



WHITE PAPER

four key technologies that make tomorrow



Research insights by



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foreword

NCS has proudly partnered with the Singapore Government on its pioneering computerisation and informatisation efforts since the 1980s and 1990s. These initiatives not only improved public sector productivity but also catalysed the growth of a vibrant ICT industry, laying the groundwork for Singapore's transformation into a 'Smart Nation'. By the 2000s, Singapore consistently ranked among the top in the World Economic Forum's Global Information Technology Report, capitalising on the rise of mobile and cloud computing to shape the digital era.

Today, we stand at the dawn of a new chapter—the 'intelligence-led' era—driven by the rise of artificial intelligence (AI), particularly Generative AI (GenAI). In December 2023, Singapore launched its National AI Strategy 2.0, marking a shift in AI from an opportunity to a necessity, from local solutions to global impact, and from individual projects to interconnected systems. NCS remains a key player in this transformative phase, committed to leveraging these emerging technologies to benefit the communities we serve, both in Singapore and across the Asia Pacific (APAC) region.

In this series of articles featuring research by IDC, we explore four related but distinct technology areas that NCS has identified as game-changing and transformative for business models and operations:

- 1. Everything AI: From opportunity to necessity** – AI's evolution from a promising technology to an indispensable driver of productivity growth and competitiveness.
- 2. The immersive, experience-centric future of work** – The future of work reshaped by immersive technologies that enhance collaboration, productivity, and employee engagement.
- 3. Rebalancing AI and the sustainability challenge** – The integration of AI with sustainability, ensuring that technology advances responsibly while addressing environmental concerns.
- 4. Digital Trust: The bedrock of innovation** – Building and maintaining trust in AI systems, ensuring their reliability, transparency, and ethical use.

These areas, while all AI-related, are distinct in their applications and potential for transformation. Each article in this collection offers insights into how these technologies are not just shaping industries but also redefining the future of work, sustainability, and digital trust. Importantly, they reflect NCS' dedication to leveraging them to make tomorrow better for all.

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acknowledgement

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Shaowei Ying

Chief Scientist, NCS



Shaowei Ying coordinates the efforts of NCS' centres of innovation and centres of excellence, including leading one or more of these centres. He builds a global network of technology experts and research institutions which NCS leverages to accelerate client development and delivery work.

Shaowei champions selected innovation programmes or practices by providing executive sponsorship and directing investment funding. He also provides advice to the NCS corporate strategy on new potential market spaces and technology trends to invest and innovate in. Equally important is Shaowei's role in developing the Voice of NCS on emerging technologies and helping to radiate NCS' long-term perspectives on important technology topics that impact businesses.

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four key technologies that make tomorrow

Key summary

This NCS Tech Bets white paper delves into four game-changing technology areas shaping the trajectory of digital enterprises and governments towards sustainable growth:

- Everything AI: From opportunity to necessity
- An immersive, experience-centric future of work
- Rebalancing AI and the sustainability challenge
- Digital trust: The bedrock of innovation

Introduction

Today's business leaders and policy makers have one job in common. It is to navigate change in a post-pandemic world as digital proliferation continues to disrupt business models, and companies face destabilising forces stemming from macro externalities. Confronted by continued economic uncertainties, rising cybersecurity threats, supply chain disruptions, persistent talent gaps, and energy shortages, businesses have no choice but to capitalise on change to grow.

IDC research shows that organisations with a holistic approach, a strategic vision, long-term road maps, and astute leadership tend to outperform the rest. Leading organisations in their fields have seen improvements of between 10 and 16 percentage points in business outcomes, including customer satisfaction, workforce productivity, innovation, and sustainability¹.

In today's pursuit of innovation, central to any successful transformation is how an organisation creates value using data, AI, and other transformational technologies. The explosive growth of Generative AI (GenAI) has catalysed wide-reaching effects beyond the realm of AI, with the potential to reshape the digital economy.

IDC estimates that by 2027, AI's global economic impact will reach US\$11 trillion against a projected US\$521 billion in investments. This marks a 21x impact per dollar invested, making AI a game changer across industries including healthcare, manufacturing, banking, and public sectors. Organisations now have functional leaders, including marketing, finance, human resource, security and technology, working on GenAI proofs of concept (PoC) to explore use cases and their potential benefits, according to IDC's *C-Suite Sentiment Survey 2023*.

Compared to past technological innovations, GenAI represents a significant leap forward in data-driven learning and cognitive augmentation to make transformative change possible. To transform using AI, companies must align initiatives with strategic priorities, establishing governance policies, and upskilling workforces. Businesses must also upgrade their data management capabilities and infrastructure by adopting an enterprise intelligence architecture that caters to AI workloads.

These efforts to embrace AI are laying the ground for everything AI, an era in which enterprise intelligence is widely accessible through the proliferation of AI models and AI-infused applications. This involves the widening of 'narrow AI' into fit-for-purpose AI agents and specialised models across multiple domains.

Specifically, the fusion of AI in domains of cybersecurity, workforce augmentation, and sustainability are foundational for driving positive change. These include using AI to enable immersive experiences for the digital workforce, power green technology for sustainable practices, and enhance cybersecurity capabilities for digital trust.

The shift to data

In 2019, IDC recorded the shift in enterprise infrastructure workloads as data management workloads overtook business applications workloads.

By 2027 data workloads will be 40% higher than business applications signifying the era of *everything AI*.

The upshot is that business leaders and policy makers must navigate change by using these capabilities to rewrite past playbooks and drive business transformation.

As Einstein said, “We cannot solve our problems with the same thinking we used when we created them.” This paper lays out the impetus for sustainable growth with *everything AI* by becoming *digital enterprises*, organisations that are distinguished by their foundational use of digital technologies to create a data-centric foundation to fuel value-creation activities.

The digital impetus: Driving sustainable growth

Financial performance, while still critical, is no longer the sole measure of success. A broader set of leading indicators encompassing areas such as customer experience, operational efficiency, innovation, and sustainability provides a more holistic view of performance and the returns on technology investments. These yardsticks serve to demonstrate that strategic initiatives are making the desired impact beyond near-term financials to enable sustained growth.

With the pace of technological change faster than ever before, sustaining growth is synonymous with capitalising on change. This requires an enterprise to continuously derive value from core business activities, while symbiotically benefitting from and contributing to all its stakeholders, within the enterprise, the broader ecosystem as well as the larger society and the environment. A business that forms codependent relationships with its constituents enables it to be more agile and resilient in times of rapid change. This expanded impact perception is driving a new digital agenda. Figure 1 illustrates four tenets driving the modern enterprise’s digital agenda.

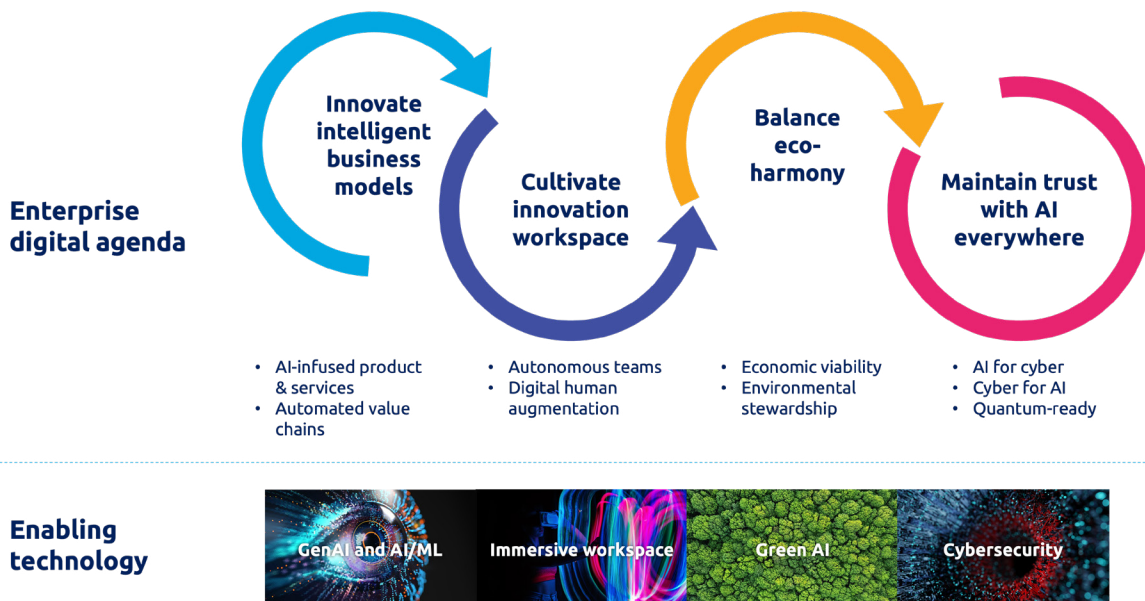


Figure 1: Digital enterprises' impetus for sustainable growth | Source: IDC, 2024

By 2028, the overall economic impact of AI will neutralise, as organisations overcome initial disruption and refocus resources on innovation and new business opportunities, fuelling economic expansion.²

By 2027, 40% of current job roles will be redefined or eliminated across top Asian 2000 organisations accelerated by GenAI adoption.³*

By 2027, due to increased focus on climate risk, 80% of all sustainability-related services engagements will include a climate risk component, a 30% increase from the present.⁴

By 2026, 25% of organisations will utilise AI-enabled risk and compliance solutions to continuously monitor data in real time to predict noncompliance internally or from third-party associations.⁵

*A2000 — the largest 2,000 enterprises, by revenue size, headquartered in APAC

- **Adoption of GenAI/AI to innovate business and operating models.** Productivity benefits from near-term GenAI/AI innovations are expected to be neutralised over the next few years. Organisations that build upon their data foundation to create AI-infused products and services will gain a competitive edge, especially those that also use intelligence to automate workflows and orchestrate their value chain. To that end, organisations must overcome challenges hindering wider AI adoption, such as enabling AI life-cycle management, protecting data assets, and ensuring AI systems operate in a secure and responsible manner for positive business impact.
- **Cultivating tomorrow's workforce using immersive and intelligent workspace.** Organisations must proactively address AI-driven disruptions in work models with redefined job roles and skills. As tasks are increasingly automated, critical job skills necessary for value creation will shift towards critical thinking, creativity, and team collaboration. At the same time, proliferation of AI agents and copilots will introduce new opportunities and challenges to established ways of working. Investments in intelligent workspaces enabled by mixed reality technologies, and digital human augmentation will pave the path for a collaborative and innovative workforce essential for business transformation.
- **Rebalancing economic and sustainability goals with green technology.** Organisations will also need to address the growing evidence of climate-related losses, infrastructure damage, and supply chain disruptions that call for eco-harmonious business practices to balance economic and sustainability goals. Today, more than 80% of the economic burden from natural disasters is borne by APAC governments in the form of healthcare support, economic subsidies, rebuilding of destroyed or damaged infrastructure, and so forth. Government regulations play a key role in driving climate risk considerations and private sector investments into green technology to ensure environmentally responsible operations and value creation.
- **Maintaining digital trust using AI and for AI.** AI safety and protection against AI-related threats continue to receive increased regulatory and public scrutiny. The proliferation of AI and increased digital connectivity are exacerbating the rapidly evolving threat landscape, outpacing traditional detection, response, and protection measures. That said, AI has democratised the security landscape, empowering organisations with tools to keep pace with compliance requirements while using these capabilities to continuously protect the data that feeds into AI models and AI-driven operations, products, and services.

The continuous interplay between these four forces will create a reinforcing virtuous cycle of growth. This is achieved when an organisation elevates its workforce to act within dynamic business ecosystems imbued with process intelligence necessary to further its transformation.

Going slow to grow far: Becoming a digital enterprise for a new era

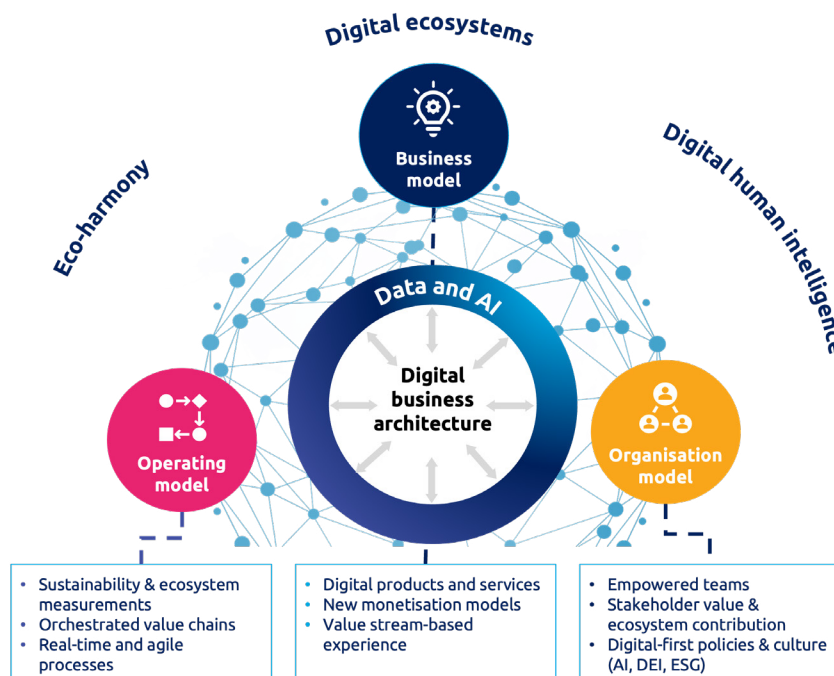


Figure 2: IDC's Digital Enterprise Framework | Source: IDC, 2024

Every organisation will increasingly be challenged to keep pace with change. It is therefore critical to create a data-centric foundation that forms the bedrock for enterprise intelligence to drive value creation.

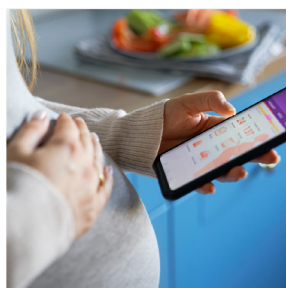
The goal is to gain AI-infused capabilities to transform every part of the business, from redefining business models and core operations to having digital capabilities to attract the right talent, as illustrated by IDC's Digital Enterprise Framework (see Figure 2). Making appropriate digital infrastructure investments ensures seamless connectivity and enterprisewide intelligence for data-driven decision-making and trusted outcomes which are key to the success of digital enterprises.

"It's not about creating a digital strategy for our business but about creating a business strategy for a digital world."

Lidia Fonseca

Chief Digital & Technology Officer,
Pfizer

Four distinguishing characteristics of a digital enterprise



Australia

Uses digital business models to create and capture value

A leading fertility care service provider is developing an AI-enabled fertility-as-a-service business model to reach underserved customer segments. The innovation aims to expand fertility services by embedding individualised fertility prognosis into AI-enabled digital services to lower the cost to service and allow care providers to focus on high-value patient interactions.



Hong Kong

Empowers an intelligent workforce

A global bank combats trade fraud by using AI/ML to augment its fraud management team. The embedded fraud intelligence uncovers hidden links between business entities to identify potential illicit activities to reduce staff investigation time and reduce false positives. The capability enables the bank to increase trade volume while keeping fraud losses in check.



Indonesia

Embeds agile and sustainable practices in operations

An oil and gas contract mining service provider improved its truck fleet utilisation and fuel usage ratio by measuring the real-time performance and coordinating the operations of its mining sites through an integrated mining operational command and control platform.



Singapore

Shifts from data processing to data-driven models

A global pharmaceutical distribution company launched an intelligence-as-a-service platform to provide its healthcare customers with data-driven actionable insights. The platform incorporates machine learning and predictive analytics to enhance its supply chain management, performance measurement, and demand forecasting across its business ecosystem and channel partners.

Figure 3: Real-world examples of digital enterprises

IDC's research shows that organisations are leveraging technologies such as GenAI and AI/ML, immersive workspace, green AI, and cybersecurity to innovate intelligence-infused business models, enable an innovative workforce, balance economic and sustainability goals, and maintain digital trust.

Today, most APAC organisations have embarked on this journey. About 66% of APAC organisations have developed a digital strategy and are in the process of transforming portions of their businesses.⁶ Another 18% have already deployed digital technology at scale organisation-wide.

Market demands are driving up corporate investments in digital technologies to enhance their digital business models and strengthen their digital capabilities to achieve sustainable growth. IDC projects that APAC organisations' spending on digital technology will grow at 5x the economy in 2024,⁷ paving the way towards sustainable growth.

The call for digital leadership

“The best way to predict the future is to create it.”

Peter Drucker

Management consultant, educator, and author

Effective digital leadership is crucial in harnessing technology to building a better tomorrow for one and all. This white paper lays out the vision for how business and technology leaders and policy makers can build momentum over time through coordinated and focused efforts to transform into digital enterprises.

Through strategic investments, supportive regulations, and partnerships, organisations can develop capabilities for sustained growth while safeguarding digital assets and maintain stakeholder trust to thrive in this new era of *everything AI*:

- Envision a future state of the enterprise that creates shareholder and stakeholder value encompassing your workforce, ecosystem partners, the society, and the environment.
- Develop the future state of digital business architecture that fuses the business and technology strategies by exploring the ‘art of the possible’ in using technology to redefine business, operating, and organisational models.
- Formulate a digital road map that paves the way for business transformation. Invest in foundational capabilities (i.e., data and AI foundation, employee workspace, green technology, cybersecurity) and extend digital capabilities to accrete benefits over time horizons.
- Leverage strategic technology vendors and service providers to build and buy a mix of digital capabilities that differentiate while maximising time to market.



everything AI: from opportunity to necessity

Key takeaways

- APAC's AI spending is projected to reach US\$88 billion by 2027.
- While GenAI is propelling AI to new heights, it is not the only form of AI driving today's software-led revolution.
- About 64% of organisations in APAC are in the middle stages of maturity, focusing on specific use cases.
- Technology limitations, skills shortages, and compliance issues are significant barriers to AI adoption.
- A strategic approach to AI adoption involves investing in talent, aligning AI initiatives with business objectives, and ensuring a robust tech infrastructure.

Introduction

2024 marks another pivotal year as enterprises accelerate their adoption of AI, not only for operational efficiencies and productivity but also innovation and sales. Rapid prototyping of new products for faster time to market is now the number 2 reason for adopting AI, while identifying market opportunities for new revenue growth ranks sixth (see Figure 4).



Figure 4: Top AI adoption drivers for 2024 | Source: IDC's Data-driven Intelligence Enterprise Survey, 2023

APAC organisations' AI spending will reach US\$88 billion by 2027, registering a CAGR of 28.2% from 2022 to 2027

Following billions of dollars in investment by the biggest technology companies across the globe, APAC enterprises are riding AI's swelling wave with no end in sight. According to IDC's projections, APAC AI spending will reach US\$88 billion by 2027, registering a CAGR of 28.2% from 2022 to 2027.

What was once seen as opportunity is now a necessity. Driven by strong government support, private and public sector collaboration on technology investments, and a growing understanding of AI's potential, the expanded landscape of opportunities for nations at every level cannot be ignored.

State of AI adoption in APAC

In terms of AI/ML adoption, the APAC region exhibits diversity, and maturity levels vary considerably. Early adopters like Australia, Singapore, Japan, and South Korea continue to invest and learn, fostering a sustained positive change and growth cycle. Developing countries like India, with robust governmental initiatives and support, a vast talent base, and enterprises proactively embracing AI, are accelerating their AI investments.

As shown in Figure 5, a majority of organisations in the APAC region fall within the middle stages of maturity, where AI is utilised for specific use cases rather than being integrated across processes to maximise business value. About 64% have either leveraged AI/ML in some areas of their businesses or have already seen quantifiable improvement in selected use cases.

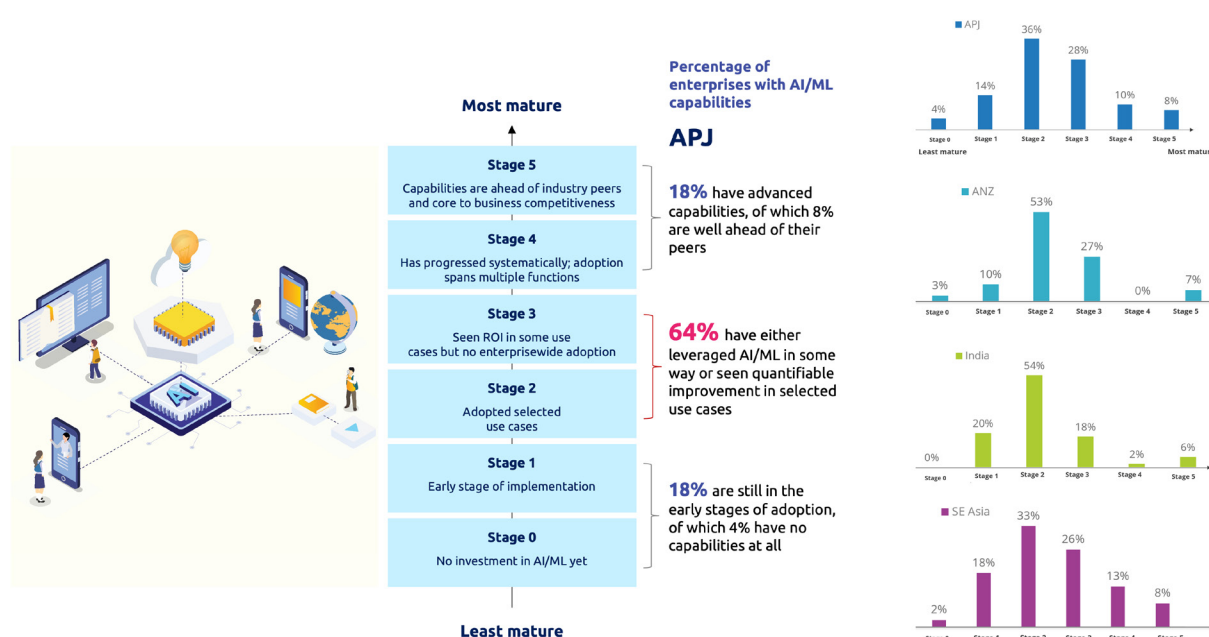


Figure 5: AI-ML-related capabilities of APJ organisations
Source: IDC's Data-driven Intelligence Enterprise Survey, 2023

Amid widespread application of AI across industries, including knowledge management, cybersecurity, chatbots, and AIOps, industry-specific AI use cases hold even greater significance. These targeted applications of AI address the distinct challenges and opportunities within different sectors, such as:

- Healthcare:**
AI is instrumental in disease detection and diagnosis, enhancing patient care and outcomes. AI systems can predict the onset of diseases and evaluate patient risk factors, prompting preventive measures or early treatments.

- **Manufacturing:**
AI-augmented quality management investigation and recommendation systems, automated preventative maintenance, and AI-augmented supply and logistics product quality inspection ensure higher standards and efficiency in production processes.
- **Banking, financial services, and insurance:**
AI plays a crucial role in fraud detection, safeguarding against financial risks and ensuring trust and security for customers.
- **Public sector:**
AI applications such as safety and emergency response, augmented defence against terrorism, and augmented threat intelligence and prevention systems are paramount for ensuring national security and public safety. Additionally, augmented citizen services agents streamline government services, improving accessibility and efficiency for citizens.

Challenges hindering wider AI adoption

Top on the list of challenges hindering the widespread adoption of AI are technology issues, followed by challenges in use cases due to misalignment of project and business goals, as well as complexity and feasibility (see Figure 6).

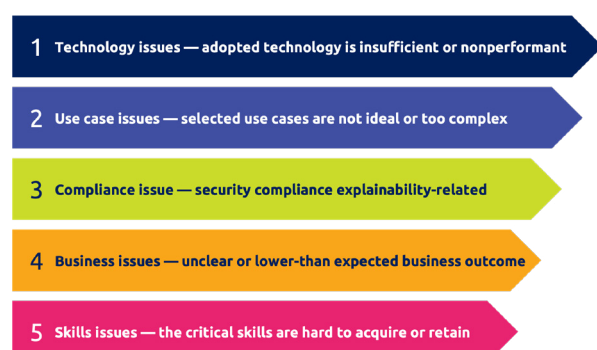


Figure 6: Challenges faced by enterprises in becoming AI-driven | Source: IDC's Data-driven Intelligence Enterprise Survey, 2023

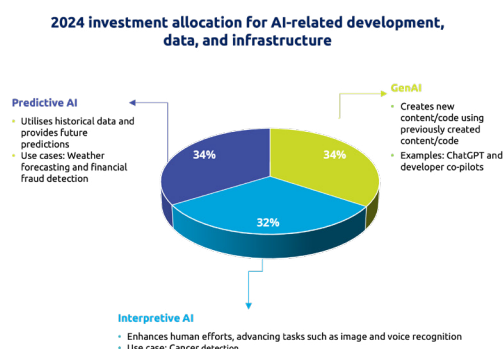
Technology issues often arise from inadequate architecture and insufficient training data to support specific use cases. Choosing the right tools is also crucial for the success of AI initiatives, as a lack of understanding can result in the selected tool failing to deliver the desired outcome for a given use case. Another significant challenge is the lack of a clearly defined AI use case. When business teams are unclear about the business process KPIs they need to address with AI, it can lead to non-viable use cases or incorrect outcomes.

Skills are another key factor. High salaries and scarcity of AI talent result in costly AI initiatives. With demand for AI talent often exceeding supply, enterprises find it difficult to build and maintain skilled teams.

Another critical issue is AI's reliance on foundational elements such as robust data quality and governance, business process engineering, and change management, and these compound the overall high cost of implementation and ownership, making it challenging for enterprises to justify the return on investment. For many enterprises, the cost of implementing AI can be prohibitive, making it even more crucial to select appropriate use cases for AI applications.

Addressing these challenges requires a holistic approach. This involves investment in talent development, careful cost-benefit analysis, clear alignment of AI initiatives with business objectives, robust technology infrastructure, strategic use case selection, adherence to compliance standards, organisational change management, and strong partnerships with supportive vendors.

Expansive world of AI



While GenAI continues to gain momentum, all other forms of traditional AI technologies will still account for more than two-thirds of Asia/Pacific's total AI investments by the end of 2027

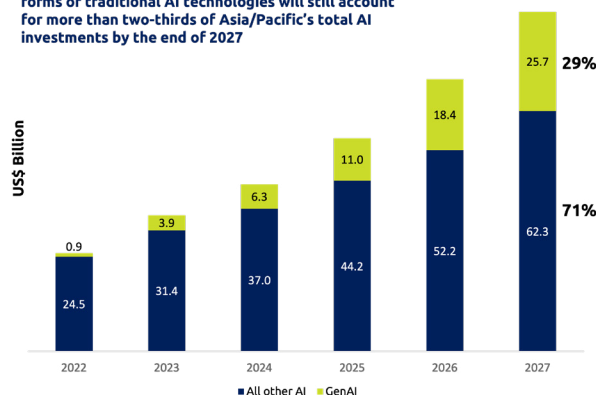


Figure 7: Investments reflect the expansive world of AI | Source: IDC's Data-driven Intelligent Enterprise Survey, 2023 & IDC's AI Spending Guide V2 2023 Forecast

While GenAI is propelling AI to new heights, it is not the only form of AI driving today's software-led revolution. About 34% of APAC enterprise AI budgets are focused on GenAI, with 66% directed towards predictive AI and interpretive AI. Figure 7 illustrates the expansive world of AI.

Unlocking GenAI's potential

An indicator of the expansive impact of GenAI is its wide range of use cases: from customer-facing applications to operational and financial applications, as well as design and marketing tools impacting product development, and customer experience management areas (Figure 8).

Enhancing knowledge management with GenAI is a primary use case among APAC enterprises. GenAI facilitates the creation, retrieval, and sharing of knowledge within organisations. Code generation applications offer significant advantages for software development by improving employee productivity, code quality, and innovation in software development projects.

By 2025, 35% of enterprises will have mastered the use of GenAI to codevelop digital products and services, leading to double the revenue growth compared with their competitors.⁸

Which two areas of your business will GenAI make the most impact in the next 18 months?



What GenAI use cases have the most potential for your organisation?



By 2028, GenAI-based tools will be capable of writing 70% of software tests, decreasing the need for manual testing and resulting in improvements to test coverage, software usability, and code quality.

IDC FutureScape: Worldwide Developer and DevOps 2024 Predictions — Asia Pacific (Excluding Japan) Implications

Figure 8: Use cases for GenAI | Source: IDC Future Enterprise Resiliency and Spending Survey, Wave 2, 2023 (n = 362 for APJ)

Blueprint for AI, from productivity to business functions and new models

The value delivered by AI to organisations is through use cases, which are defined by IDC as business-funded initiatives enabled by technology that delivers a measurable outcome. Selecting the right AI use cases is crucial for enterprises to progress, gain experience, and mature in AI adoption.

IDC's Generative AI: Path to Impact Framework (Figure 9) outlines key activities organisations should establish and how to approach new AI use cases to deliver organisational impact.

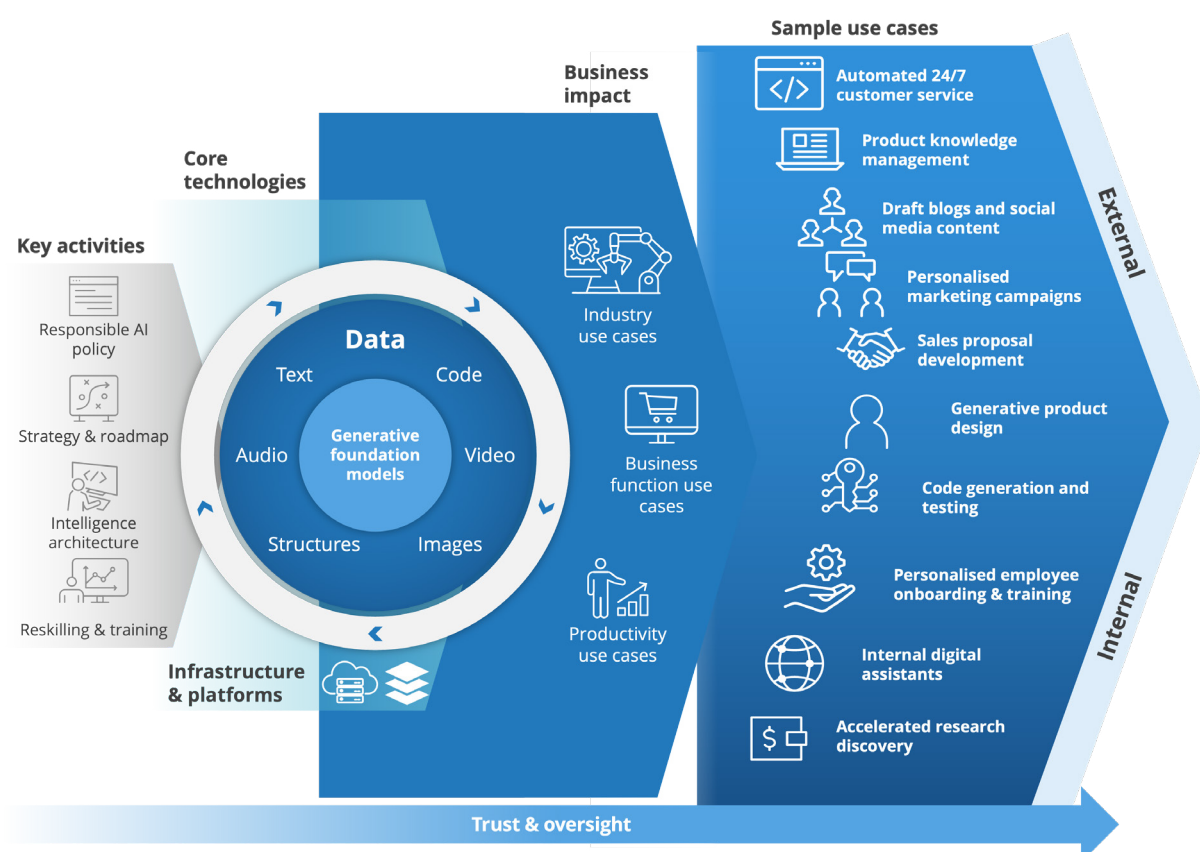


Figure 9: GenAI: The path to impact | Source: IDC, 2024

Types of AI use cases

There are three broad types of AI use cases that need to be assessed:

- **Generic productivity.** These are basic use cases, such as summarising a report, generating a job description, or code generation. This functionality is being infused into existing applications where the standalone application addresses a specific request or output that enhances the employee's work task or knowledge.
- **Business function.** These specific use cases will tend to integrate a model (or multiple models) with enterprise data for a specific function. Well-established enterprise applications and platforms from vendors will begin to incorporate AI into their offerings to provide these capabilities. Business functions include finance, IT, legal, supply chain, engineering, HR, marketing, and customer experience.
- **Industry-specific.** These advanced use cases will generally require more custom work (and, in most cases, require building your own AI model) to address industry-specific processes or activities. These will impact every industry and every phase, from product development (e.g., drug discovery), operations (e.g., visual inspection in manufacturing), and customer experience (e.g., product recommendations in retail).
- **Efficiency gain and cost reduction time:** AI enhances IT productivity with virtual assistants and conversational platforms, focusing on efficiency and knowledge management across enterprises.
- **Customer engagement and experience:** AI advances from internal productivity gains to customer-facing applications, using platforms powered by natural language processing (NLP) and ML for enhanced customer experience. Multimodality personalises interactions based on emotions or sentiments.
- **Innovation in business models:** The long-term vision for AI involves transforming business models, pioneering innovative operations, and delivering value through GenAI insights. Early adopters in various industries lead this transformation, setting new benchmarks for innovation and competitiveness.

As enterprises navigate these waves of change, it becomes increasingly critical for the role of leadership to foster an environment that encourages innovation, ensures ethical use, and builds trust in AI technologies.

Mapping AI's journey: Use cases and future outlook 2024–2026

The adoption of AI will continue to evolve as enterprises experience its transformative impact. According to IDC's research, C-suite executives expect AI initiatives over the next 18 months to deliver substantial value. The top 3 expected outcomes are productivity, customer engagement, and new business models. This evolution can be understood in three waves, each with its distinct focus and impact, as shown in Figure 10.

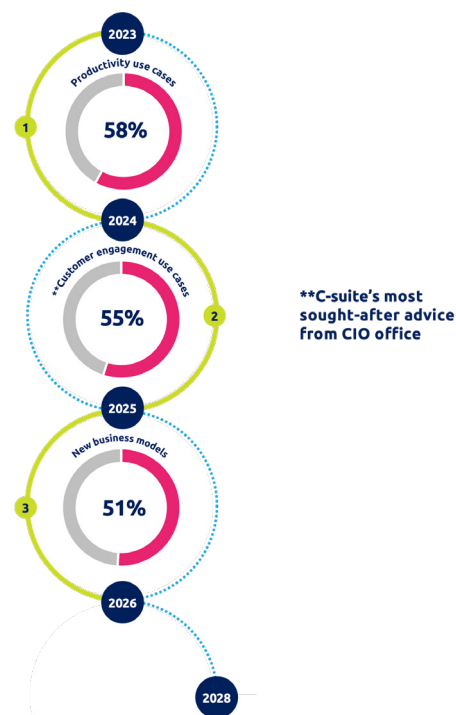


Figure 10: Top 3 desired business outcomes from AI initiatives / Source: IDC, 2024

Risk mitigation

As with any technology, adopting AI has its pros and cons for enterprises. While they can gain a competitive advantage, there is also the risk of data breaches or misuse. Private AI models can be a suitable solution, combined with public data sets. To ensure data quality and the accuracy of AI models, data sharing best practices should be followed (see Figure 11).

- **Protecting data assets:** For C-suite executives, including CEOs, CFOs, and CIOs, safeguarding their organisation's data assets is crucial. Data is often considered one of the most valuable resources for businesses, serving as the foundation for AI-driven insights, decision-making, and innovation. With the increasing reliance on AI comes the heightened risk of data breaches, unauthorised access, and misuse.
- **Brand and regulatory risks:** Organisations prefer private AI models tailored to their needs, using their own data or trusted sources. This maintains control over data and reduces the risk of breaches. They also combine internal data with public data sets to boost AI model performance while safeguarding proprietary information. In addition, enterprises train their AI models to analyse customer behaviour, market trends, and operations for better decision-making and stay ahead in their industries. Organisations ensure data quality and optimise AI model performance by following data-sharing best practices, which include setting up strong governance, quality standards, and management processes. These measures help minimise errors and biases, ensuring AI models, especially large language models (LLMs), perform effectively.
- **Partnerships to enhance value:** Enterprises also collaborate with external service providers to achieve better value realisation by proving ROI, accessing tailored solutions for specific challenges, and gaining earlier access to innovation in AI technology. This enables enterprises to maximise the impact of their AI investments, drive business growth, and maintain a competitive edge in their respective industries.

Data is often considered one of the most valuable resources for businesses, serving as the foundation for AI-driven insights, decision-making, and innovation.

Preferred AI models

Private versions of GenAI models built on public data

GenAI inhibitors

Expose the organisation to brand and regulatory risk, as well as cost of running/building GenAI



By 2026, 25% of organisations will utilise AI-enabled risk and compliance solutions to continuously monitor data in real time to predict noncompliance internally or from third-party associations.

IDC FutureScape: Worldwide Future of Trust 2024 Predictions
— Asia Pacific (Excluding Japan) Implications

Figure 11: Leveraging AI for enterprises | Source: IDC, 2024

Next steps

Adopt a multipronged approach, focusing on the long-term strategy while aiming for multiple quick wins in the shorter term that align to current business needs. There are some areas critical to the long-term success of these initiatives, starting with policies that form a strong foundation for AI adoption, having a robust data value chain and future-proof architecture, and building up a skilled AI workforce.

Essential next steps to prepare your business for AI:

- **Establish the foundation for AI readiness**
 - » Develop comprehensive policies for the ethical use of AI and GenAI technologies, covering data privacy, algorithmic transparency, fairness, accountability, and security.
 - » Align these policies with industry standards and specific compliance requirements.
- **Build a robust data value chain**
 - » Create a comprehensive data governance framework with policies, procedures, and responsibilities for managing data.
 - » Ensure data reliability, trustworthiness, and compliance with relevant regulations to power effective AI applications and enable data-driven decision-making.
- **Align build-and-buy mix with a business transformation road map**
 - » Weigh the benefits of building AI solutions in-house versus purchasing pre-made solutions, considering needs, resources, and stakeholder involvement.
 - » Align these decisions with long-term goals to drive innovation and competitiveness.

- **Evaluate ROI and build for the future**
 - » Identify metrics and KPIs to measure the ROI of AI solutions, such as cost savings, revenue generation, efficiency gains, improved decision-making, or competitive advantage.
 - » Continuously monitor and adjust strategies based on performance metrics and real-world data.
 - » Consider strategic partnerships with industry leaders and specialised AI vendors to access cutting-edge technologies and expertise, fostering collaboration and driving innovation.
- **Offer training and enablement**
 - » Increase awareness and understanding of AI technologies through training sessions and workshops.
 - » Provide specialised training on AI ethics, responsible AI practices, bias detection, and mitigation, and the ethical implications of AI applications.

Reader outcomes

This chapter should equip CXOs to:

- Understand the latest trends driving the adoption of AI/GenAI
- Discuss with the rest of the leadership team about potential investment areas and use cases
- Have a conversation with strategic IT partners about formulating a strategy for integrating AI/GenAI into the business, including technical infrastructure considerations and staff training



the immersive, experience-centric future of work

Key takeaways

- Augmented reality/virtual reality (AR/VR) is a game-changer for many industries to boost productivity and innovation.
- The worldwide AR/VR head-mounted display market is projected to reach 35.6 million units by 2028, a 5-year CAGR of 39.4%.
- AI-powered devices, mixed and extended reality, AI-enabled deep automation and digital humans are poised to reimagine the workplace and the way we work.
- A cross-functional, multi-technology, and all-of-enterprise approach is key to maximising the benefits of immersive technologies.
- Stay current on the trends and issues needed to meaningfully adopt these technologies.

Introduction

Throughout the course of human history, work—and by extension, the workplace—has been central to how human beings organise and collaborate to create shared value and shape societal development. The 2020–2022 pandemic years highlighted the critical role of immersive technologies in ensuring operational continuity in workplaces where physical presence was limited or not possible. For example, AR/VR technologies enabled innovative solutions for remote training, helping to bridge knowledge gaps in industrial workplaces and smart manufacturing processes by providing training to unskilled or temporary workers to perform complex maintenance operations.

One industry that is ripe for immersive tech is healthcare, and studies have shown training in AR/VR can improve knowledge retention 2–3x more than traditional learning methods. Training in VR can also be less expensive compared with reserving an actual operating room and using actual tools and equipment as well as medicines and materials.⁹

Johns Hopkins in the United States made medical headlines for using AR in the operating room. Surgeons used AR headsets to perform back surgeries on a living patient. The headsets projected images on the see-through display showing the patient's bones, muscles, and connective tissue from CT scans. The technology brought important and relevant information to the surgeons as needed, and it kept surgeons engaged with the patient throughout the surgery.

Many industries are teeming with opportunities for AR/VR and other advanced technologies to maximise their employees' contribution to the digital economy. Technologies such as AI-enabled digital assistance, enterprisewide intelligent automation and integration, feature-rich, and interactive immersive environments promise to amplify the potential of tomorrow's digital enterprises by revolutionising the workplace and the way we work.



Source: IDC FutureScape: Worldwide Future of Work 2024 Predictions — APAC (Excluding Japan) Implications

Revolutionising the workplace and workspace

Businesses must evolve to meet the demands of a new era driven by technological advancements, shifting workforce demographics, and new employee expectations for:

- Enhanced collaboration and communication
- Enhanced learning and training
- Enhanced employee engagement and satisfaction
- Greater efficiency, flexibility, and adaptability
- An environment that encourages innovation

Immersive interfaces and environments play a critical role in the future of work where:

- Virtual meeting spaces help employees feel more present and engaged, and enable them to work anywhere and anytime.
- Interactive learning and simulations provide realistic or precision training that is critical for complex areas, such as emergency response, incident reporting and management, medical procedures, machinery operations, and industrial maintenance.
- Smart and interactive environments leverage technologies such as Internet of Things (IoT) and AI/ML for greater data-driven intelligence to create smarter, more responsive and engaging workspaces.

The introduction of new immersive devices and interfaces is set to supercharge worker capabilities, paving the way for a new breed of digital enterprises.

Your new productivity partner: AI-powered devices

The disruptive effect of GenAI as a major new workload is ushering in accelerated deployment of new AI-ready hardware and software infrastructure, which promise to bring AI-enabled capabilities to every device and endpoint in the organisation. The AI PC is the poster child for this disruptive evolution that promises to amplify human capabilities by fundamentally transforming the paradigm of personal computing.

The AI PC

IDC defines AI PCs as personal computing devices that have new, specific system-on-a-chip (SoC) capabilities designed to run Generative AI tasks locally. Leveraging newly integrated neural processing units (NPUs), this latest crop of PCs can run AI workloads that have typically run in the cloud. This segment is poised to redefine the PC market, and IDC forecasts that the NPU-equipped AI PC sub-segment is expected to register a CAGR of 42.7% worldwide for the 2023–2027 period, while the non-NPU PC segment is expected to grow at -14.9% annually over the same period.¹⁰

Among the first manifestations of this new generation of AI devices is the Microsoft Copilot+ PC, unveiled in May 2024, which integrates advanced AI capabilities directly into the personal computing experience. Leveraging machine learning (ML) and natural language processing, Copilot+ serves as an intelligent assistant that can understand context, anticipate user needs, and perform complex tasks autonomously. This integration aims to enhance productivity by automating routine tasks, providing insights, and enabling more intuitive interactions with technology.

Lightweight large language models (LLMs) will increasingly find their way into personal computing devices, assisting and enhancing users' experiences across a host of specific capability areas.

Mixed reality: the next frontier

Rich, interactive virtual spaces represent the next generation of the internet, and a new paradigm for how people interact and generate content to unlock the true potential of the digital universe. Devices that enable us to experience these immersive environments in all their richness will be at the forefront of our journey to this future.

The arrival of the Apple Vision Pro has thrown the spotlight on mixed reality (MR), spurring the transition from a virtual reality primarily for consumers and gaming, to a blended reality with new possibilities. The Apple device is more than an AR headset. It introduces a new type of computational paradigm that seamlessly blends the real physical world with digital content to enable users to interact with digital objects as if they are present in their physical surroundings. While the Vision Pro is a prominent exemplar of this new modality

of spatial computing, other tech giants with products such as Microsoft Holo Lens, Meta Quest Pro, and Sony PlayStation VR are jostling to share the spotlight, demonstrating a shared belief in the immense potential of immersive technologies to shape our future.

According to IDC projections, the worldwide AR/VR head-mounted display (HMD) market will reach 9.7 million units in 2024, 44.2% higher than 2023 levels. By 2028, total volumes are expected to touch 35.6 million units, resulting in a five-year CAGR of 39.4%.¹¹

Immersive technologies have already proven their utility in training and simulation use cases, and Apple's entry into the extended reality (XR) B2B market will foster an innovation ecosystem critical to driving realisation of complex workplace use cases. Immersive technologies will also play a crucial role in defining and operationalising digital humans.

Devices that enable us to experience these immersive environments in all their richness will be at the forefront of our journey to this future.

Augmented vision



The worldwide AR/VR head-mounted display market is expected to reach 9.7 million units in 2024, 44.2% higher than 2023. By 2028, total volumes are expected to touch 35.6 million units, resulting in a five-year CAGR of 39.4%.

Mixed reality



The Apple Pro Vision is more than an AR headset. It marks the arrival of a new type of computational paradigm that seamlessly blends the physical world with digital content to enable a new experience.

Source: IDC's Worldwide Artificial Intelligence PC Forecast, 2023–2027

Transforming the future of work

AI devices and immersive technologies are not the only innovations reshaping the future of work as future work models evolve into hybrid, highly automated, intelligent digital workspaces premised on delivering superlative experiences.

This vision of the future workplace expands the art of the possible across the “who” (engaged workers), “how” (technology), and “where” (reimagined workspace) through an integration of digital technology enablers, such as bionic interfaces, generative and predictive AI, intelligent automation.

AI-enabled deep automation: Deep automation is premised on viewing an enterprise as a living organism where most functions are extensively automated with a focus on higher-level decision-making, constantly adapting and evolving to thrive in an ever-changing business environment. This is achieved through the integration and orchestration of different technologies such as AI/ML, robotic process automation (RPA), large language models, business process management (BPM), low-code/no-code platforms, everything-as-a-service (XaaS) model, among others, to create a self-adjusting organisation that can rapidly adapt to and profit from changing business conditions through optimised decision-making in complex scenarios, such as fraud detection and prevention, risk assessment, production optimisation, and inventory management.

Digital humans: The future workplace will also feature a seamless blend of physical and digital humans. These next-generation avatars will possess a striking visual realism, appearing almost indistinguishable from humans with lifelike facial expressions and body language. Equipped with advanced conversational abilities, they will engage employees and customers alike in natural, spoken dialogue, leveraging speech recognition and synthesis technologies, and augmented with emotional intelligence to foster empathetic interactions. Continuously learning and adapting from user engagements, they can refine their responses and tailor interactions to individual preferences. Their presence in the workplace promises to enhance engagement, efficiency, and overall user experience within the corporate environment.



Visualising an immersive, intelligent workspace

Taken together, these technological innovations represent a significant reimagination of the way we will work in the future — in an immersive, intelligent and dynamic space unbounded by time or physical place (see Figure 12).



Figure 12: The future of immersive work environments / Source: IDC, 2024

Next steps

As we step into this exciting future of work defined by seamless human-machine collaboration and supercharged workplace experiences, there are a few steps enterprises can take to prepare for this future reality:

- **Adopt a human-first strategy towards workplace transformation**
 - » Create an empowered cross-functional taskforce with a charter to identify innovative workplace technology that will help eliminate mundane, repetitive and low-value tasks.
 - » The strategic goal is to better amplify human capabilities and employees' potential for more rewarding, high-value activities (e.g., augmenting human creativity with GenAI in product and service co-design).
- **Start by identifying the right use cases**
 - » Leverage expert advice on developing business plans or ROI models to demonstrate value.
 - » Look for vendors who can orchestrate across an ecosystem of partners across hardware, software, and services to support complete use cases.
- **Cultural readiness and stakeholder buy-in**
 - » Assess if the organisational culture is conducive to the adoption of new technologies and innovative practices.
 - » Evaluate the level of support from key stakeholders, including leadership and employees.

- » If necessary, enlist the support of qualified external partners to plan and drive change management initiatives to establish the right organisational culture.
- **Technology infrastructure requirements**
 - » Conduct an 'as-is' inventory check of existing hardware, software, and network capacity and capabilities, and estimate the gap in requirements necessary to handle increased data loads and real-time processing necessary to meet the demands of the emerging tech-powered use cases.
- **Set specific goals and measure your progress against desired outcomes**
 - » Workplace evolution is a continuous journey that spans a multitude of dimensions and demands consistent support of key stakeholders across the organisation.
 - » To ensure unwavering ongoing support over the journey, it is important to set and track measurable business and operational goals (e.g., cost reduction, profitability, productivity enhancement, and experience improvement) over different time horizons.
- **Develop strategic partnerships with key technology vendors**
 - » Collaborate with partners that bring specialised knowledge and experience to accelerate the organisation's learning curve for new technologies.
 - » Find a partner that can help plan and incorporate new technologies into the overall IT adoption road map.
- **Regulatory and compliance**
 - » Take time to understand and evaluate the organisation's readiness to comply with relevant data protection and privacy regulations.
 - » Seek partner support to identify industry-specific regulations that apply to technologies and constructs such as AI, digital workers, AR/VR and other emerging technologies to develop a comprehensive strategy (spanning corporate, legal, HR and technology aspects) to navigate the complexity.

Reader outcomes

This chapter should equip CXOs to:

- Understand the emerging trends and technologies that are transforming the workplace and redefining the nature of work.
- Identify areas in their workplace operations that are ripe for radical transformation and enlist change champions to implement prioritised use cases.
- Engage in conversations with key partners and suppliers towards building a strategic road map, including the skills and capabilities needed to realise the organisation's vision of the future workplace.



rebalancing everything AI and the sustainability challenge

Key takeaways

- 43% of CEOs surveyed globally ranked environmental, social, and governance (ESG) initiatives among their top 3 business priorities, pointing to the sustainability-first mindset in today's leadership and the drive to improve the sustainability maturity readiness of organisations. Business and IT leaders are increasingly asked to contribute and support sustainability and ESG initiatives by reducing the carbon footprint in IT operations and improving energy efficiency in the IT infrastructure.
- AI is now viewed as a top innovative technology for sustainability. More than 50% of large enterprises are already using AI to reduce the emissions footprint of IT infrastructure by half from the baseline.
- Deployments of AI for sustainability are held back by concerns over the impact of training and testing of models on energy, water, and land resources, data storage and compute, as well as ethical considerations in data use.
- The human factor in any green AI strategy is the secret sauce to success. Inculcate teams with an environment-first mindset and be armed with a road map for smoother execution.

Introduction

The era of *everything AI*, ushered by the mainstreaming of GenAI, has given the world a better appreciation of how AI can be leveraged to solve the world's greatest challenges and achieve humankind's loftiest ambitions, such as the collective dream to get to a sustainable and equitable future, as defined by the United Nations' 17 Sustainable Development Goals (SDGs). Figure 13 illustrates how these goals can be understood and acted on in a corporate setting.

United Nations 17 Sustainable Development Goals

01 No poverty	02 Zero hunger	03 Good health & wellbeing	04 Quality education
05 Gender equality	06 Clean water & sanitation	07 Affordable & clean energy	08 Decent work & economic growth
09 Industry, innovation & infrastructure	10 Reduced inequalities	11 Sustainable cities & communities	12 Responsible consumption & production
13 Climate action	14 Life below water	15 Life on land	
16 Peace, justice & strong institutions	17 Partnership for the goals		



ESG is a reinterpretation of the SDGs for the purpose of putting the global goals in a context that can be understood and acted on in a corporate setup.

Environment	07 Affordable & clean energy	11 Sustainable cities & communities	12 Responsible consumption & production	13 Climate action
	14 Life below water	15 Life on land		
Social	01 No poverty	02 Zero hunger	03 Good health & wellbeing	04 Quality education
	05 Gender equality	06 Clean water & sanitation	08 Decent work & economic growth	
	09 Industry, innovation & infrastructure	10 Reduced inequalities		
Governance	16 Peace, justice & strong institutions	17 Partnership for the goals		



Another way of looking at this:

- SDG is a framework for the public sector and prioritises public value creation.
- ESG is a framework for the private sector and prioritises revenue generation with public value and environmental considerations (triple bottom-line approach).

Figure 13: SDGs and environmental, social, and governance (ESG) goals | Source: IDC, 2024

Three signs of eco-harmony everywhere

- **ESG in the public sector agenda:** Governments' aggressive push for environmental considerations in business and setting ESG standards in public sector agencies/ministries and government-owned companies. National government net-zero targets underpinned by legislation or policy documents increased substantially since 2020, from 7% to 75%.
- **ESG in the CEO agenda:** Increasingly, CEOs of enterprises have included reduction of environmental impact of business operations as a top priority. More than 40% of the world's largest enterprises have incorporated sustainability in their corporate strategy.
- **ESG as a winning factor:** Increasingly, large enterprises and public sector organisations are looking at sustainability credentials of product suppliers, service providers, and technology products to weigh qualifications, define competitive pricing, and measure the usefulness of technology.

Sources: IDC's The Sustainability Regulations 101 View. #EUR252042824; IDC's Trends in Sustainability Regulations in Asia Pacific #AP50337223; IDC's Global Sustainability Readiness Index Survey, 2023; Net Zero Tracker's Net Zero Stocktake 2023 report.

However, there is a problem. On the one hand, 40% of APAC enterprises surveyed by IDC have been using AI technology to help address the sustainability challenges faced by their organisations. On the other hand, when a sustainability-first mindset is not applied to the use of AI technology, this results in a disbalance, an offsetting of AI benefits to the cost of AI.

Thus, we are currently at an inflection point of technology and business. As we enter this latest watershed era of technology—the age of *everything AI*—we enter it alongside another watershed moment in human history.

Welcome to the age of eco-harmony. Eco-harmony is balanced and enhanced economics, going for the maximum profit today and sustaining that growth for the future. Eco-harmony is the harmonious coexistence of nature and human development, the balancing of what is good for Mother Nature and what is good for humankind. It is the adoption of a mindset that considers economic, social, and environmental impact in equal measure in the pursuit of business value (see Figure 14).



Figure 14: Eco-harmony's business value framework | Source: IDC, 2024

Evidence of this watershed moment is everywhere. Significantly, 14 APAC economies have enhanced their nationally determined contributions (NDCs) to carbon neutrality, or net-zero commitments in the last three years.

More aggressive NDCs from economic powerhouses have led to stricter ESG rules that businesses need to follow. According to IDC's research, 43% of CEOs surveyed globally ranked ESG among their top 3 business priorities¹², pointing to the sustainability-first mindset in today's leadership and the drive to improve the sustainability maturity readiness of organisations.

In APAC, organisations still have a long way to go. About 46% of enterprises are at an early stage of sustainability readiness, and another 6% are still figuring out where to start.¹³

But the CEOs' sustainability-first agenda is trickling down, accelerating the pace of sustainable business transformation. It is changing strategies and measures of key performance indicators

(KPIs). So far, it has altered CIO, CTO and IT department roles, redefined technology products and services differentiators, added to technologies' functionalities and use cases, re-elevated the importance of employee engagement and the need for eco-harmony warriors within institutions to accelerate the sustainability maturity of the entire organisation. The need to be sustainability-ready and mature has driven organisations' requirements for digital technology. First, the technology must come from a sustainable provider, and second, the technology is by itself sustainable (e.g., energy-efficient or low-carbon technology) and capable of producing sustainability outcomes. This is known as sustainability-first technology. Sustainability-first technologies enable eco-harmony.

AI's balancing act

The growing capability of AI to turn ESG strategies into action plans, with quantifiable and verifiable outcomes, is the reason that 46% of enterprises are looking to leverage more on AI and its derivatives, GenAI, ML, and predictive analytics, in the next 12 months. In the matter of ESG data, for example, we have seen AI-embedded hardware and software lead to faster decision-making and more accurate ESG reports. In fact, we expect AI to revolutionise compliance reporting in organisations starting 2024. IDC predicts 35% of the world's largest enterprises will be able to derive higher sustainability-driven cost benefits and competitive advantages with the use of AI in their ESG metrics and data management.¹⁴

Enterprises are already utilising AI in many ESG-related challenges: the reduction of energy-related carbon and greenhouse gas (GHG) emissions in business operations (Boston Consulting Group estimates GHG emissions reductions at 5–10% equivalent to 5 gigatons of GHG displaced¹⁵), the sustainable and responsible transition of production processes, migration to low carbon and renewable energy sources (average of 20% cost savings on electricity after one year of implementation), reduction of carbon emissions in IT infrastructure (some can go as high as 50% emissions reduction from baseline), as well as ESG data analysis and waste management. Figure 15 highlights the top use cases of AI in sustainability/ESG.

Q. How do you leverage AI/GenAI in your sustainability/ESG initiatives?

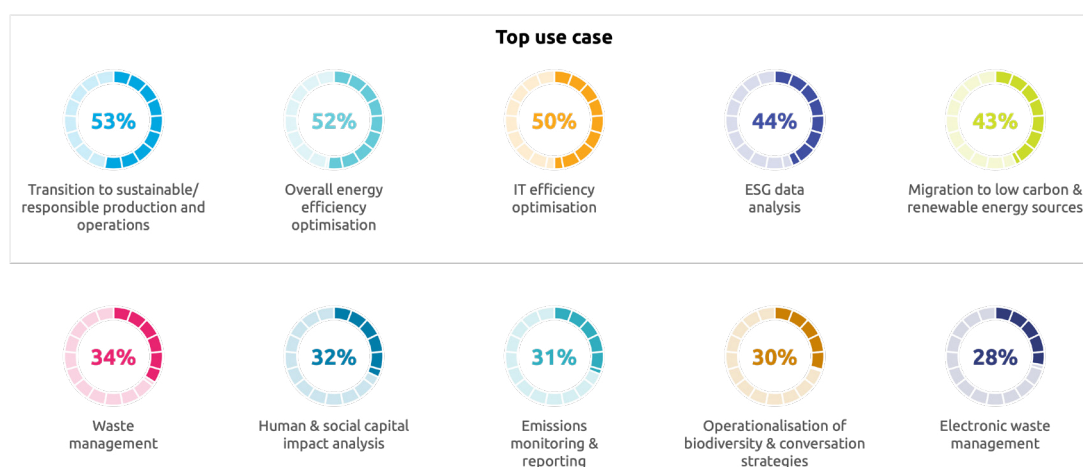


Figure 15: Top usage of AI/GenAI in sustainability/ESG initiatives | Source: Global Sustainability Readiness Index, IDC, August, 2023, n = 445 (APJ)

In net zero transition projects, organisations use AI to validate and make sense of ESG data (Figure 15 shows that currently 31% of APAC organisations are using AI for this purpose). Making sense of ESG data is the key to action that leads to realised carbon emissions reduction and sustainability-led business value. It also opens up access to affordable ESG financing valued at US\$40 trillion by 2030, according to Bloomberg Intelligence.¹⁶ This also enhances customer perception on the quality of service and products they can get from organisations.

How exactly do organisations do this?

Through AI embedded end-to-end solutions that solve challenges related to ESG data ingestion, storage, validation, analytics, reporting, assurance, and audit. We have seen organisations take data from sensors, unmanned aerial vehicles, Internet of Things (IoT) devices, and RPA, and have AI-enabled IT systems cross-check the data for inconsistencies and validate data based on international ESG standards. AI then converts these data that it has qualified into insights which is visualised in dashboards for quick decision-making; or AI translates operational information into metrics that can be plugged into any of the numerous types of ESG reporting frameworks (e.g., Global Reporting Initiative, Sustainability Accounting Standards Board, and International Financial Reporting Standards).

Another common use case, as cited by 50% of APAC organisations, is the leveraging of AI to reduce the carbon footprint of an organisation's IT infrastructure. AI technology computes for baseline carbon emissions in IT systems and is found in tools that allow the execution of remediation strategies to limit carbon emissions in the current and future design of IT infrastructure. For example, companies used AI-enabled carbon data calculators combined with AI-powered carbon data management software to conduct carbon emissions impact analysis on the IT infrastructure before the introduction of a new networking device, or before executing an IT refresh/end of life strategy, using product-level energy efficiency

factors. This enables IT leaders to evaluate new solutions beyond the technical and business parameters and check the new solution's suitability based on its alignment with the IT department's ESG-based KPIs.

Meanwhile, an emerging AI-in-sustainability use case is in the areas of team collaboration, people empowerment, engagement and upskilling. Employee well-being and sense of belonging, upskilling related to digital literacy, gap and inclusion and sustainability/ESG are examples of relevant metrics reported in the diversity, equity, and inclusion (DEI), a KPI of the "S" or social aspect of ESG. GenAI has been used to check the boxes of these "S" KPI examples with its capability to accelerate digital inclusion and training of people, and democratise ESG subject matter expertise.

We have seen citizen developers gain confidence to pursue and execute technical projects that reduce energy, water, and material wastage using GenAI enhanced low-code/no-code (LCNC) platforms and GenAI as the assistant chatbot referencing internal ESG policies and ESG learning materials for citizen developers. One such instance is the case of a building engineer citizen developer in a Southeast Asian conglomerate who led his facilities department on a successful energy transition project that resulted in overall energy cost reduction and contribution to their company's commitment to be 100% powered by renewable energy. The project involved the automation of the switching of power supply for a factory plant from the national grid source (which, in the APAC setting, is typically fossil fuel-heavy) to a solar mini grid when these factors prompting AI were confirmed by point devices and IoT to be present: peak sunshine hours, no photovoltaic (PV) shading, and PV batteries full.

But perhaps one of the biggest benefits AI brings to sustainability/ESG is its ability to operationalise seemingly abstract ESG principles like sustainable consumption and production (SDG #12, #13, #14, #15), social justice (SDG #1, #2, #5, #8, #10, #16), healthy communities (SDG #3, #6, #11), innovative

society (SDG #4, #9), and global partnership for development (SDG #17). An example of this is all over the banking industry. When banks execute their 'bank the unbanked' strategy as part of their market share growth plans, it is social justice in action. AI-powered solutions capable of adverse weather forecasting and detection have helped banks determine optimum placement for ATMs. For banks in APAC, to provide ATM service to a previously unbanked area typically means going to remote places that are often prone to super typhoons, floods, and other weather-induced disasters (after all, Asia is that one place on Earth that gets the greatest number of super typhoons per year). In other cases, AI-powered weather forecasting tools linked to IoT devices are used to automate triggers for SMS alerts to IT teams when IT asset evacuation or recovery plans need to be implemented. Another example is a company that uses AI-enabled augmented reality (AR) glasses in telemedicine, enabling healthy communities or the use of the same AI-enabled AR glasses to change the way people work in teams which include visually impaired and low-vision colleagues.

But while AI has been useful in addressing sustainability challenges and enabling the operationalisation of ESG, the utilisation of the AI technology itself can be the cause of setbacks for organisations looking to meet their publicly declared sustainability commitments, if certain aspects of the AI, such as its architecture, are overlooked.

Everything AI has increased the workload on data centres and increased demand for cloud storage and compute. These data centres need energy, require water for cooling, utilise IT hardware, and contain electronic parts that have to be safely housed in a building facility in order to run efficiently and continuously. The energy that data centres consume accounts for roughly 2.5%–3.7% of global GHG emissions. This does not yet include the carbon footprint to produce, transport, and dispose of data centres' electronic components and the embedded carbon from the construction and operations of the data centre buildings. Also,

beyond the carbon footprint, ESG accounting considers the environmental and social implications of using up to 5 million gallons of water a day per data centre and the impact of the use of land for commercial purposes instead of residential or agricultural use.

This is just on data centres and the cloud.

Everything AI also has an impact on every other aspect of the IT infrastructure that enables AI to run (e.g., data transmission networks). More than 75% of carbon emissions that an IT leader must take into consideration are from energy consumption from the usage of IT infrastructure. *Everything AI* is forecasted to increase this energy consumption by 33.5% on average year on year. On top of energy consumption, IT leaders also need to consider AI's impact on the end-of-life management of IT infrastructure, water usage, data security, and consumer privacy.

Herein lies the AI and sustainability dilemma. While AI has proven benefits and a growing portfolio of use cases solving sustainability challenges faced by organisations, it must be sustainably produced and consumed. This is to ensure that the AI for sustainability good it produces does not get negated by the natural resource it needs and the carbon footprint it emits from the AI life cycle. The accounting of carbon emissions makes it a real possibility that while companies use AI to reduce their emissions in their operations, they are also inadvertently adding to the carbon emissions they have to remove because of the energy resources AI utilises through the IT infrastructure that supports it.

Thus, there is a need to broaden the perspective on AI to ensure that there is balance between AI for sustainability and the sustainability of AI. This resetting of mindset requires a closer look at the infrastructure and architecture of AI, ensuring that sustainability is top of mind in every aspect of the setup (which supplier to work with, what technology to use), design (how they fit together), and actual implementation.

Green AI for sustainability

Sustainability considered in every aspect of AI is the type of AI that leads to eco-harmony. We call this green AI.

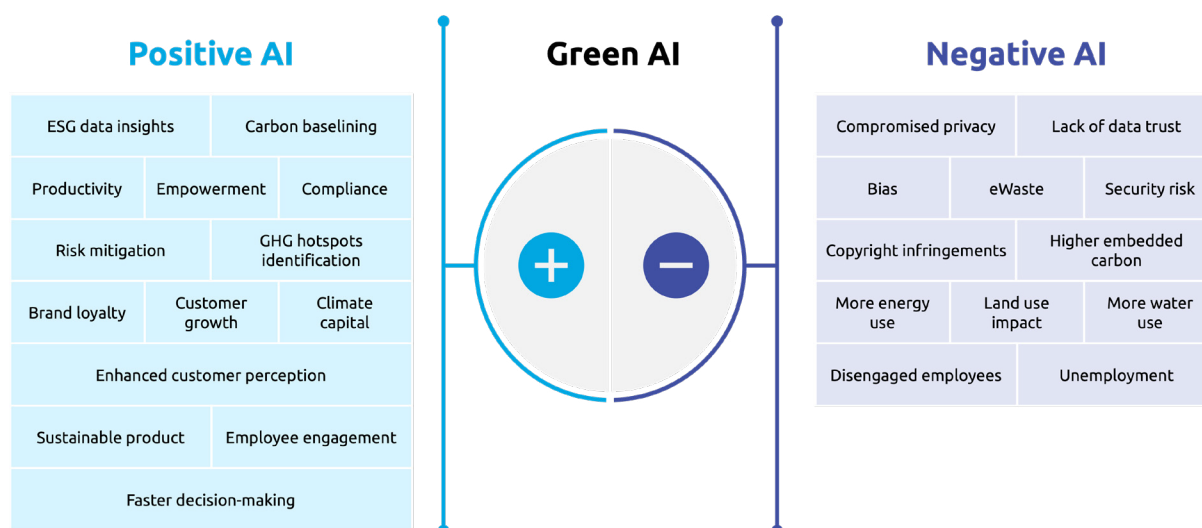


Figure 16: Green AI for eco-harmony | Source: IDC, 2024

Green AI takes a sustainability-first mindset in the development, testing, deployment, and retirement of AI. This means looking at the overall energy efficiency of the AI architecture, the direct and indirect carbon emissions from the computational resources, and the production and end of life disposal of hardware associated with AI models (e.g., graphics processing units, central processing units, and hardware components that lead to carbon emissions from electronic waste disposal). Green AI also considers the sustainability in the supply chain at each AI stage, as well as evaluating AI solutions on the criteria of overall and product-level carbon and GHG emissions, responsible sourcing, and natural resource utilisation. Green AI, therefore, considers the multiple facets of AI and requires a thorough understanding of the impact of sustainability in AI infrastructure and IT architecture.

One approach to attaining green AI is the application of a three-pronged strategy: greening data, greening systems, and greening intelligence (see Figure 17).

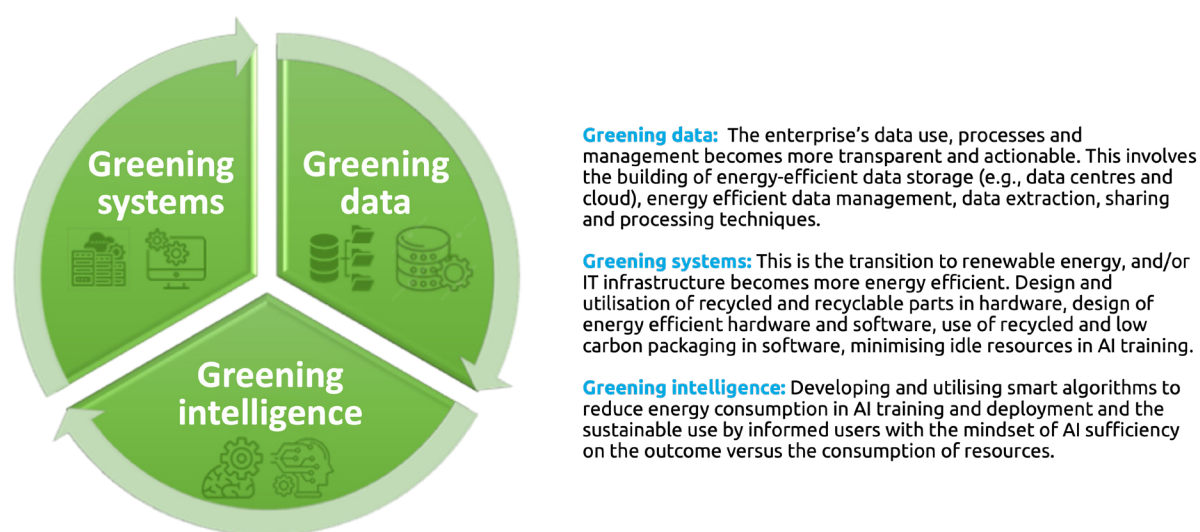


Figure 17: Three-pronged strategy of green AI | Source: NCS, 2024

Greening data involves strategies for more efficient use of data centres and cloud services. These include the reduction of data redundancy and the implementation of data compression techniques, the optimisation of data processing and data management algorithms for energy efficiency, and the execution of storage tiers with cold storage for data not used after AI model training. Greening systems involves the transition to low carbon IT infrastructure, design of an energy-efficient infrastructure, and the transition to renewable energy as the primary source of IT power. This involves the use of energy-efficient hardware, sustainable IT products and service providers, the incorporation of recyclable and recycled materials in the IT infrastructure, and maximising compute storage usage levels. Green intelligence is the implementation of green coding to make sure that AI applications use just enough energy resources or design compact AI models that require less computation and energy consumption.

People-enabled green AI

Throughout this chapter we have alluded to the importance of the human factor in green AI and its role in making sure the use of AI results in eco-harmony. The importance is not implicit but explicit. The human factor in any green AI strategy is the secret sauce to success.

IDC's research has shown that strategies to adopt sustainability principles in IT tend to fail when the IT team fails to consult the sustainability/ESG team, or if there is no sustainability/ESG team in the organisation and the IT team fails to consult or find an external partner with higher sustainability expertise. IDC's Global Sustainability Readiness Index found that 31% of APAC organisations faced this issue in 2023, preventing them from successfully executing a sustainable business transformation.

The IT department is the organisation's subject matter expert in all things related to digital technology such as AI, but the successful implementation of any sustainability/ESG-related project also needs a different type of knowledge expert that is found outside the IT team. Green AI therefore needs both IT and sustainability expertise. To be clear, CEOs do not expect the IT department to solely take on the burden of enterprisewide sustainability projects, but it is expected that the IT team contributes to the organisation's sustainability goals by solving at least the carbon footprint of the organisation's IT, and architect an IT infrastructure that should enable the successful implementation of all the organisation's ESG-related initiatives. Figure 18 summarises the role that the IT department is expected to play in sustainability. This makes collaboration across teams and partnering with external providers critical in green AI. No department should do it alone.

Q. What is the main responsibility of the IT department in the sustainability/ESG of your organisation?

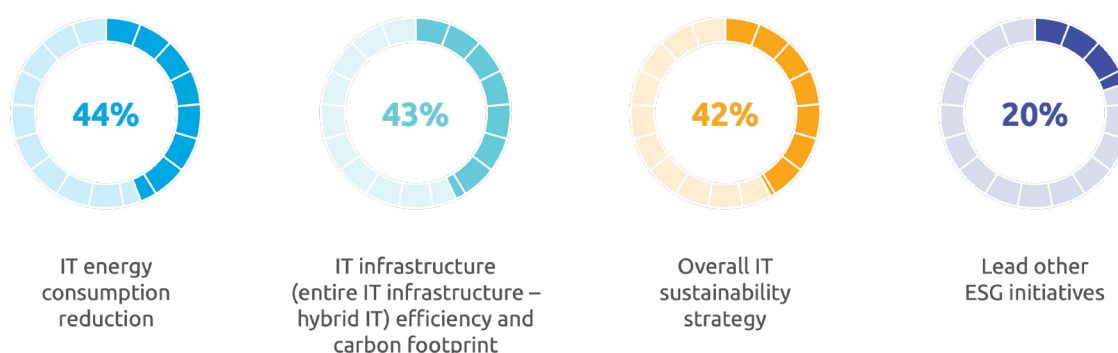
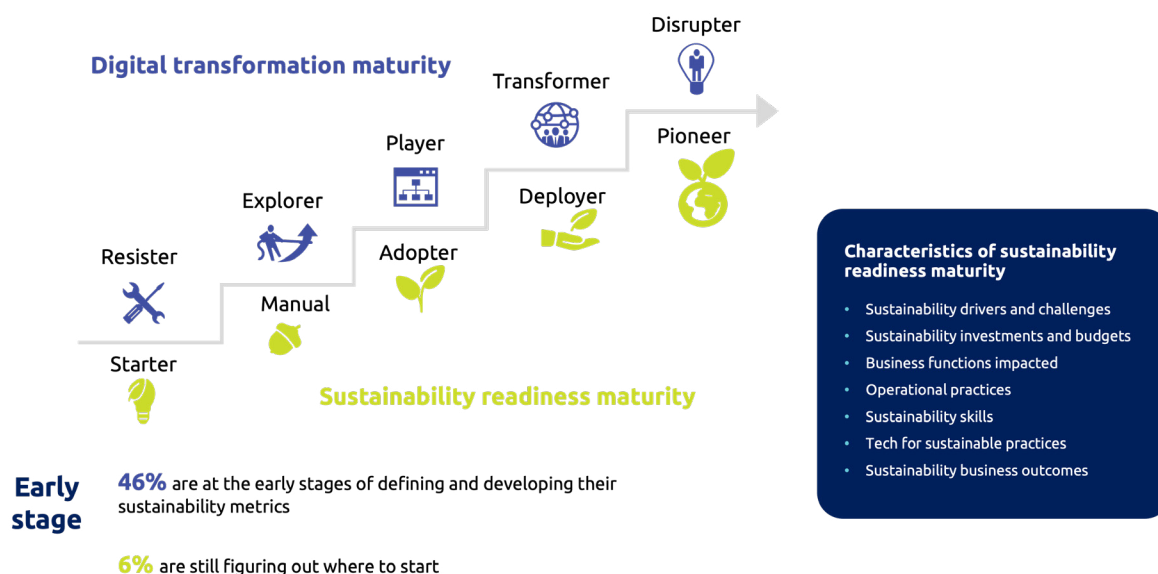


Figure 18: IT and sustainability / Source: IDC Global Sustainability Readiness Index Survey, 2023, n = 445 (Asia Pacific Enterprises)

Strategies for greening the IT infrastructure also tend to fail when users are left out of the equation. Green AI needs users that have sustainability-first mindsets. Unfortunately, it is a reality that the sustainability maturity of users still has a long way to go. This is a function of the overall sustainability readiness maturity of organisations in APAC.

IDC research shows that the relationship between an organisation's digital maturity and sustainability readiness is closely intertwined. Digitally mature organisations are not only more likely to emphasise ESG goals as part of their digital objectives but also more adept at using data for competitive differentiation and fostering innovative cultures that support sustainability initiatives. Conversely, less digitally mature organisations face challenges in integrating legacy systems and modernising operating models, which can hinder their sustainability progress (see Figure 19).



* Companies in Asia Pacific with at least 500 employees

Figure 19: Sustainability readiness maturity in APAC | Source: IDC's Digital Transformation MaturityScape and IDC's Global Sustainability Readiness Index, August 2023

What green AI looks like

While linking the direct impact of any one technology to ESG outcomes is still notoriously difficult to do, organisations can recognise if they are using green AI by its ESG outcomes. Figure 20 contains some suggestions on how to measure outcomes of green AI.

Environmental	Social	Governance
Carbon footprint reduction • % decline from baseline • Year-on-year comparison of carbon emissions linked to IT • % of IT carbon emissions to total carbon emissions of organisation	Employee training on green AI • Number of employees trained (people hours training on green AI, sustainability, and ESG material subjects) • Green AI projects by non-IT	Sustainable IT • Development of green AI framework • Development of sustainable IT framework
Energy efficiency of IT • Total energy efficiency improvement from baseline • Power usage effectiveness (PUE) comparison from baseline	Employee engagement • Green AI CoE • Number of citizen developer led AI-powered sustainability projects • ESG outcomes of green AI projects	
IT waste • Amount of waste generated and the percentage recycled • % of recyclable parts in the IT infrastructure • % of valuable materials recovery		

Figure 20: Sustainability readiness maturity in APAC | Source: IDC, 2024

When green AI is used, the enterprisewide carbon footprint is reduced even as the company expands, migrates, and modernises its IT infrastructure. IT infrastructure becomes more energy-efficient, the level of recyclability of IT systems has verifiable and actionable data, and environmental implications in the enterprise's data use and management become more transparent.

IDC predicts that more than half of organisations who are experimenting with AI and its usefulness in driving ESG outcomes will have a green AI framework in place in the next 24 months. This adoption of a green AI framework should trigger accelerated deployment of AI-enabled applications and AI-embedded solutions. By 2028, we expect that all of the sustainability-mature organisations in APAC will have this green AI framework in place, leading to new use cases of AI in sustainability and even wider adoption of green AI in the region. The wider adoption of green AI should lead to greater visibility, transparency, and accountability in ESG data, strategy, and progress. This will enable all organisations to reduce emissions across their value and supply chains by at least 35% more, and to reduce operational waste by at least 20% more.

Next steps

To move your organisation to a leadership position in sustainability/ESG and green AI, consider the following steps:

- **Bring all key stakeholders together**
 - » Have everyone familiarise themselves with the organisation's sustainability and ESG goals, strategies, and road map.
- **Have an open discussion on employee mindsets**
 - » Identify areas where employee awareness is lacking, and where training is needed to promote the right behaviours to meet ESG goals.
- **Work with an external partner**
 - » Check if your organisation has a framework for green AI, responsible AI, green IT, or sustainable IT, and find an external partner who can work with the team to review and identify potential gaps to ensure smooth execution.
- **Make an inventory of AI solutions**
 - » Map its current usability to your IT department's decarbonisation strategy and your organisation's decarbonisation road map.
- **Work with your AI suppliers**
 - » Collect product-level emissions data to determine your own AI-linked emissions footprint baseline.

- **Track measurable outcomes**

- » Develop mediation and intervention strategies to reduce AI-linked emissions and tie initiatives to KPIs and timeframes to ensure that measurable outcomes can be tracked over time.

Reader outcomes

This chapter should equip CXOs to:

- Develop a green AI framework that is aligned with the IT and sustainability road maps.
- Bring a team together to execute a green AI framework.
- Identify partners to support the agenda of lowering the emissions footprint of IT infrastructure and business operations using AI.



digital trust: the bedrock of innovation

Key takeaways

- Establishing digital trust is crucial for achieving key business outcomes like customer satisfaction, operational efficiency, and profitability. It forms the foundation for secure and ethical interactions in digital ecosystems.
- AI plays a dual role in cybersecurity, enhancing threat detection and response while also requiring robust security measures to protect AI systems themselves from specific threats.
- Navigating the diverse and evolving regulatory landscape is critical, particularly with the growing importance of AI governance. Organisations must adopt responsible AI practices to maintain stakeholder trust and comply with emerging regulations.
- Preparing for the future of quantum computing is vital. Organisations need to assess their current cryptographic systems and plan for the transition to quantum-safe encryption to protect sensitive data.
- The integration of AI in cybersecurity can significantly enhance capabilities, from automating routine tasks to sophisticated threat detection. Businesses must proactively adopt these technologies to stay ahead of evolving cyberthreats.

Introduction

In today's rapidly evolving, AI-driven marketplace, establishing digital trust is not just an option but a critical imperative. According to IDC's *Future of Trust Survey* from 2023, about 80% of APAC enterprises consider digital trust crucial for achieving business outcomes, with the top 3 being customer satisfaction, operational efficiency, and profitability (see Figure 21).

Digital trust serves as the foundation for building long-term resilience for digital business. It underpins secure, reliable, and ethical interactions within digital ecosystems, supporting sustained growth and stability. For businesses and governments alike, this means not only implementing advanced cybersecurity measures but also adopting transparent and accountable data and AI practices that bolster public and consumer confidence.



Figure 21: Top 3 business outcomes from investing in digital trust | Source: IDC's Future of Trust Survey, 2023

The greater the confidence in the security, integrity, and reliability of digital processes, the more enterprises will invest in technologies for breakthrough innovation. Digital trust removes friction in the way of delivering personalised shopping experiences, secure mobile payments, and inventory management — innovations that rely heavily on the secure handling of large volumes of consumer data.



Figure 22: Examples of where digital trust matters | Source: IDC, 2024

Maintaining digital trust with *everything AI*

Digital trust isn't easily achieved, nor does it come overnight. According to IDC's *CEO Sentiment Survey, 2024*, about 42% of senior executives are moving forward with AI initiatives with caution, while only 14% have already operationalised AI initiatives at scale. With cyberthreats fast evolving, maintaining high levels of digital trust necessitates a continuous innovation in security practices and robust infrastructure upgrades.

How can businesses establish digital trust?

To grasp the full implications of digital trust, it's imperative to explore IDC's Future of Trust Framework (see Figure 23), particularly in the context of AI's pervasive influence across all its levels.

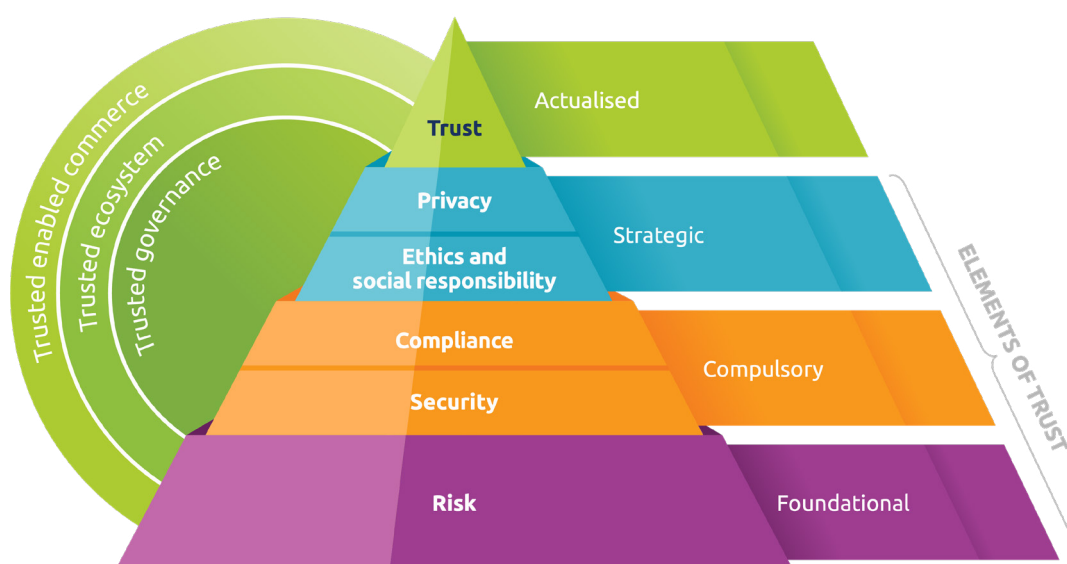


Figure 23: IDC's future of trust framework | Source: IDC, 2024

The rapid pace of disruption brings new risks and threats for enterprises, challenging CIOs and their security teams to continuously manage enterprise risks, including technology risk, market risk, security risk, financial risk, and even operational risk. At the foundational layer is balancing upside, downside, and outside risks to achieve a competitive advantage. This mindset recognises that risk management is an enabler of trust and confidence, not just as an enabler of risk avoidance. In this context, **the risks associated with AI are often underestimated**. In the rapidly evolving AI landscape, we encounter a paradox where AI serves as both a catalyst for innovation and a potential disruptor. AI systems, especially those using neural networks, differ fundamentally from traditional technologies and pose unique challenges in ensuring they align with human values and organisational goals (see Figure 24).

Aspect	AI systems (neural networks)	Traditional technologies
Learning capability	Capable of learning and adapting based on data, improving over time	Operates based on fixed, pre-programmed algorithms without adaptation
Complexity	Highly complex with potentially millions of nodes, creating opaque, 'black box' decision processes	Generally simpler and more transparent in how decisions are made
Data dependence	Performance heavily reliant on the volume and quality of training data	Less dependent on data; functionality is more static
Decision-making	Decisions evolve as the system learns, which can lead to unpredictability	Decision-making is predictable and consistent
Ethical considerations	Requires ethical guidelines to ensure fairness and prevent bias; difficult to standardise	Ethical considerations more straightforward and governed by explicit rules
Regulatory compliance	Must continuously adapt to new and existing regulations affecting AI deployment	Compliance generally stable with established regulations
Security risks	Susceptible to unique vulnerabilities like adversarial attacks	Faces conventional security risks like data breaches and unauthorised access

Figure 24: AI systems versus traditional technologies | Source: IDC, 2024

The interaction between AI and cybersecurity presents a dual-faceted challenge: AI for cyber and cyber for AI

At the **compulsory level of security**, the interaction between AI and cybersecurity presents a dual-faceted challenge: AI for cyber and cyber for AI. On one hand, AI significantly enhances cybersecurity capabilities with its ability to detect complex patterns and subtle anomalies that may indicate potential threats. On the flip side, AI systems themselves are vulnerable to specific types of cyberthreats.

In terms of **compliance**, organisations in the APAC region must navigate a complex and varied regulatory landscape. With AI regulations still in development in many countries, organisations face a mosaic of guidelines and laws.

At the **strategic** level, the domains of ethics, social responsibility, and privacy are crucial for enterprises striving to adhere to high ethical standards and maintain stakeholder trust. Commitments to transparency and fairness are essential, not just as regulatory compliance, but as core values that guide the deployment and operation of AI systems.

This comprehensive approach to digital trust, encompassing AI reliability and cybersecurity, will equip organisations to navigate the digital future securely and successfully.

AI for cyber: Enhancing trust through AI-powered automation

In the dynamic field of cybersecurity, trusted AI presents a transformative potential, fundamentally changing the traditionally unstructured threat detection and remediation processes. By automating sophisticated security measures, AI democratises the security landscape, enabling organisations of all sizes to bolster their defences with capabilities that were once exclusive to larger, more resource-rich organisations.

In the context of cybersecurity, AI is defined as a system that offers advisory, enhanced services, and semi-autonomous defence capabilities. AI in this domain is the application of advanced statistical techniques to address cybersecurity challenges, more specifically, **to boost the effectiveness of security professionals** and to **increase overall operational efficiency**.

Bridging workforce gaps and enhancing security operations

The use of AI and ML in cybersecurity primarily addresses the critical issue of workforce shortages.

Impact of AI in Security Operations Centres (SOCs). According to IDC's *APAC IT and Business Services Sourcing Survey* from 2023, about 29% of respondents reported that their security teams are overly engaged in maintaining and managing security tools, which detracts from their time spent on conducting security investigations. By automating routine and complex tasks, AI frees up SOC analysts to focus on more strategic initiatives like threat investigation and threat hunting.

The scale of AI and ML has expanded to such an extent that the problems they can solve surpass what any individual could comprehend in a lifetime or even a thousand lifetimes.

Modern AI-powered detection and response solutions help reduce the number of investigations by consolidating multiple alerts into a single 'incident,' thereby providing SOC analysts with a more detailed understanding of the attack type. This integration of AI and expert rule sets allows security analysts to effectively manage alerts at scale. The scale of AI and ML has expanded to such an extent that the problems they can solve surpass what any individual could comprehend in a lifetime or even a thousand lifetimes.

Driving efficient cybersecurity outcomes against threats of tomorrow

One of the most significant benefits of AI is its capacity to detect novel attacks — threats that have not been previously identified or catalogued. Cybersecurity is perpetually engaged in a cat-and-mouse game where defences and attacks are continuously evolving. Each time IT organisations develop defences against one form of attack, adversaries innovate new methods to circumvent these defences.

Spending on security analytics and automation software is expected to grow at a 5-year compound annual growth rate of 16.8% from 2023 to 2027, according to IDC's Worldwide Security Spending Guide.

According to IDC's *APAC IT and Business Services Sourcing Survey* for 2022 and 2023, enterprises in the region have identified enhancing security analytics and automation as the top area for improvement among security vendors for two consecutive years. However, increasingly advanced, and trusted, AI breaks this reactive cycle by integrating more deeply with data handling processes (see Figure 25).

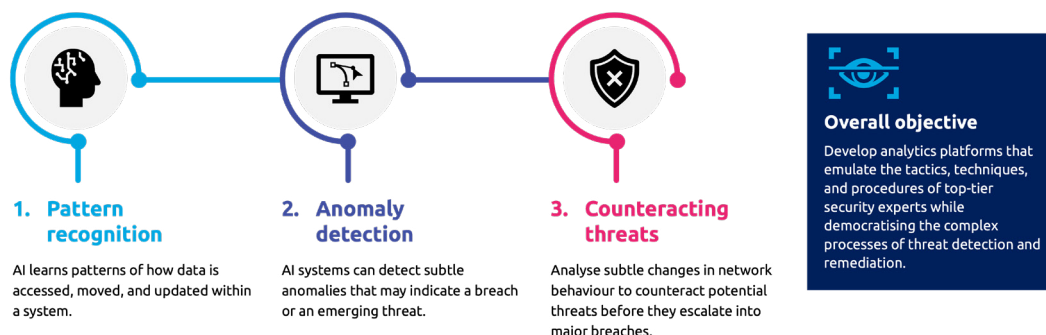


Figure 25: How advanced and trusted AI break the reactive cycle in cybersecurity | Source: IDC, 2024

AI-driven cybersecurity solutions can adapt over time without human intervention, learning from new data, and adjusting to new methods of attack much faster than traditional systems. By providing these cutting-edge capabilities, AI is not just a tool for cybersecurity — it becomes a foundational component in uplevelling security professionals while also building a proactive, adaptive, and trust-enhanced digital defence strategy (see Figure 26).

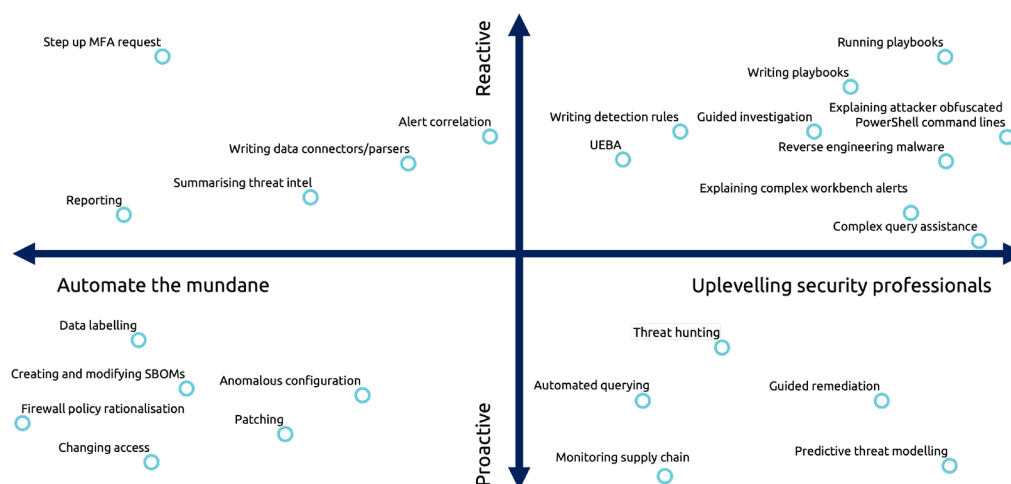


Figure 26: Illustrative examples of the practical application of AI to cybersecurity | Source: IDC, 2024

Cyber for AI: securing data and AI systems for trusted AI applications

Despite AI being a force multiplier, as described previously, one must consider the security and governance of AI models. Trustworthiness is a fundamental requirement for organisations developing, deploying, and using AI systems. While discussions often centre around privacy, ethics, societal impact, and regulatory concerns, the security of AI systems sometimes receives less attention. These systems are vulnerable to the same security risks as traditional IT systems, such as vulnerabilities and misconfigurations, and can introduce unique threats as well.

Securing AI models against adversarial threats

Security considerations often lag in the rapid pace of technological innovation. Therefore, security practices must evolve to ensure that AI infrastructure is robust enough to resist exploitation. AI and ML technologies are complex and nuanced, unlikely to ever be fully trustworthy without the oversight of human experts. Over time, best practices for using AI/ML will be established and continually refined through ongoing debate.

The effectiveness of AI models heavily relies on the accuracy of their training data; incorrect or biased data can lead to AI systems making faulty decisions, known as confabulations or hallucinations. Both customers and AI technology providers must rigorously monitor the data that informs each decision, actively identifying and rectifying training inaccuracies to mitigate bias from non-diverse data sets.

Another pressing challenge is ensuring the privacy and security of data, especially as data volumes expand. APAC enterprise spending on information and data security software is the highest growth area, with IDC's Worldwide Security Spending Guide projecting an annualised growth rate of 19.6% from 2023 to 2027.

Given that AI systems process and 'remember' all data inputs—including misleading or sensitive information—there must be stringent scrutiny over what data is input to guarantee that outputs are both reliable and ethically sound.

In order to mitigate cyberthreats to AI, a prescriptive approach needs to be adopted and encompass several key areas (see Figure 27).



Building secure models: Trustworthy AI begins with establishing secure foundations during the model creation process. This involves implementing policies and technologies that ensure sensitive, confidential, or erroneous data does not corrupt the model. Techniques such as de-identification, certification, and maintaining a clear lineage of data are crucial for safeguarding data access in GenAI models.



Protecting AI models: AI models hold vast amounts of valuable data that must be shielded from cyberthreats. This protection strategy includes utilising attack detection, undergoing stress testing, conducting model risk assessments, and employing red teaming strategies to robustly secure and protect large language models from potential breaches.



Protecting AI model interfaces: To prevent LLMs from manipulation through data poisoning, it is essential to detect and block attempts to input falsified or incorrect data. This includes thwarting attacks that may involve code execution, injection attacks, or server-side request forgeries, particularly through front-end interfaces or APIs.



Protecting AI data stores: The data utilised in AI models must be diligently protected to prevent any form of compromise. Ensuring data resiliency and utilising advanced protection technologies are vital for maintaining the security and integrity of data used across AI systems.



Content control for AI systems: It is crucial to prevent sensitive data from being improperly used in GenAI models. Effective content control strategies involve discovering, classifying, and governing data to ensure that only appropriate data is fed into the models, utilising technologies that support data loss prevention (DLP), privacy, and compliance.

Figure 27: A prescriptive approach to securing AI models | Source: IDC, 2024

Governance of AI: The way forward

As organisations employ AI systems using open-source algorithms, commercial products, and bespoke solutions developed by non-security specialists, the lack of standards or best practices for securing AI systems becomes apparent. In the coming years, chief information security officers (CISOs) anticipate that security and governance over AI systems will become a crucial responsibility. Based on IDC's *CEO Sentiment Survey* released in 2024, the second most significant challenge senior leaders face in implementing AI is ensuring its responsible use through an appropriate governance model that fosters trust (21%), only after creating a talent and skills strategy to support AI initiatives (22%).

In December 2023, the International Organization for Standardization (ISO) released the world's first AI management system standard, ISO/IEC 42001:2023. The certifiable standard provides a framework for organisations to develop and use AI systems in a responsible and accountable manner. In a 'Plan-Do-Check-Act' approach, it addresses AI risk, safety, security, fairness, transparency, and data quality. Integration with existing frameworks such as ISO 27001 (information security), ISO 27701 (privacy), and ISO 9001 (quality) enables organisations to enhance compliance and address AI-related risks holistically. Conformity is also expected to serve as evidence of compliance for high-risk AI systems under the EU AI Act.

In countries like Singapore, the government actively promotes the use of AI and ML to spur innovation and growth across various industry sectors while simultaneously developing robust AI governance frameworks to ensure responsible AI development and usage. An example of this is Infocomm Media Development Authority's (IMDA's) AI Verify. AI Verify is an AI governance testing framework and software toolkit that incorporates 11 AI ethics principles that align with globally recognised AI frameworks, such as those from the EU, Organisation for Economic Co-operation and Development (OECD), and Singapore's Model AI Governance Framework. AI Verify enables organisations to assess the performance of their AI systems against these principles

through standardised tests. The development of AI Verify involved consultation with companies of different sizes from various sectors, including prominent names like AWS, Google, Meta, Microsoft, DBS, and NCS, to name a few.

The AI regulatory landscape in the APAC region is largely diverse and fragmented. AI legislation and regulations in most countries are still in the nascent stages, with a focus on the development of guidelines and ethical principles. However, some governments have already implemented — or are in the process of passing—AI legislation. Within regional intergovernmental bodies and forums, the Association of Southeast Asia Nations (ASEAN) is drafting the ASEAN Guide on AI Governance and Ethics, while the APAC Economic Cooperation's (APEC's) Committee on Trade and Investment seeks to establish consensus-based norms and principles for AI. While the region is seeing an emergence of exciting AI initiatives, **the AI regulatory landscape in the APAC region remains largely uncharted, with a number of jurisdictions on the cusp of regulatory transformation** (see Figure 28).

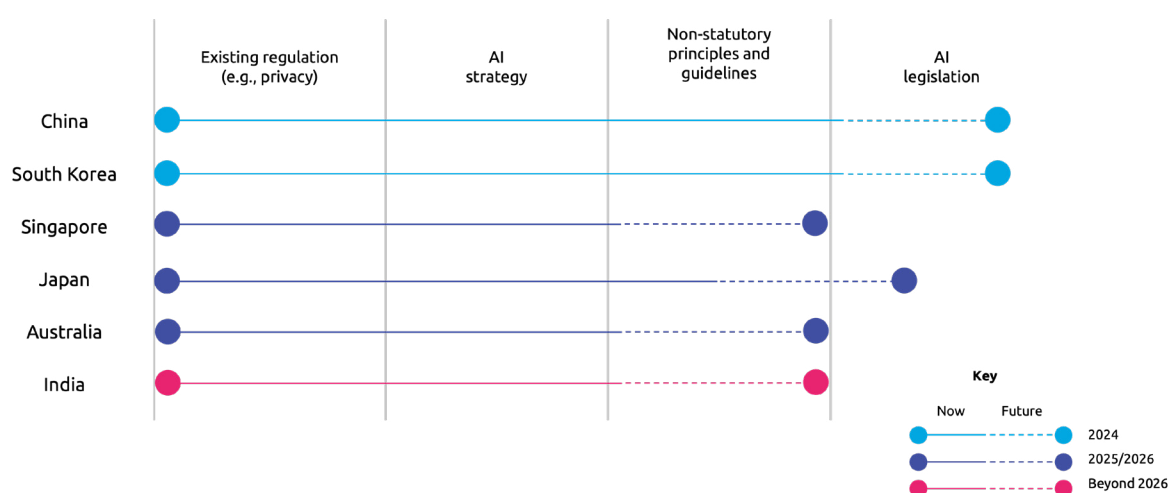


Figure 28: Journey and pace of AI regulation in select countries | Source: IDC, 2024

With the uncertainty of AI regulation looming overhead for the APAC region, enterprises should not simply 'wait and see', but instead take a proactive approach:

- **Be agile, vigilant, and flexible:**
Start preparing now for upcoming regulations in the countries and regions of operation.
- **Regulations form part of AI governance but does not define it:**
Companies are urged to establish a responsible AI readiness assessment and committee, especially in response to mandates that require high-risk AI models to be transparent about safety test results and pertinent information.
- **Think holistically about regulation in the context of operational theatres and ecosystems:**
Ensure vigilance in regulatory compliance among technology providers, advocating for scepticism and verification beyond mere claims of compliance to guarantee that AI tools adhere to ethical standards.

Quantum safe security: Building resilient foundations for the inevitable future

Post-quantum or quantum-safe encryption has been peripherally present in security discussions for several years but has recently gained prominence due to increased attention on quantum computing and efforts by the US National Institute of Standards and Technology (NIST) to establish a cryptography standard. Despite the anticipation of quantum computers becoming commercially available in 5–10 years, only 13% of respondents indicated that quantum-safe computing and encryption was an emerging technology area that was top of prioritised new investments for the next 12 months, according to IDC's *CEO Sentiment Survey, 2024*.

Although planning for future technological shifts is crucial, dedicating resources to these initiatives is often difficult, especially when current security threats demand immediate attention. However, while widespread market adoption may still be a few years away, organisations will inevitably need to confront the risks they pose (see Figure 29).

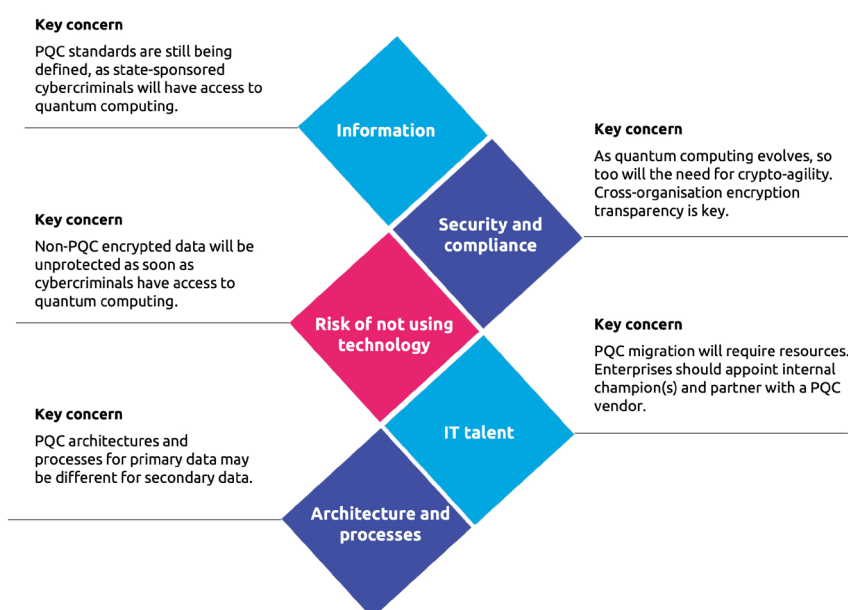


Figure 29: PQC risk profile | Source: IDC, 2024

With cybercriminals adopting the 'steal now, decrypt later' approach to data exfiltration, no organisation is safe. The RSA algorithm, commonly used for encrypting and decrypting messages over the internet using public and private keys, relies on the product of two large prime numbers to form the encryption key. Given the recommendation for the key size to be at least 2,048 bits or 617 digits, it would take a classical computer trillions of years to crack the encryption by determining the prime factors. However, quantum computers possess the computational power to easily break RSA encryption.

Adoption viewpoints and current standards

NIST is at the forefront of developing standards for post-quantum cryptography (PQC), aimed at securing digital communications against the threat posed by quantum computers. Since 2016, NIST has been running rounds of evaluation as part of their PQC Standardisation Process, asking cryptographers to devise and vet encryption algorithms that could resist attacks from a quantum computer.

The following are the four current standardised algorithms in 2022:

- **CRYSTALS-KYBER:** A lattice-based encryption algorithm used for data in flight or general encryption.
- **CRYSTALS-Dilithium:** A lattice-based encryption recommended to be used as the primary algorithm for data authentication.
- **SPHINCS+:** A hash function algorithm recommended as a secondary or backup encryption algorithm because of a different math approach design. SPHINCS+ is larger and slower than lattice-based algorithms.
- **FALCON** (expected for approval by end of 2024): An efficient and compact lattice-based algorithm following the hash-and-sign GPV paradigm (note: GPV are the initials of the authors — Gentry, Peikert, and Vaikuntanathan).

At the same time, other PQC algorithms are currently being worked on by various organisations (e.g., Ansi X9, IETF, and ETSI) but will likely not be out until at least later in the year.

IDC's adoption scenario viewpoints	Adoption	PQC adoption for data protection will largely be the backup vendor. Ultimately, we expect 100% adoption.
	User profile	PQC will affect every industry, but finance, government, defence contractors, and healthcare are most likely to be among the early adopters.
What it means for business executives	Use case	Cybercriminals target government and private secrets, intellectual property, personal information, and so forth. PQC helps 'future proof' valuable secrets.
	Metrics	Data protected by PQC is a yes or no. But organisations need data classification tools to identify critical data for encryption.
	Customer impact	Until PQC is fully implemented in backup products or services, it will be an additional layer in the data protection process.

Figure 30: Post-quantum cryptography adoption viewpoint | Source: IDC, 2024

Where we go from here: Metrics that matter

With how nascent PQC currently is, APAC enterprises will need to proactively engage security vendors who have the knowledge and capabilities to prep for the inevitability of a post-quantum era. By charting out road maps and milestones, aligned with PQC standards and regulations to come, experts and security partners in this area can tailor a strategy that fits the specific needs of an organisation. A notable partnership that has already begun its efforts in this space is IBM and NCS. In February 2024, IBM and NCS signed a memorandum of understanding (MOU) to collaborate on developing and offering end-to-end quantum-safe and privacy-enhancing services for public agencies and enterprises in Singapore. This partnership aims to assist Singaporean organisations in navigating their quantum-safe journeys by combining comprehensive assessment services with remediation efforts. It is never too early to begin a dialogue.

Key metrics and critical success factors will play a pivotal role in the transition to PQC. Metrics that matter include efficiency, as adding encryption typically demands significant resources; the impact of data protection and PQC on computing efficiency will be an important consideration. Agility is another crucial metric; PQC implementations must be flawless and free from unintended vulnerabilities to ensure robust security. Additionally, visibility is another key metric; organisations must maintain clear insight into the status and effectiveness of PQC measures, ensuring that any issues are promptly identified and addressed (see Figure 31).

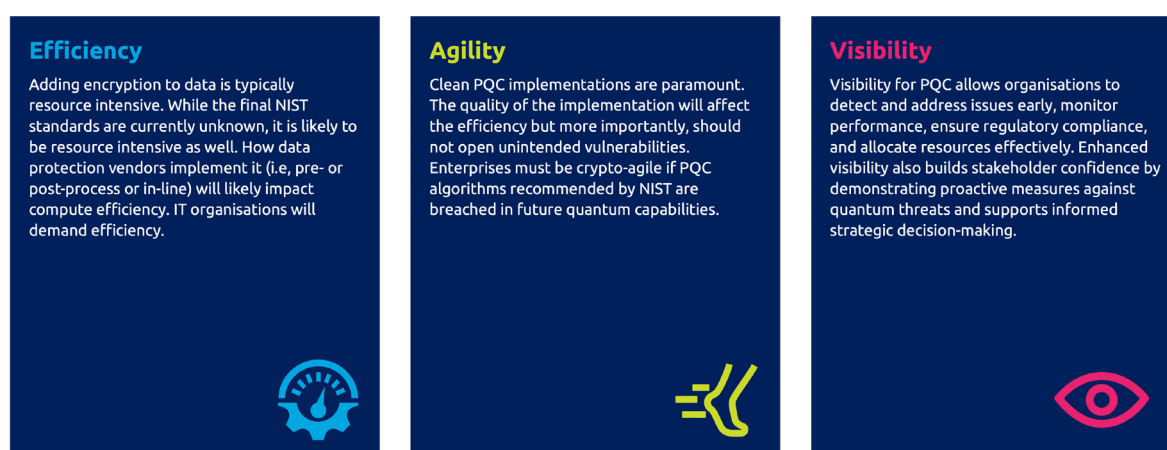


Figure 31: Metrics that matter | Source: IDC, 2024

History shows that significant technological shifts often see a pattern in security adoption — justification for resources and implementation typically emerges as attacks of this nature become more frequently publicised. IDC expects the adoption of quantum-safe encryption to eventually follow this established pattern and become more widespread as the potential threats it mitigates become more apparent.

Next steps

The course has been set. The AI ship has sailed, and there is no stopping it now, and soon, PQC will be the cornerstone of secure communication in the quantum computing era, revolutionising how we protect our data and maintain privacy in an increasingly digital world.

Essential next steps to gear the business towards trusted innovation:

- **Raise awareness**
 - » Begin by educating stakeholders about the importance of viewing innovative AI augmentation from a dual-faceted perspective: AI for cyber and cyber for AI.
- **Assess your current cryptographic footprint and potential risks**
 - » Identify areas, such as digital signatures and key exchange protocols, which are vulnerable to quantum attacks.
- **Develop a transition plan**
 - » Work with a partner on a road map to systematically upgrade cryptographic systems, ensure robust security against the quantum threats of the future, and maintain the trust and confidence of stakeholders in the long haul.
- **Experiment with caution**
 - » It might sound counterintuitive, but it's time to go slow, to go fast.
 - » Adapt to disruptive innovations such as AI and PQC, while effectively managing the associated risks.
- **Update policies**
 - » Revise security policies and incorporate new standards and procedures that align with overall digital business goals.

Reader outcomes

This chapter should equip CXOs to:

- Gain a comprehensive understanding of the importance of digital trust in driving business outcomes, such as customer satisfaction, operational efficiency, and profitability.
- Learn about the dual role of AI in enhancing cybersecurity (AI for cyber) and the necessity of securing AI systems (cyber for AI).
- Explore strategies for navigating complex regulatory landscapes and adopting responsible AI governance to maintain stakeholder trust.

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