing standards and certifications such as the refreshed Green Mark for Data Centres, driving research and development and anchoring best-in-class data centres.

Finally, the roadmap outlines ways to enhance water usage effectiveness, such as optimising cooling towers' water consumption. Through this framework, Singapore aims for its data centres to achieve Power Usage Effectiveness (PUE) of ≤1.3 and Water Usage Effectiveness (WUE) of 2.0 m^3/MWh or lower for all data centres within the next decade.

Figure 6. Challenges in Investing in Digital Sustainability Identified by Survey Respondents (N=72)



Source: Survey respondents were asked to select their top two challenges. Survey conducted by TFGI and CIIP, 2025.

Policy innovation can promote innovation while protecting public interest. These include adopting principles-based regulatory approaches, fostering multi-stakeholder collaboration, and tailoring national strategies to local contexts.

2.3.1. Principles before prescriptive regulations

Some countries are using principles-based approaches to guide rapid technology and business innovation, while leaving space for the market to develop and deploy products and services. In addition to soft-law mechanisms like guidelines and frameworks, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam (SEA-6) are using regulatory sandboxes to test emerging technology and technology-enabled business models in a controlled and time-bound manner before full market deployment.

These sandboxes serve multiple purposes in the regulatory ecosystem:

- **Real-world testing:** Allowing innovative solutions to be tested with actual users under controlled conditions;
- **Regulatory learning:** Enabling regulators to develop expertise in emerging technologies;
- **Facilitating collaboration** between research institutions and industry experts;[21]
- **Evidence-based policymaking:** Generating empirical data to inform future regulatory frameworks, and;
- **De-risking innovation:** Creating safe spaces for experimentation that might otherwise be deterred by regulatory uncertainty.

The sandbox approach is an example of a shift toward more adaptive, responsive governance models better suited to the pace of technological change. While the fintech sector has benefited from this form of policy innovation for almost a decade, there are currently 39 active sandboxes in the region across various verticals: fintech, healthcare, transportation, drones, agriculture, energy, environment, built environment and education (**Table 2**).[22]

Table 2. Key Sandbox Developments in SEA-6, 2024

Country	Sandbox development
Indonesia	Updated framework for the Financial Sector Technology Innovation sandbox under OJK Regulation No. 3 of 2024, superseding the 2018 regulation
Malaysia	Released policy document on Financial Technology Regulatory Sandbox Framework, which supersedes the 2015 regulation
The Philippines	Established Strategic Sandboxes for the financial sector through a memorandum circular
Singapore	Expanded the Privacy Enhancing Tech (PET) Sandbox to cover innovations supported by generative AI
Thailand	Established the Digital Assets Regulatory Sandbox under the Securities and Exchange Commission (SEC) and updated the framework for testing Fintech Innovations under the Bank of Thailand
Vietnam	Updated the draft law on Fintech Regulatory Sandbox under the State Bank of Vietnam

Source: Tech for Good Institute analysis on the Evolution of Tech Governance in SEA-6, 2025[23]

Singapore, a regional data centre hub and compact city-state, is leveraging sandbox environments to provide secure settings for testing and deploying green software innovations, aiming to reduce AI's environmental impact.[24] As seen in Case Study 1, Singapore launched its Green Data Centre Roadmap to overcome its constraints through sustainable growth.

2.3.2. Multi-stakeholder governance and implementation

Other parties aside from governments can be held accountable or play a role in innovation governance. Co-regulation, for example, may involve industry formulating a code of practice in consultation with the government, with code breaches usually enforceable by industry or professional organisations rather than the government directly. Examples of these approaches include:

- **Digital industry forums:** Industry-led self-regulatory bodies that develop standards and best practices, such as in the fintech sector;
- **Public-private digital governance committees:** Co-regulatory approaches where government and industry jointly develop governance frameworks, such as AFTECH (Asosiasi Fintech Indonesia), and;
- **Civic-tech partnerships:** Collaborative initiatives that engage the private sector, academia and civil society in iterating digital governance, such as AI Verify, an open-source AI governance testing framework and software toolkit engaging developer, industry and research communities in improving testing and evaluation.

These multi-stakeholder approaches offer several advantages over purely government-led regulation:

- **Adaptation speed:** Ability to respond more quickly to technological changes;
- **Technical expertise:** Access to industry and academic knowledge;
- **Implementation effectiveness:** Greater buy-in from regulated entities, and;
- **Innovation-friendly:** More likely to balance innovation with protection.

2.3.3. Common priorities, different approaches

While countries across SEA may share common policy priorities, they diverge in structure and approach given the diversity of development, legal traditions and national priorities.[25] In AI governance, for instance, some countries favour legally binding regulations while others lean toward more flexible, principle-based guidelines (**Table 3**).

Table 3. Regulatory Frameworks of Shared Priorities across SEA-6

Country	Common Tech Governance Areas of Interest in SEA in 2024		
	AI Governance	Cybersecurity and Data Protection	User Protection and Safety
Indonesia	Draft AI regulation 2024	Updates to the Electronic Information and Transactions (EIT) Law Personal Data Protection (PDP) Law National Cyber and Crypto Agency (BSSN) Regulations	Draft Amendments to the Consumer Protection Law (under review) OJK Regulation No. 3 of 2024 (Financial Sector Technology Innovations)
Malaysia	National Guidelines on AI Governance and Ethics (NAIGE)	Cybersecurity Act of 2024 Amendments to the Online Safety Act Personal Data Protection Act (PDPA) Amendments (2024)	Online Safety Act Amendment to the Communications and Multimedia Act (CMA)
Philippines	National AI Strategy Roadmap 2.0	National Cybersecurity Plan 2025-2028	Implementing Rules and Regulations of the Internet Transactions Act Anti-Financial Scamming Act (AFASA)
Singapore	Model AI Governance Framework for Generative AI (MGF-Gen AI)	Cybersecurity (Amendment) Bill No. 15/2024 Personal Data Protection Act (PDPA) Advisory Guidelines	Shared Responsibility Framework for Digital Transactions
Thailand	AI Governance Guidelines for Executives and Organizations	Cloud Security Standard 2024	Digital Platform Services (DPS) Law Guidelines for Managing Advertisements on Digital Platform Services Cybercrime Case Division
Vietnam	Official dispatch No.83/CD-TTg of 2024: Advancing Human Resource Development in Key Technology Sectors: Semiconductors, Artificial Intelligence (AI) and Cloud Computing Decision *No.699/QD-BTTTT of 2024 : Phê Duyệt Kế Hoạch Hành Động Năm 2024 Triển Khai Chiến Lược Phát Triển Ứng Dụng Trí Tuệ Nhân Tạo Đến Năm 2030 (Chiến Lược Ai Ứng Dụng)* *Translation* *"Approving the 2024 Action Plan for Implementing the Strategy for Developing Artificial Intelligence Applications by 2030"*	National Data Strategy to 2030 Decision No. 1437/QD-TTg: Promulgating the National Action Plan on development of digital economy in the 2024-2025 period	National Data Strategy to 2030 (Decision No. 142/QD-TTg: Approving the National Data Strategy by 2030

Source: Tech for Good Institute analysis on the Evolution of Tech Governance in SEA-6, 2025[26]

2.3.4. Opportunities for regional policy alignment

Despite different national approaches, regional efforts to further interoperability can advance digital sustainability. The ASEAN Digital Integration Framework, for example, supports cross-border digital infrastructure development. The ten ASEAN member states are negotiating the ASEAN Digital Economy Framework Agreement (DEFA) to establish shared principles on data governance, digital trade and cross-border services.[27] Regional policy alignment is vital for regional scaling, particularly for sectors like health, agriculture and financial services that rely on cross-border data flows.

ASEAN has facilitated cooperation on present challenges and emerging topics. Cybersecurity response coordination is an example of the former, while the ASEAN Guides on AI Governance and Ethics and Generative AI the latter.[28] Looking ahead, cross-border policy learning and sandbox corridors will enable governments to observe and adapt their own digital governance approaches to innovation.

2025 will likely see updates from key ASEAN cooperation plans, including the ASEAN Economic Community Blueprint and the ASEAN Vision and Strategic Plan of Action for Food, Agriculture and Forestry.[29] Continued cooperation and regulatory alignment across countries will be a key factor in advancing technologically-enabled digital sustainability solutions to the region's social, economic and environmental challenges.

2.4. Financing Innovation

> "What's most crucial is driving innovation in finance. In Southeast Asia, there's tremendous potential to de-risk investments that are often seen as high-risk. Tools like blended finance, project financing and carbon credits can play a pivotal role in lowering barriers and unlocking greater private capital participation."
>
> **- Tan Jun Da, Vice President at GenZero**

SEA has the opportunity to broaden financing methods for digital sustainability. A range of capital sources can be mobilised, including philanthropic grants, impact-first capital, blended finance, and, in the right contexts, traditional investment. These approaches increasingly account for social and environmental objectives, helping to redefine how investment success is measured.

2.4.1. A spectrum of capital for digital sustainability

Structuring and delivering funding and capital for digital sustainability can take many forms—from **traditional investments** seeking financial returns, to **philanthropic donations** with no return expectations, to **development funding** that spans a wide spectrum, including no-return grants and concessional capital with modest returns. **Impact capital (Figure 7) helps bridge the early-stage funding gap** where philanthropic or development capital alone may not be sufficient, and commercial investors perceive the risks as too high.[30] By offering flexible return expectations, it enables the development and scaling of technologies that might otherwise struggle to attract funding while ensuring that long-term social and environmental benefits remain central to their success metrics.

Financing innovation involves three key aspects:

- **Engaging** new sources of capital, such as impact investments and philanthropy;
- **Creating** innovative instruments for capital deployment, such as recoverable grants and blended finance, and;
- **Developing** new pathways for financial returns and exits to improve liquidity, including activities like trading impact or biodiversity credits.

Crucially, different sources of capital, instruments, and exits pathways are needed at different stages of a technology or company's maturity.

Figure 7: Spectrum of Capital

Source	Traditional Investing	Responsible Investing	Sustainable Investing	Impact Investing	Impact First Investing	Venture Philanthropy	Philanthropic Donation	Development Finance
Description	Focused on financial returns with limited or no consideration for social or environmental impact.	Considers environmental, social and governance (ESG) issues alongside financial returns, typically with a focus on managing ESG risks on long-term financial performance.	Invests in assets or companies with long term sustainability and financial viability.	Invests in assets or companies with long term sustainability and financial viability.	Prioritises social or environmental impact over financial returns, accepting lower financial gains.	Applies venture capital principles, such as long-term investment, hands-on support, and performance measurement to philanthropy, through tailored financial and nonfinancial assistance.	Provides funds without expectation of financial returns, purely for social or environmental benefit.	Encompasses diverse and evolving funding landscape including official development assistance (ODA); other public resources, such as national, bilateral (government-to-government) and multilateral funding flows; private investments; portfolio flows and grants; remittances and innovative forms of public-private partnerships.
Returns	Market returns, focused solely on financial performance.	Market returns, with consideration for ESG factors potentially influencing long-term financial performance.	Market returns, with positive social/environmental impact potentially enhancing value.	Market returns, alongside measurable social/environmental impact.	Below-market returns, prioritising social/environmental impact over financial gains.	Typically no direct financial returns expected, with potential milestone-based capital recovery in some instances.	No financial returns; purely focused on achieving social/environmental benefits.	Ranges from zero returns (e.g., ODA) to concessional and non-concessional financing, e.g., foreign direct investments (FDI).
Instruments	Stocks, bonds, mutual funds.	ESG-focused stocks, bonds, mutual funds.	Green bonds, sustainable mutual funds, ETFs.	Impact bonds, venture capital, private equity.	Concessional loans, Social Impact bonds/ Outcomes-based financing.	Grants, Recoverable grants.	Direct donations, charitable grants.	Diverse mechanisms including grants, technical assistance, reimbursable grants, guarantees, loans, equity, and others
Goals	Limited or no regard for ESG practices.	Mitigate risky ESG practices in order to protect value.	Adopt progressive ESG practices that may enhance value.	Address societal challenges that generate competitive financial returns for investors.	Address societal challenges that require a below-market financial return for investors or where returns are unproven.	Address societal challenges through commercially viable means but with no expectation of direct or immediate financial returns.	Address societal challenges that cannot generate a financial return for investors.	Address development challenges, advance sustainable development goals.
Target	Startups, established companies, publicly traded firms.	Companies with strong ESG practices, sustainable businesses.	Green technology firms, renewable energy projects.	Social enterprises, impact-driven startups.	Social enterprises, impact-focused startups, nonprofits with a business model.	Social enterprises, impact-focused startups, nonprofits with a business model.	Nonprofits, charities, community projects.	Wide range of recipients from public (e.g., government entities) to private sectors (e.g., businesses) and non-profits/NGOs, typically in developing economies.

Potential sources of catalytic capital

Blended finance combines capital with different objectives to mobilise private sector investment

Source: Analysis by Tech for Good Institute, based on the Spectrum of Capital found in "Scaling Impact in Asia: Achieving Purpose and Profit, by CIIP, Accenture and SMU" and the Organisation for Economic Co-operation and Development (OECD)'s definition of development finance. The examples provided in the table are non-exhaustive and intended for illustrative purposes only.[31]

> "For me, there's no difference between innovation and impact because all innovation makes an impact – I believe it should be good for humans and for society. That is why we do not segregate impact and innovation for our investment thesis."
>
> **- Atsushi Taira, Managing Director, Mistletoe**

Commercial (market-rate) impact investments seek the simultaneous pursuit of profit and social and/or environmental good. Their defining feature is an articulated motive and intent to generate positive social and/or environmental impact alongside a targeted market-competitive financial return, without one foregoing the other as both are of equal importance.

Concessionary and impact-first impact investments have similar commitments to creating social or environmental impact, but either regard financial returns as a secondary goal, or extend capital beyond the usual return horizon (as with patient capital). Impact-first investors often target regions and sectors where traditional investors are less active but the potential for positive impact remains. Impact-first investors may accept below market rate returns or offer flexible/patient terms, while concessionary investors accept below-market returns more explicitly.

Philanthropic capital is a financial resource dedicated to driving social and environmental change, prioritising impact over financial returns. It can be provided as an outright gift with no return expectations or an asset with below-market returns. This capital typically funds non-profit organisations through donations or fuels commercially viable entities via venture philanthropy. Its risk-absorbing and patient nature makes it a powerful tool for catalysing early-stage innovations.

Compared to impact investments and other emerging innovative financing methods, philanthropic capital is more established and generally enjoys clearer regulatory frameworks in most SEA countries.[32] Incentives typically take the form of tax deductions, tax exemptions or direct government grants focused on supporting non-profit and local organisations.

Given the early-stage and high-risk nature of many digital sustainability solutions in SEA, **development finance** plays a crucial role in bridging funding gaps that commercial capital is often unable or unwilling to fill. While its initial purpose was to support economic development, the scope of development finance has since expanded to explicitly prioritise sustainable development and facilitate transitions to greener economies including climate adaptation and mitigation efforts.[33]

Multilateral Development Banks (MDBs) such as the World Bank, International Finance Corporation (IFC) and the Asian Development Bank (ADB) deploy pooled financial contributions from multiple countries and private sources. Such funding generally supports large-scale infrastructural projects to address global development challenges like poverty and climate change, to promote cross-border cooperation. **Bilateral development finance institutions** like the Japan International Cooperation Agency (JICA) and Nederlandse Financierings-Maatschappij voor Ontwikkelingslanden N.V. (FMO) are typically government-owned agencies of developed countries that provide financing to developing countries. While financial returns are not always expected, bilateral aid is underscored with intentions to improve relations between countries, promote stability and enhance the recipient country's ability to achieve long-term development objectives. **National Development Finance Institutions**, such as the Philippines' National Development Company and the Malaysian Development Bank of Sarawak aim to drive competitiveness and advance sustainable development on a national level.

These institutions employ various financial tools such as grants, technical assistance, loans, guarantees and equity participation to address market gaps and bridge the gap between public aid and private investment.[34] The *State of Blended Finance 2024: Climate Edition* report by Convergence[35] found that commercial financing from Development Finance Institutions (DFIs) and MDBs grew by 60% in 2023, to a six-year high.

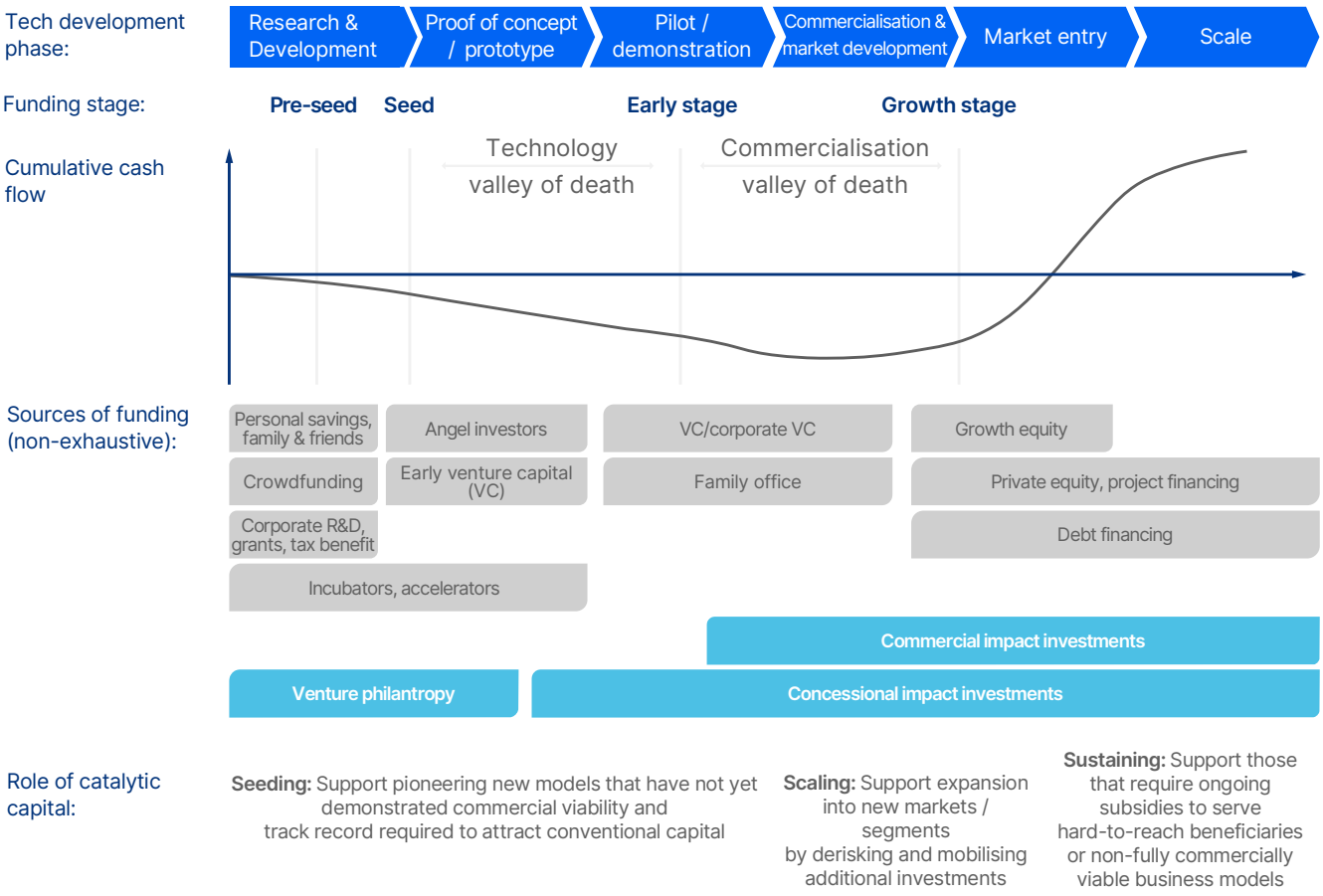
The scale and focus of funding provided through development finance has historically meant that larger established companies tend to be selected as implementing partners. Recognising the need for innovation and new ideas, DFIs are now supporting early-stage companies and pilot initiatives. For example, the Creative Technology Solution (CTS) initiative by the Korea International Cooperation Agency (KOICA) and other DFIs are also participating in funds, such as the Omnivore Agritech and Climate Sustainability Fund–joined by the IFC, FMO, the German KfW and the Belgian Investment Company for Developing Countries and philanthropic backers like the Gates Foundation.[36,37]

2.4.2 Capital deployment innovations

Innovations in financial product design, new return and exit pathways can expand access and improve liquidity in the impact financing market.

Blended finance strategically combines funding from governments, philanthropists and private-sector organisations.[38] Aligning capital with the right stage of a company or technology—and with funders' risk profiles—supports innovation (**Figure 8**). By pooling capital with different risk levels, blended finance also promotes cross-sector collaboration.

Figure 8. Capital Requirements across a Company's Lifecycle



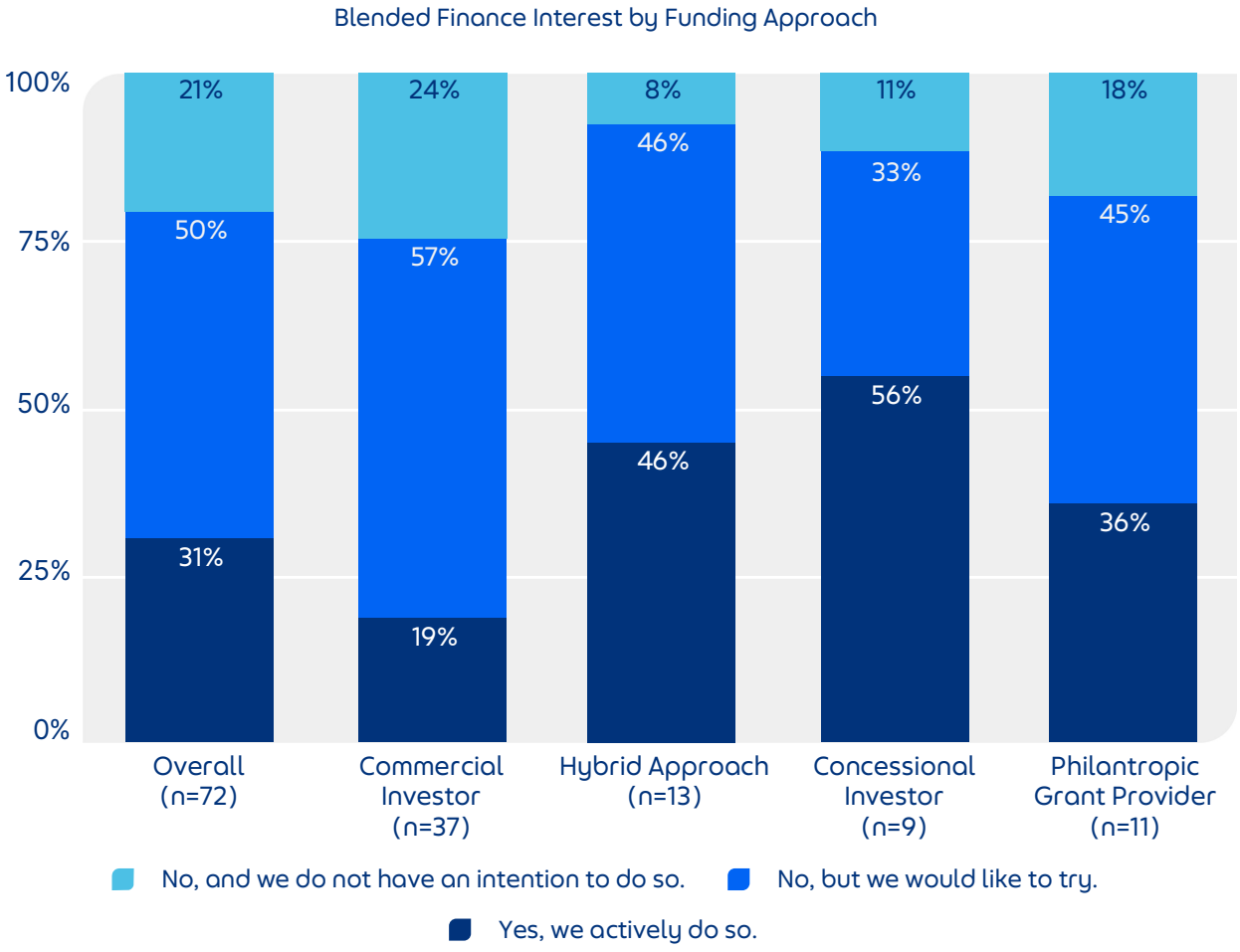
Source: CIIP analysis adapted based on Kaylanpepin.com, BDC's ICE Venture fund, Catalytic Capital Consortium

For example, a blended finance vehicle can be established with three tranches of capital. The junior tranche carries the highest risk and is typically funded through catalytic capital (in the form of e.g., grants, unsecured debt) provided by impact organisations and philanthropic foundations. The mezzanine tranche is designed to be investible by multi-development banks (MDBs), development finance institutions (DFIs) have been previously mentioned, perhaps use the abbreviations instead of the full terms here and moving forward and high-yield investors, in the form of bonds or loans, with commensurate return. The senior tranche, benefiting from asset diversification and 10-20% subordination, can achieve an investment-grade rating (e.g., BBB), making it attractive to a broad range of debt investors.[39]

Blended finance enables marginally unbankable opportunities—such as early-stage startups, large-scale infrastructure projects and others—to tap into larger and more diverse pools of capital, ultimately scaling social and environmental impact. Blended finance has been used in SEA and beyond to leverage public and private capital to address development challenges, particularly in sustainable infrastructure and trade finance. Blended finance and catalytic finance are still nascent, with few standalone national frameworks or taxonomies present globally. High-level principles on blended finance have been issued, such as the G20 Principles to Scale up Blended Finance in Developing Countries, agreed upon during the Indonesian G20 Presidency. The framework sets out voluntary principles that reflect the common strategic direction and aspiration for scaling up blended finance implementation in developing countries.

Blended finance is attracting strong interest among capital providers. 31% actively participate in blended finance mechanisms, while 50% are interested to try (**Figure 9**). For those interested to try, a lack of know-how and access to viable opportunities may represent barriers. Among the groups, concessional funders lead in participation, followed by hybrid funders and then philanthropic grant providers. Notably, significant untapped interest exists among both commercial investors and philanthropic grant providers. The presence of over 2,000 family offices in Singapore alone offers a unique opportunity to tap such sources, as these entities often possess the flexibility, patience and resources to support innovative projects that drive meaningful social and environmental change.[40]

Figure 9: Blended Finance Interest by Survey Respondents with Different Funding Approaches (N=72). Investor category 'Others' (N=2) is not shown



Source : Survey by TFGI and CIIP, 2025

Blended finance is just one example of financing innovation for digital sustainability. Another example is **green financing**, which refers to any structured financial activity created to ensure better environmental outcomes, including loans, debt mechanisms, green bonds, Shariah-compliant green sukuks[41] and investments. **Sustainability-linked bonds** are structurally linked to the issuer's climate achievements or broader sustainable development goals, while **sustainability-linked loans** are linked to predetermined sustainability performance targets on the borrower's end. For examples of green finance instruments, see **Appendix B**.

Capital flows can also be facilitated through co-investment platforms and marketplaces underpinned by strong impact management and measurement systems. These platforms can help open new pathways for returns and exits, and reduce barriers to fundraising. One such example is **Co-Axis**, a digital platform where global impact communities connect, collaborate and catalyse innovation for a sustainable world.[42] The platform serves as a matchmaker between funders and impactful early-stage initiatives raising catalytic capital funding. Co-Axis is part of the Temasek Trust ecosystem, availing access to a broader network of partners and entities such as the Philanthropy Asia Alliance and the Centre for Impact Investing and Practices.

Importantly, financial innovation must be underpinned by strong governance across all investment stages and continuous impact measurement and management (IMM). This is critical to ensure desired impact outcomes are achieved and to avoid critical risks such as "impact-washing" or greenwashing.

Effective IMM depends on robust monitoring of outputs, outcomes and impact. Outputs—such as services delivered or individuals reached—provide immediate, actionable signals of progress. Outcomes reflect the longer-term changes experienced by stakeholders, while impact captures the measurable difference made. Together, they validate a theory of change[43] and help assess additionality—the unique value created by an investment.

2.5. Integrated Innovation for Digital Sustainability

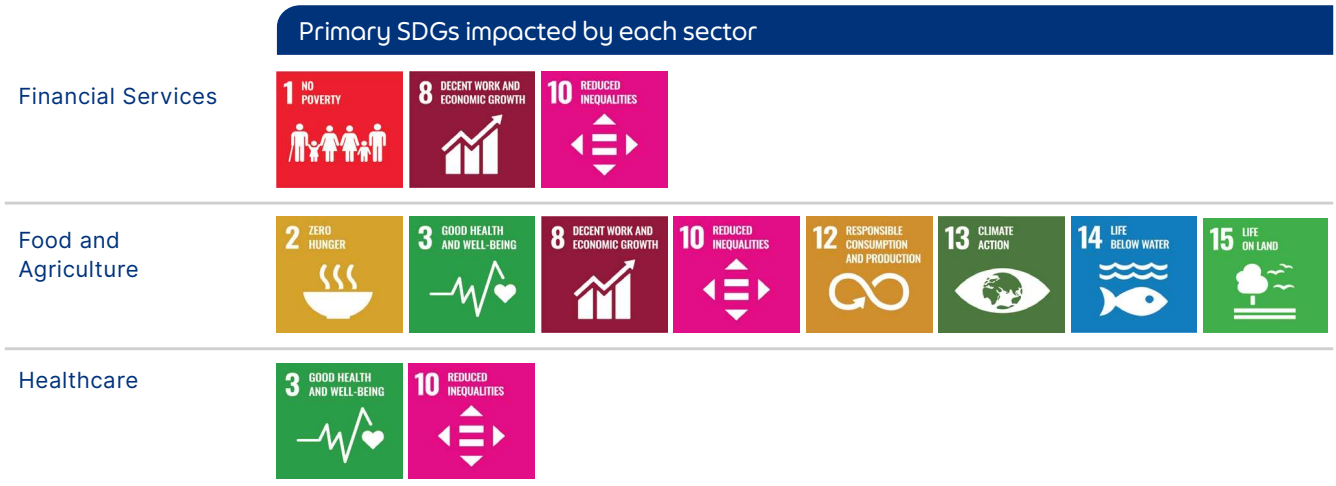
In summary, the interaction between innovations in technology, business model, policy and financing shape the potential for digital technologies to contribute to sustainable development outcomes. Technology breakthroughs require business innovation to reach scale, appropriate financing to support growth and enabling policy frameworks to ensure responsible deployment. These dimensions do not operate in isolation. No single innovation type is sufficient in isolation; rather, they form an integrated ecosystem where advances in one area both enable and are enabled by developments in others.

SEA's diversity and rapid evolution demands continued experimentation that combines digital capabilities with contextual market, business and policy understanding—creating solutions that are not just technically sophisticated but genuinely adapted to local needs, constraints and opportunities.

3. Three High Impact Sectors for Digital Sustainability in SEA

As SEA undergoes rapid digital transformation, the question is not **whether** to invest in the digital economy, but **where** digital investments can bring the most impact. This chapter explores three high-opportunity sectors: **financial inclusion, food and agriculture, and healthcare,** which advance multiple SDGs.[44] Financial inclusion expands access for underserved individuals and MSMEs to payments, credit and insurance, and strengthens financial health and resilience. Sustainable food and agriculture not only reduces hunger, but also improves nutrition, promotes health and wellbeing, reduces poverty, enables responsible consumption, protects ecosystems and supports climate resilience. Healthcare improves health and wellbeing, while reducing poverty and inequality (see **Figure 10**).

Figure 10. Primary SDG Impact of Each Focus Sector



Source: Analysis by TFGI and CIIP based on sector assessments and UNDP SDG Investor Maps.

In terms of technology innovation, healthcare dominates in total patent activities (around 1.9 million patents), yet has the lowest digital technology penetration (19.8%). In contrast, financial services and food and agriculture show a greater proportion of digital technologies (**Table 4**).

Table 4. Total Invention and Digital Technology Inventions 2015-2024 By Focus Sector

Sectors	Total Inventions (2015-2024)	Number of Digital Technology Inventions	% of Digital Technology
Financial services	186,320	167,910	90.1%
Food and Agriculture	452,918	92,983	20.5%
Healthcare	1,865,228	368,910	19.8%

Source: % of digital technology is defined as the proportion of digital technology inventions out of total inventions. Patent data was retrieved from the Questel FAMPAT database and analysed by IPOS International for this study. Further detail on the patent analytics approach is available in **Appendix A**.

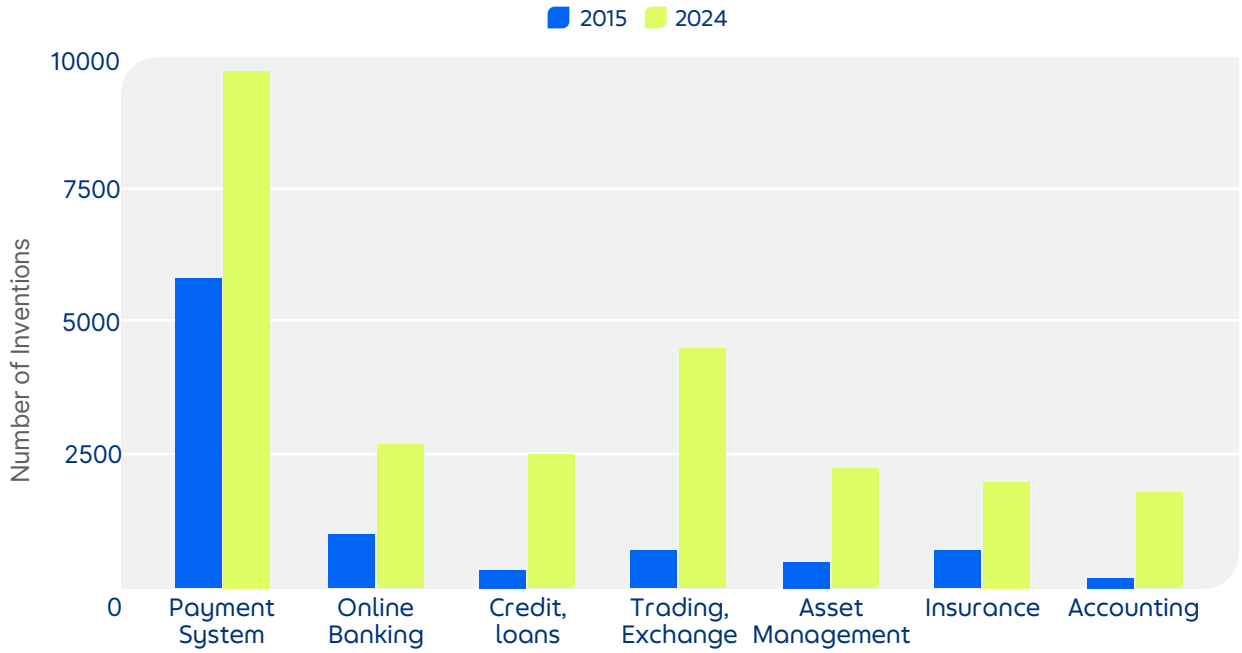
3.1. Innovation for Impact: Financial Inclusion

> "Financial inclusion remains a strategic priority for our fund in Southeast Asia. Digital financial services are demonstrating the ability to scale with strong fundamentals, but as the fintech sector matures, persistent gaps continue to present attractive opportunities for innovation, growth and impact. "
>
> **- Ming Xian Tan, Vice President, Investments, ABC Impact**

The financial services sector has increasingly turned to digital innovation to improve service accessibility and foster financial inclusion.[45] Over the past decade, fintech has experienced significant growth (**Figure 11**), Technology areas such as credit loans, accounting and trading exchange have shown CAGRs of 28.5%, 27.6% and 25.9%, respectively.

Payment systems saw the most technological innovation over the past decade. Capital providers view these technologies as transformative mechanisms, enabling individuals to access credit and transact more easily, while helping businesses expand reach and reduce cash-handling frictions. One investor noted its systemic impact in breaking down longstanding market barriers that have historically excluded underserved communities.

Figure 11: Financial Inventions by Technology Area, 2015 vs 2024



Source: Patent data was retrieved from the Questel FAMPAT database and analysed by IPOS International in this project. The scope of each technology area is defined in **Appendix A**. Some inventions may be included in multiple areas.

Alongside payment systems, online banking has overcome traditional banking infrastructure constraints, making it economically viable to serve unbanked populations through mobile channels. MSMEs, in particular, have benefited from this shift, using QR codes and mobile wallets to digitise their transactions and broaden customer reach. Building on these foundational innovations, the next wave of use cases will leverage advanced technologies, such as blockchain and AI to address deeper structural barriers and further expand financial inclusion across SEA.

3.1.1. Use cases and innovation trends

Digital financial services across SEA are evolving from foundational access to sophisticated, inclusive systems that address longstanding structural barriers. The following use cases and innovation trends are highlighted by surveyed investors as particularly promising.

1. **Remittances**

   Related Challenge: Limited cross-border payment infrastructure.

   In 2020, SEA saw large remittance flows from both outside the region and between ASEAN countries. The Philippines ranked fourth in the world with US$39 billion, while Indonesia, Vietnam and Thailand also received significant amounts, US$14.4 billion, US$14 billion and US$9.8 billion, respectively.[46] Linkages between national payment systems, such as the connection between Singapore's PayNow, Thailand's PromptPay and Malaysia's DuitNow, allow for near real-time transfers using just mobile numbers. Inclusive cross-border payment systems reduce reliance on traditional banking channels, which often involve higher fees and longer processing times, making remittances more accessible and affordable for migrant workers and their families.

   Blockchain and other distributed ledger technology are also facilitating cross-border financial transfers. Singapore-based StraitsX, for example, deploys blockchain-enabled digital payments infrastructure while utilising stablecoins such as XSGD on the Avalanche network, delivering expedited, secure and cost-efficient remittance services. Similarly, Indonesia's state-owned digital wallet LinkAja has partnered with Telcoin to develop blockchain-powered remittance solutions to target cost reduction in transactions.

   Patent trends reflect this momentum, with blockchain-related financial technology patents growing at a CAGR of 21% between 2015 and 2024, particularly in areas such as transaction security, identity verification and asset tokenisation.

2. **Verification and authentication**

   Related Challenge: Absence of formal identification documentation.

   Mobile and blockchain-based systems are enabling remote verification processes that satisfy Know Your Customer (KYC) requirements. These solutions eliminate the need for physical paperwork and in-person procedures, lowering onboarding friction. It is particularly relevant for refugee and migrant populations who typically lack conventional documentation.

   Facial recognition and other biometric technologies are also streamlining customer authentication and reducing fraud risks. For example, our interview noted that Vietnam's national digital identity platform, VNeID, is moving beyond identity verification to serve as a multi-service platform, providing access to both government and financial services in line with Vietnam's broader digital transformation agenda.[47]

3. **Credit access**

   Related Challenge: Exclusion from credit access due to lack of formal credit histories.

   AI and big data have revolutionised credit access for individuals and MSMEs without traditional collateral or credit histories. Transitioning from retrospective to real-time data analysis has enabled financial service providers to serve previously excluded customer segments. Machine learning models now analyse alternative data points, such as mobile phone usage, utility payments and transaction history, to assess creditworthiness, which fundamentally reconfigures participation barriers within financial markets. For example, Filipino fintech company BillEase uses alternative credit scoring beyond credit bureau data to provide loans to its underserved customers.

   Such data-driven underwriting capabilities are pivotal for expanding financial inclusion. By overcoming traditional credit assessment limitations, capital can be deployed more efficiently to enable access for previously-excluded populations.

   Figure 11 above shows credit scoring applications growing at a CAGR of 28.5% from 2015 to 2024—more than double the overall fintech patent growth of 12.5%. This concentrated innovation activity underscores the strategic importance of alternative data approaches to expand financial access.

4. **Personalised financial services**

   Related Challenge: Trust and usability for diverse populations.

   In SEA's heterogeneous markets, one-size-fits-all products often fail to address the specific needs of diverse customer segments. Companies in SEA like Advance Intelligence Group and DANA provide AI-driven financial products tailored to individual customer needs and risk profiles. These platforms analyse customer behaviour and preferences, creating personalised financial services that align with an individual's specific needs while remaining commercially viable at scale.

5. **Microinsurance**

   Related Challenge: Weak protection mechanisms for climate-vulnerable populations.

   Insurance solutions for smallholder farmers, featuring efficient claims processing through digital and physical platforms, represent a key Investment Opportunity Area in the UNDP SDG Investor Maps for the Philippines, highlighting the commercial viability of mass customisation in inclusive insurance.[48] Digitally-enabled microinsurance products are designed to be affordable, accessible and relevant, particularly in contexts where traditional insurance was unavailable.

   Parametric insurance, for example, triggers automatic payments in response to predefined events. Utilising satellite data and weather analytics, payouts are automatically triggered when predefined conditions indicate a likely crop damage. This eliminates the need for traditional claims adjustment processes that were prohibitively expensive in rural agricultural contexts. Not only does this system reduce administrative costs, it speeds up disbursement and increases trust among users, thus improving customer experience. One capital provider noted that platforms such as IBISA empower insurance companies to launch targeted products for risks like typhoons or heat stress, specifically designed for smallholder farmers in countries like the Philippines and India.

Case Study 2

Grab: A platform marketplace to advance livelihoods across SEA[49]

Grab is a platform ecosystem in SEA with a mission to create economic empowerment opportunities for everyone. Evolving from a ride-hailing app to an everyday services platform, Grab operates across eight countries and in over 800 cities. In a region with 244 million informal workers[50] and 70 million Micro, Small and Medium-sized Enterprises (MSMEs),[51] Grab's suite of services spanning transport, food delivery, payments, financial services, and insurance expands access to income opportunities and the digital economy for workers and MSMEs. Its **hyperlocal approach, user-focused innovation** and **participation in public-private partnerships** have been instrumental in enabling Grab's leadership and innovation in the digital transformation of the region.

A fit-for-purpose digital ecosystem that creates value for users across SEA

Many of its innovations are direct responses to the lack of fit-for-purpose solutions to local problems. Some innovations initially developed to serve adjacent needs have grown into full business verticals.

- ***Driving financial inclusion***: While developing its transport and mobility business, Grab discovered that millions of Southeast Asians, including drivers and MSMEs, lacked access to basic financial services like banking. This led to its entry into financial services in 2017, with the aim of providing financial products that are simple, transparent and flexible. Embedded directly into the platform experience, and supported by alternative data and credit scoring, GrabFin provides users a single entry point to access payment, lending, and insurance services within the Grab app.[52] Its microfinance products, for example, include emergency cash loans, product-based financing, and microinsurance that covers drivers and their families while merchant cash advances provide support for small business operations. Grab's growth in financial services has expanded into fully-licensed digital banks in Indonesia, Malaysia and Singapore.

User-centricity in Design

As a multi-sided marketplace, Grab integrates hyperlocalised services into a digital ecosystem that fits the unique needs of each market and each user.

- *For driver- and delivery-partners* – Its platform promotes flexibility for partners, enabling them to work when they are able. Since demand for drivers and deliveries vary during the day, workers also have diversified earning opportunities,[53] from providing rides to delivering parcels to collecting mapping data for Grab's in-house mapping technology.[54] The proprietary mapping system,[55] together with AI-driven route optimisation[56] through real-time data, algorithms, batching and navigation, help drivers and delivery partners complete trips more efficiently.[57]
- *For merchants* – Businesses can grow and reach more customers not just through deliveries, but also with payments, marketing tools and financing support. Many merchants on Grab are food and mart-based small businesses. The GrabMerchant app's AI Merchant Assistant provides owners with round-the-clock operational support via the GrabMerchant app, assisting with menu updates, campaign creation, and access to financial tools.[58] To help owners optimise their marketing budgets, advertising on the Grab app is based on a "Cost-Per-Order" system, in which the merchants are charged only upon successful orders.[59]

- *For users* – Safety features such as recording feature *AudioProtect*[60] enhances passenger and driver safety, while the same technology that helps drivers locate jobs more quickly reduces waiting time for users.

Collaboration for Scale and Inclusive Growth

Last but not least, Grab's open partnership philosophy has anchored the company's strategic partnerships with governments, regulators and other industry players. For example, the company has:

- Partnered with governments to extend national social protection schemes to gig workers in Indonesia, Malaysia, the Philippines
- Participated in MAS' FinTech Regulatory Sandbox prior to GXS Bank's launch.
- Supported governments in identifying potholes and reducing traffic through its mapping and real-time data.[61]
- Contributed data on more than 800,000 kilometers of missing roads to OpenStreetMap, the open-source mapping platform[62]
- Provided data to other companies requiring accurate and up-to-date mapping, such as Bing, Amazon Location Services and Loqate.[63]

3.1.2. Recommendations for further financial inclusion

SEA's digital finance ecosystem is maturing, but many innovations, from blockchain-powered remittances to AI-driven credit scoring, remain constrained in scope and scale. These technologies have demonstrated proof of concept, but moving from pilot to widespread adoption requires structural interventions that address interoperability gaps, regulatory ambiguity and underdeveloped capital pipelines.

While this section focuses on financial inclusion, many of the barriers to scale, such as capital mobilisation, data governance and ecosystem fragmentation, are not unique to this sector. Interventions outlined here are sector-specific, but should be viewed as part of a broader, integrated strategy to advance digital sustainability across SEA.

1. **Unlock regional infrastructure for cross-border payment and ID systems**

   Scalable remittances, authentication and onboarding models depend on seamless integration between national platforms. Initiatives like Project Nexus enable interoperable instant payment systems. Moreover, shared KYC and Digital ID standards across ASEAN will simplify cross-border access for individuals and businesses.[64] This can be achieved through regionally-aligned APIs, verification protocols and digital credential tools.

2. **Establish regulatory foundations for responsible data use and AI**

   Scaling inclusive credit and personalisation models requires a foundation of trust, standardisation and safeguards. To achieve this, financial regulators and ecosystem stakeholders should develop explainability standards, bias audits and grievance redressal mechanisms that ensure transparency and accountability in AI-based decision-making. Regulatory sandboxes for innovations using alternative data and AI, with active participation from public, private and community stakeholders, can inform policy and build trust. Open digital infrastructure, such as multilingual NLP libraries and validated scoring datasets, should be encouraged to reduce barriers for smaller innovators and support fairer market participation.

3. **Enable emerging models through adaptive governance**

   Adaptive governance approaches can support the growth of microinsurance and responsible exploration of new models. For example, modular regulatory frameworks for parametric and climate-linked financial products are guided by performance-based metrics. Regional sandbox corridors can enable multi-country testing of inclusive finance models, supporting scalability across diverse regulatory environments

4. **Scale capital and delivery infrastructure across stakeholders**

   Scaling inclusive financial solutions requires coordinated action across public, private, philanthropic and community actors. Governments play a pivotal role by investing in core digital public infrastructure and fostering innovation through responsive regulation and targeted tax incentives. Private providers should align their product design with inclusive use cases and emerging regional standards to ensure broader uptake and interoperability. Philanthropic actors can de-risk early-stage ventures, fund digital literacy and fairness research, and subsidise models that prioritise inclusion. Meanwhile, community groups are essential for localising solutions, building trust and supporting onboarding and feedback mechanisms that close the gap between design and adoption. Such Public-Private-Philanthropic Partnership (4P) models can support digital sustainability by pooling expertise and resources, de-risking early innovation, enabling effective scale and ensuring inclusion.

5. **Leverage finance as a cross-sector enabler**

   - **Food and agriculture**: Enhanced financial access for smallholder farmers creates investment in climate-resilient agricultural practices and technologies. AI-driven credit scoring that incorporates agricultural data can better assess seasonal cash flows and weather-related risks, making financing available for productivity-enhancing technologies.
   - **Healthcare:** Digital financial services enable more efficient healthcare financing through savings mechanisms, insurance products and payment systems specifically designed for health expenditures. The integration of financial and health data (with appropriate privacy safeguards) can lead to a more effective health coverage and financial protection against catastrophic health expenses.
   - **Climate resilience:** Financial inclusion is increasingly critical for climate adaptation, with digital financial services enabling faster disaster response through direct cash transfers, and innovative parametric insurance products.

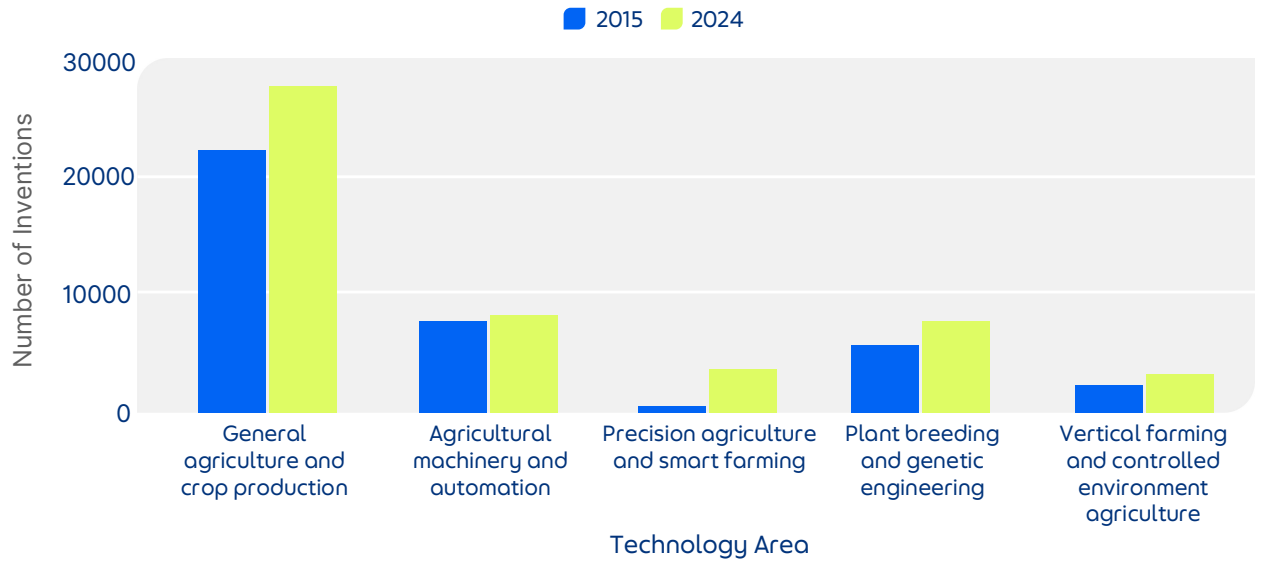
3.2. Innovation for Impact: Food and Agriculture

> "We're seeing good use cases of digital technologies in agriculture. We have seen innovative technologies helping smallholder farmers plan when to harvest their crops based on available data. IoT will be very helpful for farmers as they enter peak harvest season and are able to use IoT processes to determine when crops are closest to maturity, when storage facilities are full and when to send food to the right places. This prevents wastage of crops and ensures farmers are adequately compensated."
>
> **- Norbert Ling, Portfolio Manager – Sustainable and Impact Investing, Invesco**

Smallholder farmers are the backbone of SEA food systems. They hold a large portion of the agriculture market and produce key global commodities, and are vital to the region's food security and economic base.[65] At the same time, low productivity, financial exclusion and environmental degradation are challenges for the sector. These are also opportunities for digital sustainability solutions.

Only 20.53% of inventions in food and agriculture from 2015 to 2024 were digitally-enabled—a stark contrast to 90.12% in financial services.[66] This suggests untapped potential to significantly advance sustainable agriculture towards digital integration. Patent trends show a clear shift toward digitalisation, with precision agriculture and smart farming technologies growing at a CAGR of 28.87% over the same period (see **Figure 12**). This signals that digital agriculture is not just possible, but already accelerating. Capital providers acknowledge this trend, with many highlighting the growing role of smart farming technologies such as IoT in agriculture, supply chain optimisation and energy efficiency.

Figure 12. Food and Agriculture Inventions by Technology Area, 2015 vs 2024



Source: Patent data was retrieved from the Questel FAMPAT database and analysed by IPOS International in this project. The scope of each technology area is defined in **Appendix A**. Some inventions may be included in multiple areas.

These innovations are laying the groundwork for a new generation of solutions tailored to SEA's unique challenges. Technologies such as blockchain-enabled traceability, IoT-powered precision farming, AI-driven advisory platforms and satellite analytics actively address systemic inefficiencies across agricultural value chains. The following use cases illustrate how these digital tools are overcoming barriers in distribution and decision-making, and producing inclusive, resilient and sustainable outcomes for smallholder farmers across the region.

3.2.1. Use cases and innovation trends

The following use cases and innovation trends are a few ways to tackle key development gaps, including supporting smallholder farmers, boosting climate resilience and improving market connectivity.

1. **Digital platforms for distribution**

   Related Challenge: Inefficient and fragmented supply chains that increase waste and suppress farmer earnings.

   Digital technologies are democratising access to agricultural knowledge, inputs and markets, making sustainable farming more viable for smallholder farmers. As such, digital platforms for distribution emerge as transformative tools across the region. By coordinating logistics, integrating seamless payment systems and enabling real-time tracking, these platforms streamline supply chains and reduce reliance on multiple intermediaries. By reducing waste and operational costs, the final price of goods can be lowered, ensuring that food reaches broader and often underserved markets.

   For instance, Surplus Indonesia uses digital distribution models to simultaneously improve efficiency and enhance market access. Its approach demonstrates the broader potential of these tools to reduce wastage, drive down prices and expand reach, ultimately improving affordability and accessibility.

   Capital providers interviewed for this study suggest that digital tools can empower smallholder farmers to bypass traditional distribution layers, secure better prices, build stronger bonds with consumers and reach bigger marketplaces. These evolving digital supply chains are not only improving logistics, it is reshaping how value is shared across agricultural ecosystems to promote more equitable and sustainable outcomes.

2. **Digital verification for supply chain traceability**

   Related Challenge: Smallholder farmers' exclusion from high-value markets due to limited traceability and verification.

   Improving transparency and traceability is a pressing need in SEA's fragmented agricultural markets. Digital verification, including blockchain-based solutions, can create a secure and verifiable record of produce origin and handling, which are critical for entering higher-value markets with sustainability or quality requirements.

   Interviews with investors highlight a growing interest in blockchain's application across supply chains, in agriculture and in other commodities. One capital provider pointed to responsible gold sourcing, in which blockchain is used to trace gold from mine to market and build trust across a complex, decentralised ecosystem. Similar principles are now being adopted in agricultural value chains.

Emerging platforms in Cambodia and Indonesia demonstrate this transition. In Cambodia, companies such as Azaylla are building B2B digital infrastructure that connects producers to buyers while supporting quality control and traceability.[67] In Indonesia, SayurBox enables farmers to access post-harvest supply chain solutions through digital platforms that facilitate direct-to-market distribution, improving visibility and pricing for smallholders.

These examples show how targeted applications of blockchain and digital verification tools can shift power dynamics in agricultural markets—supporting more transparent transactions, reducing dependency on opaque intermediaries and strengthening smallholder integration into regional and global value chains.

3. **Monitoring, forecasting and environmental impact assessment**

   Related Challenge: Limited visibility and data gaps in diverse and fragmented farming environments.

   Remote sensing offers a cost-effective and scalable alternative to ground-based data collection. Satellite imagery and remote sensing technologies are increasingly being deployed to enhance visibility and data accuracy across agricultural landscapes. These tools support a range of critical functions at spatial and temporal scales, including crop health monitoring, yield forecasting and environmental impact assessment.

   For example, Perennial Earth uses satellite-based remote sensing for soil and land cover measurement to significantly lower monitoring costs while improving the precision of environmental data collection. Perennial Earth is part of the broader trend of technological democratisation, shifting capabilities that were once exclusive to government agencies into the hands of private sector actors, non-profit organisations and smallholder farmers.

4. **Optimising agricultural decisions with real-time and AI-driven insights**

   Related Challenge: Low productivity, fragmented supply chains and limited access to tailored agronomic advice.

   IoT-based field monitoring and AI-powered advisory platforms help smallholder farmers make better decisions, reduce losses, and improve yields. IoT sensors provide real-time data on microclimates, soil conditions and crop health, enabling more precise application of water and fertilisers, timely harvests, and better coordination with storage and logistics. These field-level insights are increasingly being integrated with AI models, which synthesise broader datasets including weather forecasts, soil profiles and historical crop performance, to generate personalised farming recommendations.

   Biops Agrotekno, for example, is an early-stage Indonesian agritech startup offering IoT-based crop intelligence systems tailored to smallholder farmers. Their technology helps farmers monitor microclimates, optimise fertiliser use and detect crop stress early. By equipping farmers with actionable insights, Biops not only improves yield predictability but also supports sustainable resource use, illustrating how IoT can enhance efficiency and resilience across fragmented agricultural systems.

Additionally, Cropin, is an India-based agritech firm supported by both ABC Impact and British International Investment (BII). Cropin's cloud-based platform leverages machine learning to provide real-time climate advisory and adaptive farming recommendations.[68] According to post-implementation surveys, farmers using the platform experienced a 31% increase in yields and a 38% improvement in income.[69] These outcomes demonstrate the tangible benefits of digitised advisory services when aligned with local needs and capacities.

Capital providers also emphasised the importance of robust monitoring frameworks. ABC Impact, for example, tracks key performance indicators such as the number of smallholder farmers supported, farms digitised and rates of advisory adoption. This commitment to continuous feedback and adaptive learning underscores a broader insight from the field: effective technical assistance must remain responsive to farmer needs over time to drive enduring impact.

5. **Localised farming system adaptation**

Related Challenge: Climate vulnerability and lack of tailored adaptation options.

Interviews for this report highlighted a growing wave of agritech ventures focused on combining data-driven techniques with climate resilience. Digital technologies are helping farming systems adapt to highly localised environmental conditions and market contexts by combining traditional knowledge with modern data analytics to create approaches optimised for specific microclimates, soil types and socioeconomic conditions.

Interview insights from capital providers reinforce the sector's growing emphasis on context-sensitive innovation. ADB Ventures highlighted active investments in breakthrough technologies across agricultural domains—from Singapore-based BioDefense, which develops seafood coating solutions to extend shelf life and bridge cold chain gaps, to Thailand's UniFAHs, which offers phage-based alternatives to antibiotic alternatives for poultry production. ADB Ventures, for example, has backed climate resilience solutions, including IBISA's parametric insurance platform, which helps protect agricultural cooperatives in the Philippines from typhoons and support dairy farmers in India facing heat stress.

Another capital provider described observing the development of digital tools for monitoring biochar production, including equipment performance and maintenance. These tools, while relatively simple, play a crucial role in improving operational planning and verifying environmental outcomes, such as carbon impact. This example illustrates how enabling technologies, depending on its context, can support the deployment of more complex core innovations and enhance overall system performance.

From a broader investment perspective, "Agritech Solutions for Farm Production" has been identified in the UNDP SDG Investor Map for Vietnam as a high-potential opportunity area. This includes a range of B2B solutions for precision agriculture, such as crop monitoring, predictive analytics and automation, with an emphasis on practical, locally-adapted implementation.[70]

Interviewed funders also pointed to a growing wave of agritech ventures focused on combining data-driven techniques with climate resilience. Rize (**Case Study 3**), a precision farming platform for smallholder farmers, exemplifies this shift toward sustainable, digitally-enabled agriculture.

Case Study 3

Rize: Transforming rice farming with data-driven technology[71]

Rize, established in 2023, is an agritech startup formed as a joint venture between Temasek, Wavemaker Impact, Breakthrough Energy Ventures and GenZero. The company is dedicated to supporting smallholder rice farmers in adopting sustainable practices to enhance their income and reduce emissions from rice cultivation.

Technology innovations and sustainable practices

Rize is redefining rice farming with precision, transparency and real-time data. Its Digital Measuring, Reporting, and Verification (MRV) system replaces guesswork with GPS-stamped field insights, ensuring accurate tracking of AWD (Alternate Wetting and Drying) and MRL (Maximum Residue Limits). The Farmer Digital Footprint creates a traceable, data-backed identity for every farmer, linking verified IDs, farm locations and sustainability practices. On-the-Ground Operations seamlessly connect sales, mechanisation and compliance through real-time digital verification. At the core of Rize's business model, a powerful dashboard provides complete oversight, enabling smarter decisions and data-driven sustainability—making farming more transparent, efficient and climate-resilient.

Localised implementation and farmer engagement

Rize's platform provides farmers with management tools, financial support and tailored agronomic guidance, adapted to local agricultural conditions. To scale operations, Rize is developing a digitally-enabled agronomy model, where farmers receive support through digital tools and dedicated agronomists.

Agronomists play a crucial role in building trust with farmers and ensuring a seamless transition to sustainable practices. They also collect data using Rize's MRV platform to help bridge the digital skills gap among farmers. Each agronomist supports over 150 hectares of farmland per season, offering timely advice both in person and remotely.

Multinational Operations and Expansion

As of 2025, Rize operates across SEA, covering over 10,000 hectares and engaging more than 7,000 farmers. By the end of its seed phase, Rize had onboarded 2,500 hectares of smallholder farmland and aimed to scale up to 30,000 hectares through its Series A fundraising. The company has already reduced over 4,000 tonnes of methane emissions across more than 200 targeted villages.

In May 2024, Rize secured US$14 million in Series A funding, co-led by Temasek, GenZero, Breakthrough Energy Ventures and Wavemaker Impact. This investment will enhance Rize's technological capabilities, particularly its MRV platform and support expansion into Indonesia, Vietnam and other parts of South and Southeast Asia.

Strategic partnerships and growth in Indonesia and Vietnam

In April 2024, Rize partnered with Temasek Life Sciences Laboratory (TLL) and Temasek Life Sciences Accelerator (TLA) to promote sustainable rice farming in Indonesia. This collaboration focused on implementing innovative farming techniques and leveraged Rize's technology platform to improve both sustainability and productivity.

In 2024, Rize announced plans to expand its team to over 100 agronomists, aiming to support more than 20,000 farmers. These agronomists are intended to act as trusted advisors, facilitate data collection, offer personalised recommendations and reinforce best practices.

Rize's innovative approach of combining technology, financial incentives and strong farmer relationships is transforming rice farming by driving large-scale adoption of sustainable practices. They are creating lasting environmental and economic benefits while pioneering a new model for climate-smart agriculture in Asia.

"We all know that rice is a staple crop, but few realise it's the second-largest emitter of methane globally (after livestock). It is time for all of us to see and think about rice differently. At Rize, we begin with the farmers, but we believe everyone, from traders, millers and off-takers to institutions and governments, play an equally vital role in transforming the rice industry."

-Dhruv Sawhney, CEO, Rize

3.2.2. Recommendations to scale inclusive food and agriculture

SEA's agri-digital innovation landscape is growing, but many high-potential solutions—from blockchain-enabled traceability to AI-driven advisory systems—remain localised and fragmented. These technologies have shown proof of concept, yet its transition to widespread, system-level adoption is hindered by gaps in rural infrastructure, data governance, regulatory coherence and financing models.

As with financial inclusion above, many of the barriers to scale, such as policy alignment, interoperability and inclusive capital mobilisation, are not unique to food and agriculture. More holistic recommendations on enabling policy, financing and cross-sector innovation are presented in Chapter 4. The strategic interventions outlined here are tailored to agriculture but should be understood as part of a broader, integrated agenda for advancing digital sustainability across SEA.

1. **Adapt digital infrastructure to enable agri-digital platforms**

   Scaling agricultural distribution and traceability platforms require digital infrastructure to meet the specific needs of rural producers and supply chains. Aside from clear connectivity, it also needs integrated logistics, interoperable payments for informal economies and rural digital service hubs designed to support farmer engagement.

2. **Strengthen data governance for precision and remote sensing tools**

   Trusted and standardised agricultural data systems are critical to enable wide-scale deployment of IoT and remote sensing technologies. Shared protocols, privacy safeguards and open-access environmental datasets can support innovation while protecting farmer data rights.

3. **Localise advisory and decision-support systems**

   AI-driven advisory tools must be adapted to local conditions, languages and user needs. Co-developing these solutions with farmer cooperatives and public extension systems, and embedding them in wider agricultural services, can ensure it is contextually relevant and scalable.

4. **De-risk innovation through climate-smart regulation and finance**

   Scaling traceability and climate-smart practices requires targeted regulation and tailored finance. Performance-based standards, concessional funding for high-risk ventures and digitally-verifiable sustainability credits can help bring inclusive agritech models to market.

5. **Enable regional standards and sandbox corridors**

   Cross-border scaling depends on shared certification and regulatory alignment. ASEAN-wide protocols for digital traceability, food safety and sustainability reporting—paired with sandbox corridors for multi-country testing—can reduce compliance costs and accelerate regional adoption.

6. **Embed agricultural innovation in 4P platforms**

   Successful scaling depends on coordinated implementation. National food security strategies and investments in inclusive delivery channels can be advanced with philanthropic early stage support and community engagement for local relevance, trust and adoption.

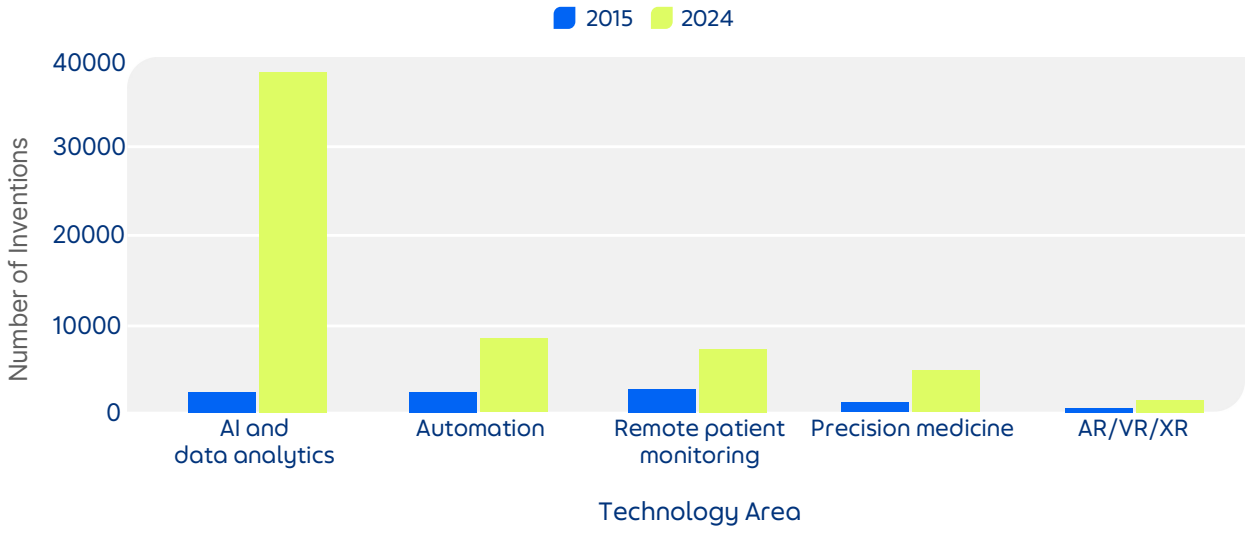
3.3. Innovation for Impact: Healthcare

> "The frontier that I find most exciting is the intersection of AI and healthcare. This powerful combination can solve very real problems in SEA and globally relating to drug discovery, healthspan expansion, management and efficiency of healthcare systems, proper insurance underwriting and ensuring affordable treatments are available to the broader community."
>
> **- Vishal Harnal, Managing Partner, 500 Global**

Lack of access to good quality healthcare, ageing populations and chronic disease management are among some of the urgent healthcare-related barriers to sustainable development in SEA. At the same time, the region is attracting venture capital, insurance innovation and growing medical tourism. Thus, the convergence of rising demand, digital momentum and investment appetite presents a significant opportunity to scale more inclusive healthcare systems.

Digital technologies are managing limited resources, improving access to services and making healthcare more efficient. AI and data analytics in healthcare is growing rapidly, with a compound annual growth rate of 34.93% between 2015 and 2024 (**Figure 13**). Investors surveyed concur, identifying AI and data analytics as the most promising technologies to expand access through streamlined processes, automated care delivery and personalised healthcare to improve chronic disease management.

Figure 13. Digital Healthcare Inventions by Technology Area, 2015 vs. 2024



Source: Patent data was retrieved from the Questel FAMPAT database and analysed by IPOS International in this project. The scope of each technology area is defined in **Appendix A**. Some inventions may be included in multiple areas.

3.3.1. Emerging use cases and innovation trends

Digital healthcare solutions address specific system gaps while improving access and outcomes in SEA. From telemedicine to AI-powered diagnostics, the following use cases and innovation trends highlight how digital innovation is actively reshaping healthcare delivery in the region.

1. **Access to quality healthcare**

   Related Challenge: Geographical barriers and uneven distribution of healthcare resources.

   Access to quality healthcare remains a persistent challenge, particularly in rural and remote areas. The strategic importance of telemedicine is reflected in UNDP's SDG Investor Maps, which identify Thailand's "Telemedicine to Enhance Medical Access in Remote Areas" and Vietnam's "Telemedicine" as key investment opportunity areas.[72]

   Patients often face long travel distances and extended wait times for brief consultations, limiting the timeliness and continuity of care. Telemedicine and other hybrid care models combine virtual consultations with physical diagnostic and prescription services, reducing geographic and logistical barriers. In particular, the adoption of telemedicine surged following the pandemic, driven in part by swift government action to improve accessibility, such as easing licensing requirements for practitioners to deliver care digitally. These behavioural shifts have largely persisted, creating a stable foundation that makes investments and innovations in this space both commercially viable and scalable.[73]

   In Indonesia, Halodoc provides a clear example of this shift. The platform enables virtual consultations and medication delivery, thereby expanding access to affordable care for millions of users. Its growth is backed by several regional investors, including UOB Venture Management, which identified digital health as a priority area during this study's interview.

   Mobile health applications have further expanded the reach of telemedicine, especially in specialised care. During the COVID-19 pandemic, for example, the Australian startup Virtual Psychologist, supported by Singtel's expansion into the region, partnered with Globe Telecom in the Philippines to deliver remote mental health counselling. This initiative offered critical support at a time of heightened psychological stress and demonstrated the adaptability of telehealth platforms to reach diverse healthcare needs.

   Interviewees highlighted telemedicine platforms as critical enablers of healthcare access, particularly in remote and underserved areas. For example, Doctor Anywhere (Case Study 4) demonstrates how digital innovation can bridge gaps in affordability, convenience and continuity of care across SEA.

Case Study 4

Doctor Anywhere: Advancing regional digital health through regulatory innovation[74]

Doctor Anywhere, founded in 2017, has evolved from a telehealth startup into a comprehensive digital healthcare provider operating in key SEA markets.

Regulatory sandbox participation

Between 2018 and 2021, Doctor Anywhere took part in Singapore's Ministry of Health's Licensing Experimentation and Adaptation Programme (MOH's LEAP) program, designed to support innovative telemedicine models. By working closely with MOH within the regulatory sandbox, Doctor Anywhere demonstrated meeting strict patient safety and governance standards with its digital consultation services. This participation provided valuable insights for regulatory development and enhanced patient trust in its telehealth solutions.

Multinational operations

Today, Doctor Anywhere operates in at least six countries across SEA, including Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam. The company's omni-channel ecosystem–integrating telemedicine, physical clinics, pharmacies and an in-app marketplace–caters to over 2.5 million users in the region. This broad presence underscores its ability to localise services according to each market's unique healthcare needs, regulatory requirements and patient preferences.

Participation in the LEAP regulatory sandbox has been instrumental in building a robust framework for Doctor Anywhere's telehealth services. By gaining early exposure to regulatory requirements and adopting best practices, the company is well positioned to lead the evolving digital healthcare landscape in SEA. Its success in operating across multiple markets provides a model for how regulatory innovation, when paired with technology and strategic localisation, can drive regional growth and sustainable healthcare delivery.

"The future of healthcare lies in a decentralised approach–like our 'Hospital Anywhere' model–which makes quality care more accessible and affordable for everyone. By investing heavily in technology, we're building a future where personalised experiences and seamless access to healthcare are a reality for all. Doctor Anywhere is committed to building this future, for ourselves and our communities."

-Wai Mun Lim, Founder and CEO of Doctor Anywhere

2. **Precision medicine**

   Related Challenge: Limited representation in genomic data

   Traditional healthcare systems have often relied on standardised treatment protocols that do not account for individual variations in genetics, behaviour or environmental exposure, factors that can significantly influence health outcomes. This limitation is particularly evident in SEA, where diverse populations remain underrepresented in global genomic datasets, contributing to diagnostic gaps and reduced treatment efficacy.

   However, emerging technologies are beginning to address these disparities. Advances in genomic sequencing are targeting more personalised and targeted interventions. Precision medicine integrates genetic, lifestyle, environmental and clinical information to inform disease prevention and personalised treatments. AI is also increasingly used in drug discovery to support complex computations and accelerate the development of precision therapies that were previously time and cost-prohibitive.

   Regionally, efforts are underway to develop genomic platforms tailored to its unique genetic profiles. While there is a dearth of Asian genomic data in public databases, genomic programmes are gaining momentum across the region through national bodies and networks, such as by BGSi in Indonesia, MyGenom in Malaysia, PRECISE in Singapore, Genomics Thailand and Saigon Precision Medicine Centre in Vietnam. Meanwhile, genomic and genetic startups are translating data to its services. Startup Nalagenetics, for example, uses AI to enhance diagnostic accuracy and improve clinical decision-making, such as predicting responses toward certain drugs based on a patient's genetic variant. Further, LeapFrog's MedGenome is a genomic pioneer and founding member of Genome Asia 100K, an initiative to sequence 100,000 genomes in Asia. Their solutions are available across 50 countries, democratising precision medicine and transforming treatment.

3. **Personalised care models**

   Related Challenge: Lack of tailored care delivery

   The demand for personalised caregiving services, spanning in-home care, medication management and support services, is growing, particularly for ageing and vulnerable populations. In Malaysia, for instance, "Personalised Caregiving Services"—identified in the UNDP SDG Investor Maps—offers tailored in-home care, medication management and support services, particularly for ageing and vulnerable populations.[75] Along these lines, LeapFrog's investment in Redcliffe Labs is transforming diagnostics in India by offering at-home sample collection through an app, making early detection and disease management far more convenient and affordable.

4. **Integrating patient data for interoperability and real-time monitoring**

   Related Challenge: Lack of interoperable systems and real-time data flows across healthcare providers.

   One of the longstanding barriers to efficient healthcare delivery is fragmented patient data often stored in paper-based formats or siloed digital systems. This lack of interoperability impedes continuity of care, limits coordination among healthcare providers, and restricts a patient's ability to access and manage their health data.

In response, digital health records and interoperability frameworks are emerging as critical enablers of more connected, patient-centred systems. Health Information Management (HIM) systems and Electronic Medical Records (EMR) offer secure, centralised platforms that facilitate medical data sharing across public and private institutions. AI further supports various functions such as clinical decision support, and diagnostics and treatment planning. In the Philippines, software company Dashlabs.ai automates processes for customers, such as having small laboratories and hospitals streamline diagnostics and reporting, allowing healthcare professionals to focus on core tasks rather than manual data entry.

One capital provider interviewed for this study emphasised the strategic importance of integrating healthcare data infrastructure across institutional boundaries, particularly in settings where AI-driven analytics can improve consultation accuracy and reduce inefficiencies. Startups such as Holmusk, operating in Singapore and the U.S. apply big data analytics to enhance HIM and EMR systems, particularly in behavioural healthcare to enable more personalised and evidence-based clinical interventions.

Furthermore, interoperable data systems support remote patient monitoring (RPM), increasingly important for chronic disease management and post-acute care. RPM technologies rely on the seamless flow of real-time patient data between individuals and providers, making interoperability a prerequisite for effective implementation. When integrated with EMR platforms, RPM can support early detection of health issues, enable timely interventions and reduce the burden on hospital systems.

5. **Reducing operational inefficiencies**

Related Challenge: Fragmented healthcare payments and persistent supply chain inefficiencies.

Operational inefficiencies, particularly in payment processing and pharmaceutical supply chains, hinder service delivery, elevate costs and erode trust among patients and providers. The UNDP SDG Investor Maps highlight "Digitising Healthcare Payments" in the Philippines as a high-impact investment opportunity.[76] These platforms, particularly those focused on B2B applications, facilitate automated claims processing and payment workflows, contributing to system efficiency and inclusion.

Innovations such as MiyaHealth's MiyaPayor, a Singapore-based SaaS platform, are streamlining insurance claims and reimbursements, reducing manual errors and administrative complexity for both insurers and patients. Zuellig Pharma's eZTracker is a blockchain-enabled application that authenticates medication in real-time, ensuring its legitimacy and protecting patients from counterfeit products, a persistent issue in fragmented distribution networks.

3.3.2. Recommendations to scale inclusive healthcare innovation

To meet the growing needs for inclusive healthcare, barriers such as fragmented data systems, unclear reimbursement pathways and underinvestment in local health infrastructure must be addressed.

While this section focuses on healthcare, many scale-related challenges, such as capital alignment, policy coordination and digital trust, are pertinent in different sectors. More holistic system-level recommendations are outlined in Chapter 4.2. These strategic interventions below are tailored to health system transformation, supporting the integration of digital innovation into inclusive, people-centred care models.

1. **Localise data with shared standards for personal care**

   SEA must invest in locally-relevant data ecosystems to advance personalised medicine and diagnostics. This includes building regionally representative genomic datasets and establishing validation protocols for AI models trained on SEA populations. Cross-border data sharing at research and clinical levels require robust and aligned data privacy governance and systems. Public–private research hubs and shared genomic infrastructure are critical to ensure equity in precision health.

2. **Establish national and regional frameworks for telehealth integration**

   Scaling telemedicine and hybrid care models depends on regulatory clarity, integration with existing health systems and fair reimbursement. Policymakers can advance digital healthcare solutions within national health strategies, define standards for remote care delivery and ensure that virtual consultations are recognised in health insurance schemes.

3. **Build interoperable health information Infrastructure**

   Governments must invest in interoperable clinical data infrastructure sub-nationally, nationally and regionally to support real-time care coordination and AI-enabled analytics. This includes standardising EMR protocols, enabling secure data exchange across facilities, and supporting shared platforms for behavioural and chronic disease monitoring.

4. **Modernise claims and supply chain systems through smart contracts and AI**

   Fragmented claims processing and medicine distribution can be addressed through intelligent automation. Governments and insurers should adopt smart contract frameworks for healthcare claims, while investing in digital track-and-trace infrastructure to improve supply chain transparency and reduce fraud.

5. **Enable inclusive innovation through 4P health platforms**

   Health innovation at scale requires collaboration across public agencies, private providers, philanthropic funders and communities. Governments can lead with regulatory alignment and public infrastructure, private actors can scale innovation through service integration, philanthropic capital can fund data governance and trust-building initiatives, and communities play a critical role in digital health literacy and feedback.

3.4 Common Factors for Success

> "Southeast Asia isn't one market—each country is at a different stage of growth with unique cultures. This diversity poses challenges for outsiders, but it also creates opportunities. The challenges are significant, but the opportunities are even greater."
>
> **- Atsushi Taira, Managing Director, Mistletoe**

Across financial inclusion, agriculture and healthcare, the most impactful solutions are those attuned to local conditions and constraints, not those with the most advanced features. The greatest value and impact is often realised when digital solutions adapt to the realities of the communities it serves. This is not a call to limit ambition but to recognise that relevance is a precondition for scale. In a region as diverse as SEA, fit-for-purpose solutions consistently outperform frontier technologies that lack contextual grounding.

For example, in agriculture, digital advisory tools that function reliably on basic mobile phones and low-bandwidth networks are more effective than data-intensive platforms that require high connectivity. In financial inclusion, digital wallets supported by human agents build greater adoption than app-only solutions, especially among first-time users. Inclusive healthcare platforms, particularly those designed with offline functionality and simplified interfaces, help to extend reach into rural communities with limited infrastructure and diverse user needs.

3.4.1. Connecting fragmented markets

SEA's diversity demands a contextualised approach to technology deployment. Regulatory environments, cultural dynamics, user habits and infrastructure capacity differ significantly across countries, making standardised models difficult to replicate. While markets like Indonesia, the Philippines, and Vietnam are sufficiently large to sustain domestic innovation and offer strong foundations for scale, the region is also becoming increasingly interconnected through cross-border digital platforms, regional investment flows and integration initiatives.

Firms that can adapt to local conditions and connect markets across SEA are uniquely positioned to turn diversity into strength, contributing to a more inclusive, scalable digital sustainability ecosystem.

3.4.2. Enabling local decision-making at scale

Sectoral examples in this chapter reveal that the most impactful digital solutions empower timely, localised decision-making based on real-time data. In agriculture, platforms translated satellite and sensor inputs into instant, tailored guidance for smallholder farmers. In healthcare, remote monitoring tools allowed frontline workers to adjust care plans in real time. In finance, behavioural analytics enabled instant credit assessments to underserved borrowers.

These examples show that impact is more likely to be realised with systems that distribute useful information and decision power to the end users, thus building user trust while helping services adapt to local conditions in real time.

Across all three sectors, locally-grounded approaches that integrate contextual knowledge, community relationships and physical infrastructure were more likely to succeed, suggesting that aggregation models that connect and coordinate existing players can complement a platform approach for digital sustainability.

3.4.3. Hybrid models bridge digital and human interfaces

A recurring theme across sectors is that technology alone is rarely enough to reach the most marginalised. As highlighted in Section 2.2.1, delivery models that blend the scalability of digital systems with the trust and flexibility of human interactions are necessary to reach lower-connectivity, lower-literacy and lower-trust environments. These hybrid models do more than just bridge access gaps—they create a more adaptable, resilient form of service delivery.

In financial inclusion, agent networks play a critical role in helping first-time users navigate mobile wallets, build confidence and access support in real time. In agriculture, agri-extension workers help farmers interpret digital advisories, apply new techniques and troubleshoot local issues. In healthcare, telemedicine platforms are often paired with community health workers or in-person clinics to ensure continuity of care and follow-up.

3.4.4. System change requires a systems approach

The digital solutions explored in this chapter demonstrate that sustainable impact relies less on isolated sectoral innovations and more on the strength of the shared systems that support them. Digital health tools, for example, scaled faster where national eID systems enabled secure patient records. Financial inclusion efforts advanced where real-time payments and KYC regulations were in place. Agricultural platforms gained traction where connectivity infrastructure and open data policies supported timely, localised advice.

Sustainability goals are similarly interlinked. Financial inclusion enables farmers to invest in sustainable agricultural practices, which improves both environmental outcomes and household nutrition. Better nutrition contributes to improved health outcomes, and healthier populations are more economically productive, thus enhancing financial well-being. This highlights the need for governments, private sector actors and development partners to adopt a holistic approach to digital sustainability.

4.
Scaling Digital Sustainability in SEA: From Readiness to Impact

> "The biggest blocker to scaling digital sustainability is often the fragmentation and lack of collaboration within the ecosystem. Many players run siloed programmes with their own programme brand names and this can limit collective impact."
>
> **- Andrew Buay, Vice President Group Sustainability, Singtel**

Looking ahead, SEA will need interconnected avenues of action to leverage its digital momentum to advance growth and sustainability. There is much room for greater collaboration across stakeholders. **Governments** provide digital public goods while establishing regulatory frameworks that balance innovation with appropriate safeguards. **Innovators, solution providers and companies** develop and deploy technologies and business models that create commercial value and achieve sustainability impact, often serving as the primary vehicle for scaling solutions. By strategically directing capital, expertise and influence, **investors** can be powerful catalysts in supporting digital sustainability and fostering more sustainable digital economy growth. **Other funders**, such as development banks and philanthropic organisations, supply patient, risk-tolerant and early stage capital, support capacity building, and fund market validation for early-stage innovations that may not yet demonstrate commercial viability, but hold significant impact potential. **Community groups** are partners in ensuring contextual relevance and appropriateness, building trust and supporting implementation, particularly for solutions targeting underserved or marginalised communities.

In fact, while 71% of capital providers who participated in this study report frequent collaboration with other private sector stakeholders, while only 13% engage regularly with government counterparts. Improving public-private coordination can inform policy and build readiness for innovation and adoption.

4.1 Community Groups

Community groups ensure that digital sustainability solutions are locally relevant, responsibly deployed and inclusively adopted, particularly among underserved populations.

Key actions:

- Facilitate grassroots engagement and co-design of solutions
- Support digital literacy initiatives and trust-building at the community level
- Act as verification and implementation partners for pilot programmes
- Provide feedback mechanisms to ensure continuous adaptation and improvement

4.2 Innovators and Solution Providers

Innovators can advance digital sustainability by developing solutions that are accessible, affordable and contextually relevant, bridging gaps across sectors.

Key actions:

- Design right-sized, right-priced digital solutions that integrate trust-building mechanisms and local knowledge
- Implement hybrid delivery models combining digital and offline engagement
- Participate in regulatory sandboxes and develop standards to shape responsible innovation
- Leverage interdisciplinary innovation, blending technology with business, policy and finance insights

4.3 Capital Providers

Capital providers are crucial in addressing funding gaps for early-stage and scalable digital sustainability innovations. Their role includes de-risking investments through blended finance structures and mainstreaming digital sustainability in investment theses.

Key actions:

- Allocate catalytic capital to high-impact sectors and blended finance vehicles
- Participate in co-investment platforms and cross-border funding initiatives
- Align due diligence and reporting frameworks with sustainability outcomes
- Support innovative financing instruments such as recoverable grants and sustainability-linked structures

4.4 Governments

Governments are pivotal in setting the foundations for digital sustainability by investing in digital public infrastructure, creating an enabling environment for innovation and aligning digital economy policies with sustainability objectives.

Key actions:

- Expand last-mile connectivity and develop an inclusive and interoperable digital public infrastructure
- Integrate digital transformation and sustainability strategies to ensure cohesive policy environments
- Utilise the full range of policy levers to protect public interest while fostering innovation

4.5 Regional Bodies

Regional bodies such as ASEAN play a key role in facilitating digital sustainability by advancing interoperability, harmonising regulatory standards and enabling regional initiatives.

Key actions:

- Advance ASEAN-level frameworks for digital public infrastructure, data governance and sustainable finance
- Establish sandbox corridors for multi-country testing and regulatory cooperation
- Support regional investment platforms and shared due diligence mechanisms
- Promote cross-border talent mobility and regional standards for measuring sustainability outcomes

4.6 Conclusion

SEA has a unique opportunity to shape the future of digital sustainability. Just as the region's digital ecosystem has demonstrated robust growth, it has the potential to identify use cases, develop fit-for-purpose solutions and scale efforts across borders to advance towards our shared sustainability goals. Successful implementation of these complementary avenues of action requires a concerted collaboration across stakeholders. Singapore, with its digital infrastructure, regulatory agility and active investment ecosystem is well positioned to serve as a digital sustainability living lab for SEA. It can also act as a launch pad and global hub for deploying digital innovation to accelerate sustainability growth, both within the region and for the world.

Appendix A – Research Methodology

Overview

Our research methodology involved a mixed method approach to explore how SEA's digital momentum can be leveraged for digital sustainability. This includes literature reviews focusing on policy, infrastructure and digital public goods, along with patent analytics to uncover emerging digital technologies. Surveys and interviews were conducted with capital and solution providers to gain insights into current practices and innovations, while case studies of successful digital sustainability models were analysed. The study examined foundational readiness through hypotheses related to innovations in technology, business, governance and financing. Corresponding analysis methods involved assessing enabling policies and infrastructure, identifying technology trends, evaluating digitally-enabled business models, and reviewing financing mechanisms and governance structures to highlight opportunities for scalable and sustainable digital innovation in the region.

Priority sector selection

This study employed sectoral selection methodology as a tool to assist stakeholders, such as policymakers, to determine which pivotal sectors experienced accelerated digital transformation with the potential to advance sustainability goals in SEA. This methodology was designed to assess relative importance between each sector in respect to the achievement level of sustainability goals, investment and funding potential, and digital innovation potential. The study identified three sectors—financial inclusion, food and agriculture, and healthcare—that are experiencing a transformative digital acceleration, with climate-tech as a cross-cutting enabler.

The quantifiable gap to sustainable and inclusive development in each sector

We provide the following rationale to explain each sector's relevance with the associated SDGs:

Sectors	SDGs directly impacted	Rationale	Sectoral rating
Financial Inclusion	1 No Poverty, 8 Decent Work, 10 Reduced Inequalities	Greater financial inclusion accelerates progress toward SDG 1: No Poverty, SDG 8: Decent Work and Economic Growth, and SDG 10: Reduced Inequalities, by equipping individuals and MSMEs with essential financial tools, services and knowledge to enhance livelihoods and drive social mobility.	4.53
Food and Agriculture	2 Zero Hunger, 3 Good Health and Well-being, 8 Decent Work, 10 Reduced Inequalities, 12 Responsible Consumption, 13 Climate Action, 14 Life Below Water, 15 Life on Land	The food and agriculture sector contributes to SDG 2: Zero Hunger, SDG 3: Good Health and Well-being, SDG 8: Decent Work, SDG 10: Reduced Inequalities, SDG 12: Responsible Consumption, SDG 13: Climate Action, SDG 14: Life Below Water and SDG 15: Life on Land by implementing sustainable agricultural practices, improving nutritional outcomes, providing employment opportunities and reducing environmental impacts across the entire supply chain.	5.89
Healthcare	3 Good Health and Well-being, 10 Reduced Inequalities	The healthcare sector drives progress toward SDG 3: Good Health and Well-being and SDG 10: Reduced Inequalities by delivering essential medical services, and preventive care and health education that improve population outcomes while addressing disparities in access and quality of care across socioeconomic groups.	5.74
Education	4 Quality Education, 8 Decent Work, 10 Reduced Inequalities	The education sector advances SDG 4: Quality Education, SDG 8: Decent Work and Economic Growth and SDG 10: Reduced Inequalities by equipping individuals with critical knowledge, skills and credentials that unlock economic opportunities, foster innovation and dismantle systemic barriers to social mobility across diverse demographic groups.	4.58
Renewable Resources and Alternative Energy	7 Affordable and Clean Energy, 9 Industry, Innovation and Infrastructure, 10 Reduced Inequalities, 11 Sustainable Cities, 12 Responsible Consumption, 13 Climate Action	Renewable resources and alternative energy drive progress toward SDG 7: Affordable and Clean Energy, SDG 9: Industry, Innovation and Infrastructure, SDG 10: Reduced Inequalities, SDG 11: Sustainable Cities, SDG 12: Responsible Consumption and SDG 13: Climate Action by accelerating the transition to low-carbon economies, creating green jobs and enhancing energy security while reducing environmental impacts.	5.03
Infrastructure	6 Clean Water and Sanitation, 7 Affordable and Clean Energy, 9 Industry, Innovation and Infrastructure, 10 Reduced Inequalities, 11 Sustainable Cities, 12 Responsible Consumption, 13 Climate Action	Infrastructure development catalyses advancement of SDG 6: Clean Water and Sanitation, SDG 7: Affordable and Clean Energy, SDG 9: Industry, Innovation and Infrastructure, SDG 10: Reduced Inequalities, SDG 11: Sustainable Cities, SDG 12: Responsible Consumption and SDG 13: Climate Action by establishing the physical and digital foundations that enable economic growth, social inclusion and environmental sustainability across urban and rural communities.	5.14

Sectors	SDGs directly impacted	Rationale	Sectoral rating
Technology and Communications	9 Industry, Innovation and Infrastructure, 10 Reduced Inequalities	Technology and communications contribute to SDG 9: Industry, Innovation and Infrastructure and SDG 10: Reduced Inequalities by developing transformative digital solutions, expanding connectivity and democratising access to information that bridge technological divides, and creating new pathways for economic participation and social inclusion.	5.19
Services	8 Decent Work, 10 Reduced Inequalities	The services sector advances SDG 8: Decent Work and Economic Growth and SDG 10: Reduced Inequalities by generating diverse employment opportunities, facilitating skill development and providing support to essential businesses that enables broader participation in the formal economy across various demographic groups.	5.37

*Calculated using the average of associated SDG rating from all of the SEA countries

The first step in the sectoral prioritisation framework quantifies SDG attainment gaps using a scoring system where achieved SDGs receive a value of 0 (indicating no immediate intervention required), challenges remaining are assigned a value of 3, significant challenges are valued at 5 and major challenges are designated with a value of 7, whilst data gaps remain unscored. This methodical assessment process aggregates performance across the relevant SDGs for each sector based on our established sector-SDG mapping, calculating mean values to generate comprehensive sector-specific ratings that systematically identify priority intervention areas, requiring strategic resource allocation and focused implementation efforts. By translating qualitative sustainability assessments into actionable quantitative metrics, this framework helps executive decision-makers to objectively prioritise sectoral investments that are aligned with the most pressing SDGs in the region.

The proven attractiveness of impact capital and conventional funding mechanisms

Our second step in the sectoral investment potential assessment leveraged the comprehensive UNDP SDG Investor Maps for SEA countries, developed by UNDP's Private Finance for the SDGs with CIIP support, to systematically evaluate investment opportunity alignment with SEA's sustainable development priorities. This analytical approach identified Investment Opportunity Areas (IOAs) through multiple dimensions including primary and secondary SDG impacts, return profiles, associated impact and business risks, IMP (Impact Management Platform) classification and supportive governmental policy frameworks, ultimately cataloguing 100 distinct IOAs across seven regional markets with varying sectoral distribution patterns.

The quantitative analysis of SEA's IOAs revealed three sectors with exceptional investment potential: food and beverage (24 IOAs) emerged as the predominant sector for impact investment, followed by healthcare, infrastructure and renewable resources (15 IOAs each), with financial services (14 IOAs) completing the high-potential domain cluster. This distribution pattern provides compelling evidence for strategic capital allocation priorities, highlighting these sectors as offering the most robust opportunities for investors seeking both financial returns and sustainability impacts within the region's unique development context.

The measurable potential of digital innovation and technology absorption capacity

The third methodological component employed sophisticated patent analytics by correlating IPOS data integration and SDG Investor Maps to systematically evaluate the digital innovation potential across priority sectors. This comprehensive assessment revealed significant sectoral variations in technological advancement, with healthcare demonstrating exceptional innovation scale (1.86 million patents filed between 2015-2024), followed by renewable resources (505,047 patents) and food and agriculture (452,918 patents), whilst financial services demonstrated remarkable digital concentration with 90.12% of its 186,320 patents specifically focused on digital technologies, significantly outpacing other sectors in digital transformation intensity.

Further refinement of the innovation potential analysis examined the digital capability characteristics of 100 identified Investment Opportunity Areas (IOAs) across SEA, revealing that 78% demonstrated either digital-native characteristics (30 IOAs) or high potential for digital innovation acceleration (48 IOAs). This pattern was particularly pronounced in the financial services sector (100% of IOAs exhibited strong digital transformation potential), followed by healthcare (73.3% with high digital potential), and food and agriculture (54.2% with high digital potential)-providing quantitative validation to prioritise these sectors as optimal domains for technology-enabled sustainability interventions within the regional context.

Summary of Sector Selection

Sector	SDGs directly impacted	Criteria	Gap to sustainable and inclusive development	Attractiveness for impact capital	Digital innovation potential
		Metric	SDG Index Score Average Rating	# Investment Opportunity Areas (IOAs)	Qualitative rating based on IPOS' tech innovation patent data & IOAs underpinned by digital business models
		Source	SDG Index (i.e., SDGs with challenges remaining across Southeast Asia)	UNDP SDG Investor Maps	IPOS' Patent Analytics and UNDP SDG Investor Maps
Education	4 Quality Education, 8 Decent Work, 10 Reduced Inequalities		4.58	10	Medium
Financial inclusion	1 No Poverty, 8 Decent Work, 10 Reduced Inequalities		4.53	14	Very High
Food and beverage	2 Zero Hunger, 3 Good Health, 8 Decent Work, 10 Reduced Inequalities, 12 Responsible Consumption, 13 Climate Action, 14 Life Below Water, 15 Life on Land		5.89	24	Medium
Healthcare	3 Good Health, 10 Reduced Inequalities		5.74	15	High
Infrastructure	6 Clean Water & Sanitation, 7 Affordable & Clean Energy, 9 Industry, Innovation, & Infrastructure, 10 Reduced Inequalities, 11 Sustainable Cities, 12 Responsible Consumption, 13 AClimate Action		5.14	15	High
Renewable resources and Alternative Energy	7 Affordable & Clean Energy, 9 Industry, Innovation, & Infrastructure, 10 Reduced Inequalities, 11 Sustainable Cities, 12 Responsible Consumption, 13 Climate Action		5.03	15	High
Services	8 Decent Work, 10 Reduced Inequalities		5.37	4	Low
Technology and Communications	9 Industry, Innovation, & Infrastructure, 10 Reduced Inequalities		5.19	3	Very High

Source: Analysis by TFGI, CIIP and IPOS International, 2025

The sectoral prioritisation matrix methodology resulted in three priority areas identified—financial inclusion, food and agriculture, and healthcare—demonstrating exceptional potential for digitally-accelerated sustainability outcomes across SEA, each characterised by distinct regional nuances and transformation pathways.

The financial inclusion sector emerges as a critical enabler of socioeconomic development, leveraging digital innovation to enhance financial access for underserved populations throughout SEA. This sector demonstrates remarkable digital transformation characteristics, with 100% of IOAs exhibiting high digital potential and 90.12% of sectoral patents filed between 2015-2024, representing digital technology innovations. The sector's strategic importance is further underscored by its multidimensional contributions to poverty reduction (SDG 1), economic growth acceleration (SDG 8) and inequality mitigation (SDG 10) by providing essential financial mechanisms that enhance resilience and economic participation amongst vulnerable communities and MSMEs. Digital transformation within this sector—encompassing fintech innovations, digital banking platforms and strategic hybrid collaborations—creates unprecedented opportunities to develop inclusive financial ecosystems whilst simultaneously addressing persistent regional development challenges.

Concurrently, the food and agriculture sector demonstrated compelling transformation potential as a foundational economic pillar confronting critical challenges. These include productivity constraints, market fragmentation, ecological degradation and climate vulnerability. This sector exhibits extraordinary sustainability breadth through its impact across eight distinct SDGs, while commanding the highest representation in regional investment opportunities with 24 identified IOAs–54.2% of which demonstrate significant digital innovation potential. The sector's technological advancement trajectory is substantiated by approximately 452,918 patents filed between 2015-2024, establishing a robust foundation for digitally-enabled sustainability interventions. Particularly noteworthy are emerging "*phygital*" business models that strategically integrate digital capabilities with physical agricultural systems to enhance smallholder farmers integration, productivity optimisation and environmental sustainability throughout agricultural value chains—addressing multiple regional sustainability imperatives simultaneously through coordinated technological deployment.

Capital Provider Survey Methodology

Survey is conducted towards capital providers, including impact investors, non-impact investors and philanthropic grant givers. The data collection was finalised by 10 April 2025.

Respondent Demography

Funders survey demography (N=72).

Type of organisation	Private Investor (e.g., Private Equity (PE) / Venture Capital (VC))	42
	Philanthropic Organisation (e.g., Corporate Foundation)	13
	Asset Manager	6
	Others*	11
Regions**	Southeast Asia	62
	Broader Asia Pacific (excluding Southeast Asia)	47
	North America	24
	Europe	19
	Sub-Saharan Africa	15
	Middle East and North Africa (MENA)	14
	Latin America	11
Fund size	<$10M	7
	$10M - $50M	9
	$50M - $100M	7
	$100M - $500M	14
	Over $500M	23
	Prefer not to reply	12
Average ticket size	<$500k	12
	$500k - $5M	32
	$5M - $25M	15
	$25M - $50M	5
	>$50M	2
	Prefer not to specify	6
Impact focus	Impact Investor	49
	Philanthropic Grant Giver	11
	Non-Impact Investor	12

Primary funding approach	Concessional Investor	9
	Philanthropic Grant Provider	11
	Commercial Investor	37
	Hybrid Approach	13
	Others (Please Specify)***	2
Type of instruments deployed**	Equity	60
	Debt	45
	Convertible Debt	33
	Grant	19
	Mezzanine	11
	Revenue-Based Financing	4
	Other****	2

*Others include development finance institutions (DFIs), entrepreneur support organisations, corporates with an impact investing practice, institutional asset owners, and family offices.
**Multi-select question.
***Others include investing in synergistic/ecosystem opportunities that strengthen the overall value proposition of the group's offerings and being primarily a commercial investor, but as a corporate VC, also some strategic aspects to investments.
****Others include guarantee and blockchain-enabled financing.

Expert Interview Methodology

The research methodology further incorporated in-depth interviews with capital and solution providers to garner rich perspectives on how SEA can strategically leverage its digital momentum to advance regional sustainability objectives, whilst simultaneously contributing to global sustainable development efforts by functioning as a living laboratory and global hub for digital sustainability innovation. In the interview, digital sustainability is defined as the use of digital solutions, driven by innovation, to achieve sustainable outcomes aligned with the United Nations' SDGs.

Interview question for capital providers

Section 1: Funding Focus

1. Could you explain briefly your key markets in Southeast Asia and the specific focus of your funding activities there?
2. What are the key sector(s) for your digital sustainability funding and why are these areas a priority for you?
3 At what stage of funding maturity does your organisation typically participate in (e.g., seed, early, growth, mature, public) and why are these stages particularly important for your strategy?
4 How do you ensure your portfolio companies align with the SDGs and how do you measure the impact of your funding (e.g., internal metrics, external frameworks, or third-party evaluations)? Could you share examples of frameworks, IMM tools, or metrics you rely on?

Section 2: Perspectives on Digital Sustainability and Innovation

5. Which sectors or technologies do you believe will be game-changers for sustainability in Southeast Asia over the next 5-10 years? Follow-up: How do you see the role of (impact) investors evolving in driving digital sustainability in the region?
6. As an investor, how do you determine whether a solution is ready to move from the innovation stage (e.g., pilots, smaller scale deployment) to scaling? What factors or metrics guide your decision? Follow-up: Have you encountered situations where scaling a solution prematurely impacted its success or sustainability? What were the key lessons learned?
7. Which stakeholders do you collaborate with most frequently to drive digital sustainability? For example, governments, private sector, or NGOs. What is the primary purpose of these collaborations? Follow-up: Are there opportunities for stronger collaborations with governments, corporates, or other stakeholders?

Section 3: Ecosystem Needs and Challenges

8. What challenges does your organisation face when investing in digital technologies for sustainability in Southeast Asia? For example, regulatory hurdles, high upfront costs, or lack of viable projects?
9. What do you think needs to change in the investment ecosystem to better support digital sustainability in Southeast Asia?

Interview question for solution providers

Section 1: Solutions and Technology Focus

1. Could you describe your primary solutions or initiatives and how they contribute to achieving sustainable development goals (SDGs) in Southeast Asia?
2. What type of digital technologies do you use or focus on in your solution or initiative?

Section 2: Impact and Scaling

3. How do you ensure your solutions create measurable and meaningful impact and what tools or metrics do you use to track progress? What factors or conditions do you consider before scaling your solutions across new communities, markets, or sectors? Follow-up: Have you encountered challenges when scaling and what key lessons have you learned?
4. What kind of support—whether from investors, policymakers, or other stakeholders—would most help accelerate the adoption and scaling of your solutions?

Section 3: Perspectives on Digital Technologies

5. What digital technologies do you think have the potential to address sustainable development challenges in Southeast Asia today? What pain points does the region face that can be addressed by digital technologies?
6. What emerging trends or technologies do you believe have the greatest potential to transform digital sustainability in the next 5-10 years (in the region and globally)?
7. What role do you see your organisation playing in shaping the future of digital sustainability in Southeast Asia?
8. What advice would you give to others in the solution-provider space who are looking to contribute more effectively to sustainability outcomes?

Section 4: Ecosystem and Collaboration Needs

9. How would you assess Southeast Asia's readiness to adopt digital technology solutions? What are key gaps and what's needed to address?
10. What ecosystem barriers (e.g., regulatory hurdles, funding gaps, technological limitations) do you believe must be addressed to better support the adoption of your solutions in Southeast Asia?
11. Who are your key collaborators (e.g., governments, private sector, NGOs) and how do these partnerships enhance the reach or impact of your solutions? Follow-up: Are there areas where stronger collaboration could help you amplify your impact?

Patent Analytics

Patent analysis was conducted to generate insight on the trend of emerging technologies and prioritised sectors, including financial, food and agriculture, and healthcare. Patent data was also used as criteria for priority sector selection.

Dataset

The final dataset was retrieved on 23 Feb 2025 and comprises worldwide patent applications published from 2015–2024. The data was retrieved from the Questel FAMPAT database.

Counting of inventions

Inventions are counted based on unique patent families.
A patent family represents a group of patent applications linked to the same invention. Analysing unique patent families provides a more accurate reflection of innovation productivity, as counting individual patent applications can result in double counting. This occurs when multiple publications are filed for the same invention across various jurisdictions.

Grouping of inventions into technology domains and areas

Individual inventions were classified into the respective technology categories, domains and areas using a combination of patent classification codes, text-mining and semantic analysis of the patent specifications, particularly claims, titles and abstracts.

Appendix B – Green Finance

Green finance plays an increasingly important role in supporting environmentally sustainable projects and business practices, such as encouraging the development of green projects or minimising impact on the climate of regular projects.

Examples of green finance projects include renewable energy and energy efficiency, green buildings, circular economy initiatives, and sustainable use of natural resources and land. Such financing can be extended to an array of recipients, from small- and medium-enterprises looking for financing to support the development of sustainable practices and reporting capabilities, to large infrastructure projects.

Common green finance instruments include:

- Green bonds, which are financial instruments that finance green projects and provide investors with regular or fixed income payments. The green bond market has also seen substantial growth globally. The International Capital Market Association has issued Green Bond Principles, a set of voluntary guidelines that outline that bonds should adhere to stringent criteria concerning project evaluation and selection, management of proceeds and offering detailed reporting. For example, In 2020, the Indonesia-headquartered Star Energy Geothermal (Dajarat II) Ltd issued a US$790 million green bond, with proceeds used to finance and refinance geothermal projects and assets.
- Sustainability-linked bonds, by contrast, are financial instruments that are structurally linked to the issuer's achievement of climate or broader sustainable development goals. Progress, or lack thereof, toward achieving these predetermined goals can increase or decrease an instrument's coupon. For example, in 2023, WHA Corporation issued the first sustainability-linked bond under the ASEAN Sustainability-Linked Bond Standards. The bond raised THB4 billion (US$117 million) and is linked to KPI achievements, including Scope 1 and 2 greenhouse gas emission intensity reduction, raw water consumption reduction and reducing reliance from natural sources by increasing reclaimed water production.

- Green sukuks are Shariah-compliant financial instruments that are also used to fund green projects. Unlike bonds, sukuks are interest-free and generate returns to investors through an agreed share of profits generated by underlying assets. Green sukuks are also compliant with green bond standards. For example, in 2017 Tadau Energy issued the world's first green sukuk linked to sustainable and responsible investment at RM250 million (US$56 million) in Malaysia. The sukuk was used to finance large-scale solar photovoltaic plants in Kudat, Sabah.
- Green loans are a form of financing that lets borrowers use the proceeds to exclusively fund projects that have a larger environmental objective. For example, BDO Unibank issued a PHP2 billion (US$34 million) green corporate loan to Alternergy Holdings Corporation in 2023, financing its renewable energy construction projects in Rizal, Quezon, and Bataan in the Philippines.
- Sustainability-linked loans, by contrast, are loans where margins are linked to predetermined sustainability performance targets on the part of the borrower. These targets are pre-selected, core and material to the borrower's business. For example, in 2023, City Developments Limited (CDL) received a sustainability-linked loan from OCBC, with interest rate incentives pegged to annual decarbonisation targets. The £200 million (US$258 million) sustainability-linked revolving credit facility was used for refinancing, general corporate funding and working capital purposes, and maintained its alignments with CDL's commitment to achieve operational net zero by 2030 for its new and existing wholly-loaned assets and developments under its direct operational and management control.

In the digital sustainability space, green financing can play a key role in funding digital solutions that address pressing environmental and climate challenges, such as AI-powered smart grids for renewable energy management, blockchain-enabled carbon tracking systems and IoT-based precision agriculture to reduce resource consumption. Green finance can bridge the gap between digital innovation and environmental sustainability, and create scalable impact while meeting the growing demand of impactful investment opportunities. As both fields continue to evolve, its convergence offers promising pathways to accelerate the transition toward a sustainable and inclusive economy.

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