KPMG

Advancing digital sustainable talent for the future

A strategic guide to Green by Design for businesses in Singapore

KPMG in Singapore

With contributed content from
► Infocomm Media Development Authority, Singapore (IMDA)
► Singapore Computer Society Sustainable Tech Special Interest Group

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Introduction

As the global economy changes, so do the skills it demands from the workforce. Two powerful forces account for much of this change. One is the advancement of digital technology. The second is the need for greater sustainability. At many junctures, these two forces are flowing into one.

This growing digital economy brings rising environmental costs, from energy-heavy data centres to the rapid adoption of generative AI (Gen AI) and the associated increase in processing requirements. Yet used in the right way, AI in conjunction with other emerging technologies such as blockchain, the internet of things (IoT) and quantum computing, holds enormous potential for delivering innovative solutions that can significantly improve service quality, optimise resources – and even mitigate environmental impacts.

Around the world, governments and regulators are working to understand how they can maximise the economic and sustainability upsides of digitalisation while minimising its costs. Here, talent and skills will be central to success. Demand is rising sharply for professionals who understand how to improve the sustainability of the digital economy. Supply has yet to catch up.

Such is the urgency of the challenge that the world cannot wait for a new generation of graduates to emerge with these skills. The Paris Climate Accords have placed binding targets on signatories to deliver measurable curbs to emissions, with many leading countries setting 2030 as an initial deadline for major improvements. The current generation of digital and sustainability professionals need the skills relevant to this task.

One country that will likely serve as an exemplar is Singapore. There are two reasons why Singapore is poised to lead. The first is the quality of its education system.[1] While global acclaim focuses on how Singapore educates its children and young adults, it often misses one of the most important elements of its success: the opportunities Singapore offers professionals to re-skill in mid-career, allowing them to adapt to the constantly shifting demands of an economy founded on sophisticated services and advanced manufacturing.

The second is that Singapore has for decades been a leader in optimising the efficiency of its limited physical resources. It is therefore well situated to show the world how to transform a workforce so that every industry has the specific sustainability skills it needs.

Today, Singapore is reimagining roles to embed sustainability into the core of every profession. This approach, known as "Green by Design", enables the integration of sustainability into digital strategies across all industries. In so doing, it offers an example of how to revolutionise those industries, redefine strategies and align innovation with environmental responsibility.

This strategic paper, crafted by KPMG, with contributions from the Infocomm Media Development Authority (IMDA) and the Singapore Computer Society (SCS)'s Sustainable Tech Special Interest Group, explores how Singapore is championing this transformational vision.

- Chapter 1 examines how Singapore, as a regional and global nexus of digital and financial activity, is moving to adopt Green by Design. It explains what the term means and the background to its adoption. It also sets out some of the initiatives that the country has put in place to support this transition, particularly in the digital space.

- Chapter 2 demonstrates how businesses can and should adopt Green by Design as a fundamental strategy. It explains the advantages of such an approach and the prerequisites for success, notably the full embrace and endorsement of Green by Design by leadership teams, and the importance of creating and monitoring key performance indicators.

- Chapter 3 focuses on the future of Green by Design talent. Businesses already possess much of the human expertise needed to execute Green by Design strategies. The challenge lies in unlocking this potential — identifying existing skills, filling gaps through targeted upskilling, and leveraging innovative methods such as micro-credentialling to empower employees with new capabilities mid-career.

- Finally, in Chapter 4 the paper concludes with some further recommendations for businesses to align with Green by Design, and the advantages that doing so will bring.

The intersection of digital innovation and sustainability constitutes a profound shift in how businesses operate and create value. Green by Design is a strategic imperative, enabling companies to succeed sustainably. Singapore's leadership in this approach offers a model for transformation. This is your chance to be part of the change.

CHAPTER 01
Why Green by Design can propel a green revolution

The global business landscape is undergoing a profound transformation—sustainability is no longer a choice but a strategic imperative. Where the mantra once was "data is the new oil," today, it is "green is the new oil." Sustainability, like data, now represents a critical asset driving competitive advantage, investment flows, and market differentiation. For Singapore, the adoption of Green by Design principles is essential to remain at the forefront of this green revolution while ensuring continued economic success.

Understanding Green by Design

Green by Design means embedding sustainability into every layer of an organisation—from product development to operations, supply chains, and ICT infrastructure. It is not a retrofit or an afterthought; it is an ethos ensuring every decision actively contributes to environmental goals. Much as Secure by Design transformed industries by making cybersecurity a core principle, Green by Design integrates environmental, social and governance (ESG) considerations as a prerequisite for business processes.

This approach is not just about meeting environmental goals; it is a response to multiple external and societal pressures. Investors are demanding stronger ESG credentials from organisations. Consumers are aligning spending decisions with their sustainability values. Corporate leaders and policymakers alike face relentless expectations to act decisively on climate change, social uplift and incorporate better governance practices. Adopting Green by Design enables businesses to address these pressures proactively while unlocking opportunities.

Riding Singapore's 'green wave' to economic growth

Singapore as a hub of green innovation aligns naturally with its history of engineering competitive advantages from constraints. Limited land and natural resources drove the city-state to pioneer sustainable urban solutions, which now inspire nations worldwide. However, as Singapore enters its SG60 milestone, it must seize the unprecedented economic possibilities of the global 'green wave.'

Green by Design is critical to this vision. For Singapore to solidify its reputation as a leader in sustainability and the "go-to" destination for green innovation, businesses must make sustainability central to their operations. Investors play a critical role in this ecosystem by prioritising green performance in their decision-making, thereby fuelling value-driven growth. The launch of the Sustainable Finance Jobs Transformation Map [2] in 2024 in Singapore exemplifies this effort, aiming to upskill finance professionals to support the shift towards a more sustainable economy.

A strategic imperative for business

For businesses, sustainability is no longer a "nice-to-have" but a baseline expectation. Green by Design enables companies to stay ahead of rapid regulatory evolution, such as carbon tax implementations or mandatory ESG disclosures. Integrating sustainability at the outset avoids costly reactive adjustments and enhances efficiency throughout operations.

The financial case for Green by Design is equally compelling. By streamlining energy consumption, optimising material use, and building sustainable supply chains, companies can achieve significant cost savings and align with growing consumer and investor preferences for green credentials. Superior ESG reporting from Green by Design boosts access to capital from sustainability-focused funds and enhances brand trust.

Failing to act carries significant risks. Delayed adoption exposes companies to escalating costs from carbon policies, reputational risks, and potential loss of market share to greener and more socially responsible competitors. Conversely, forward-looking sustainability measures generate first-mover advantages, safeguarding long-term profitability while strengthening resilience against future market disruptions.

Bridging the cost perception gap

Green by Design does not require financial strain—on the contrary, government incentives and programmes are making sustainable transformation accessible to businesses of all sizes. The Singapore Green Plan 2030 exemplifies this support, providing grants, tax incentives, and funding to offset initial costs. These programmes not only reduce barriers to adoption but also enhance the financial upside for companies engaging in green innovation.

Further, the innovation spurred by Green by Design often results in indirect benefits, from new product capabilities to broader efficiencies in supply chains and operations. Businesses that adopt sustainable principles frequently find that the associated creative output offers unique, marketable value additions, further strengthening their competitive position.

Harnessing ICT for sustainable and inclusive transformation

ICT sits at the nexus of Singapore's economic and environmental ambitions. While there has been much debate on the sector's potential contribution to global emissions, such technologies also offer unparalleled potential to catalyse economy-wide sustainable transformation if used optimally.

For example, Singapore is positioning itself as a pioneer in sustainable ICT practices, including energy-efficient data centres, green software development to make the most efficient use of those facilities, and carbon-conscious cloud computing.

Green software offers significant opportunities for applying Green by Design principles, focusing on optimising energy usage and minimising unnecessary emissions for end users. With data centres among the largest energy consumers, their operations are heavily influenced by software demands. Thoughtful software design plays a crucial role in reducing the energy burden on data centres, thereby lowering the overall environmental footprint of the digital ecosystem. Singapore is already setting standards with initiatives like the Tropical Data Centre programme, stringent energy efficiency regulations, and workforce upskilling efforts. Together, these measures reduce emissions while enhancing the nation's attractiveness to high-value ICT players.

The ripple effects of green innovation in ICT extend beyond the sector itself. Sustainable ICT practices drive process efficiencies critical to industries ranging from logistics to finance. They offer companies a platform to reduce operational costs while innovating for cleaner, smarter systems. Businesses that align their digital operations with Green by Design principles will secure a central role in the future of Singapore's green economy.

The advantages of adopting Green by Design principles are not confined to environmental gains. For instance, businesses and charities can leverage AI and data analytics to enhance the efficiency of social impact reporting, improving their ability to evaluate philanthropic initiatives. Generative AI can further support better governance and integrate sustainable practices such as carbon accounting into operations. These steps naturally enhance organisational corporate reputation and brand value, particularly in capital markets.

Magnifying the ROI

For Singapore, Green by Design is more than a national strategy—it is an economic transformation driver. Leveraging sustainability enhances resilience and builds competitiveness across sectors. Capitalising on the 'green wave' requires companies operating within Singapore to embed sustainability into their DNA, delivering on both environmental, social, governance and economic metrics.

Businesses that act decisively gain superior positioning to attract investment, drive innovation, and secure long-term success in an increasingly sustainability-driven market. Green by Design is the blueprint for how Singapore can maintain its competitive legacy while turning environmental responsibility into sustained economic growth. The time to act is now.

CHAPTER 02
Crafting a Green by Design strategy

Green by Design is no longer a peripheral consideration for businesses—it is the foundation of a strategy for resilience, differentiation, and sustained growth. Beyond addressing compliance or meeting ISSB reporting requirements [3], it serves as a blueprint to create value in the evolving economic landscape. Companies that implement Green by Design strategies stand to gain from cost efficiencies, enhanced market perception, and opportunities for funding, investment, and collaboration.

Leveraging Green by Design for value
At its core, Green by Design equips businesses with tools to achieve and communicate sustainability goals. Transparent reporting, underpinned by a mindset of continuous improvement, signals accountability and builds trust with stakeholders. Identifying metrics and establishing key performance indicators

(KPIs) aligned with green objectives is foundational. Embedded processes to track and evaluate these metrics help identify opportunities for improvement and support well-informed decision-making.

Hence, while initial R&D investments may be needed in the initial phases, it paves the way for long-term operational rewards and enhanced profitability.

In an ESG-conscious environment, it also boosts reputational advantages essential for today's market. In that regard, Green By Design can serve as a differentiator for higher valuations and attract like-minded investors. This can unlock access to capital and partnerships, paving the way for market expansion.

Shaping market perception

Sustainability is redefining how businesses project value and differentiate themselves. Companies embedded with Green by Design send a strong signal of leadership in driving environmental responsibility. For listed entities, this commitment assures investors, enhances credibility, and fosters confidence in long-term growth, positively influencing valuations.

For SMEs, the stakes are equally significant. A credible Green by Design strategy can open doors to funding, strategic alliances, and new customers. It positions SMEs as reliable collaborators in competitive markets and trusted players in the global sustainability landscape.

Leadership and cross-functional ownership

A successful Green by Design strategy demands conviction from senior leadership and board buy-in. Leadership must articulate the vision, set green KPIs, and commit resources toward structured implementation. Without clear top-level engagement, companies risk falling short of the cultural shift needed for success.

However, leadership alone is insufficient. Effective execution requires cross-functional collaboration. Business units must champion green initiatives, aligning the company's sustainability vision with operational goals. For organisations without a dedicated Chief Sustainability Officer, units driven by the potential for enhanced market positioning and government partnerships can drive these initiatives forward.

Strategic partnerships with external stakeholders, especially government agencies, are crucial. Aligning corporate goals with national strategies like the Singapore Green Plan 2030 provides access to grants, shared expertise, and scalable solutions to green ambitions.

Addressing data challenges

Reporting on sustainability goals requires a robust data framework. However, capturing reliable data across fragmented supply chains and ICT environments presents a persistent hurdle. Companies must first evaluate gaps in their current systems and invest in tools to streamline data collection and analysis.

System unification across ICT teams is critical to consolidating relevant metrics. Senior leadership plays a pivotal role in authorising investments and embedding thorough data-monitoring frameworks into the Green by Design strategy.

With proper data infrastructure, businesses can track performance, refine KPIs, and deliver transparent reporting that fosters credibility and drives accountability. This infrastructure forms the backbone of continuous improvement, ensuring steady progress toward sustainability objectives.

Aligning technology with business outcomes

To drive meaningful transformation and ensure that Green By Design fits well into the business strategy, companies must shift focus from chasing emerging technologies to aligning technology goals with clear business outcomes. Whether it's generative AI, quantum computing, or other advancements, the real value lies in integrating technology with the company's business model to achieve impactful results. Integrating Green by Design amplifies this approach by embedding sustainability into technology strategies from the beginning, ensuring it is a foundation rather than an afterthought.

The most successful organisations are those that define technology goals in direct alignment with long-term business objectives. These businesses look beyond the hype of new technologies and focus on how tools can advance specific goals. Key questions must guide technology decisions: How will this innovation strengthen the company's business model? How does it support operational, financial, or market outcomes?

Differentiating through Green by Design

Green by Design is not merely a compliance framework—it is an innovation enabler and market differentiator. Companies embedding sustainability reporting, energy efficiencies, and robust KPIs into their operations gain a competitive edge in today's dynamic marketplace.

From green software development to resource optimised supply chains, Green by Design unlocks opportunities for businesses to deliver unique value. Clear metrics, paired with sustained efforts to improve, reassure stakeholders and attract critical ESG-focused investments.

For Singapore businesses, Green by Design aligns corporate objectives with national sustainability goals, enhances brand perception, and future-proofs organisations in a rapidly evolving economic landscape. Companies taking deliberate steps now to adopt and scale Green by Design will lead—not just participate in—the green economy of tomorrow. The time to act is immediate.

CHAPTER 03
Green by Design for digital talent

Building talent to support Green by Design

To realise Green by Design goals, businesses must invest in talent acquisition and upskilling. Skills in IoT, data analytics, and Gen AI are vital for collecting and interpreting sustainability data. This is especially true as companies increasingly rely on advanced technologies to optimise operations and uncover actionable insights.

For SMEs facing constraints in acquiring specialists, government programmes such as Forward Singapore and the Enterprise Sustainability Programme are invaluable. These initiatives support workforce upskilling while promoting sector-specific alignment to sustainability agendas. Through these avenues, businesses can bridge talent gaps without overburdening resources.

The long-term success of Green by Design relies on developing a sustainable internal talent pool adaptable to technological advancements. Current employees bring invaluable institutional knowledge, such as identifying energy-intensive processes and recognising opportunities to apply AI and data analytics to improve efficiency.

At the leadership level, there is a need for senior strategists skilled in both technology and sustainability. Beyond upskilling technology leaders with green expertise, Chief Sustainability Officers must gain insights into the broader ESG factors influencing digital technologies.

For SMEs especially, competing with major tech players for talent makes retention a priority. Providing opportunities for employees to gain sustainability-related skills demonstrates a serious commitment to career development and can foster long-term loyalty.

Upskilling must be driven from the top – both because this sets expectations around behaviour and because re-skilling involves planning for what a business requires over the next one to five years.

The value of skills mapping

Mapping employee talent is a critical step in achieving strategic goals. However, skills mapping must be treated as an adaptable guide, not a rigid template, as each business's needs are unique. Corporates should consider re-mapping roles to ensure that Gen AI combines effectively with human skills such as influencing people, insight, empathy and sense-checking AI outputs, for example to implement green software optimisation.

The process begins with a clear vision of future objectives—what the company aims to achieve over five to ten years, factoring in sustainability impacts, the alignment of technology with business goals, and identifying talent gaps.

An effective skills mapping process involves three key phases:

1. **Landscape analysis** – Assess sector-specific challenges such as regulatory trends and Green by Design requirements.
2. **Impact analysis** – Evaluate how these changes will influence roles, capabilities, and staffing needs.
3. **Skills analysis** – Identify the precise skills required to fill organisational gaps and achieve goals.

This dynamic map enables firms to prioritise development areas, allocate resources strategically, and adapt to evolving environments. Once the mapping is complete, training strategies can be designed and aligned with company objectives, opening opportunities for talent mobility and enhancing career growth. The subsequent chart shows how skills mapping can be done, using the example of ESG-related skills.

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Three essential elements in a skills mapping exercise

◄ Source: KPMG in Singapore

Leveraging the Singapore Skills Frameworks

For many organisations, undertaking skills analysis is a challenging process due to limited knowledge of existing roles and future skill demands. To address this, Singapore's comprehensive Skills Frameworks serve as invaluable guides. These frameworks outline sector trends, critical work functions, and potential training pathways for over 36 industries.

Particularly relevant for Green by Design in ICT is the Infocomm Technology (ICT) Skills Framework, as seen in the chart on the next page. Developed collaboratively with industry experts, unions, and educational institutions, the framework identifies over 80 skills and 100 job roles. It highlights both current and emerging competencies essential for the sector. The ICT Skills Framework serves as a valuable resource for organisations aiming to focus on key job roles to effectively upskill their tech workforce.

The following section explores how specific roles can be adapted to integrate sustainability under the Green by Design approach. This mirrors the approach taken in the Sustainable Finance Jobs Transformation Map introduced in 2024, providing actionable insights into embedding sustainable considerations into core job functions.

The Skills Framework for the ICT sector
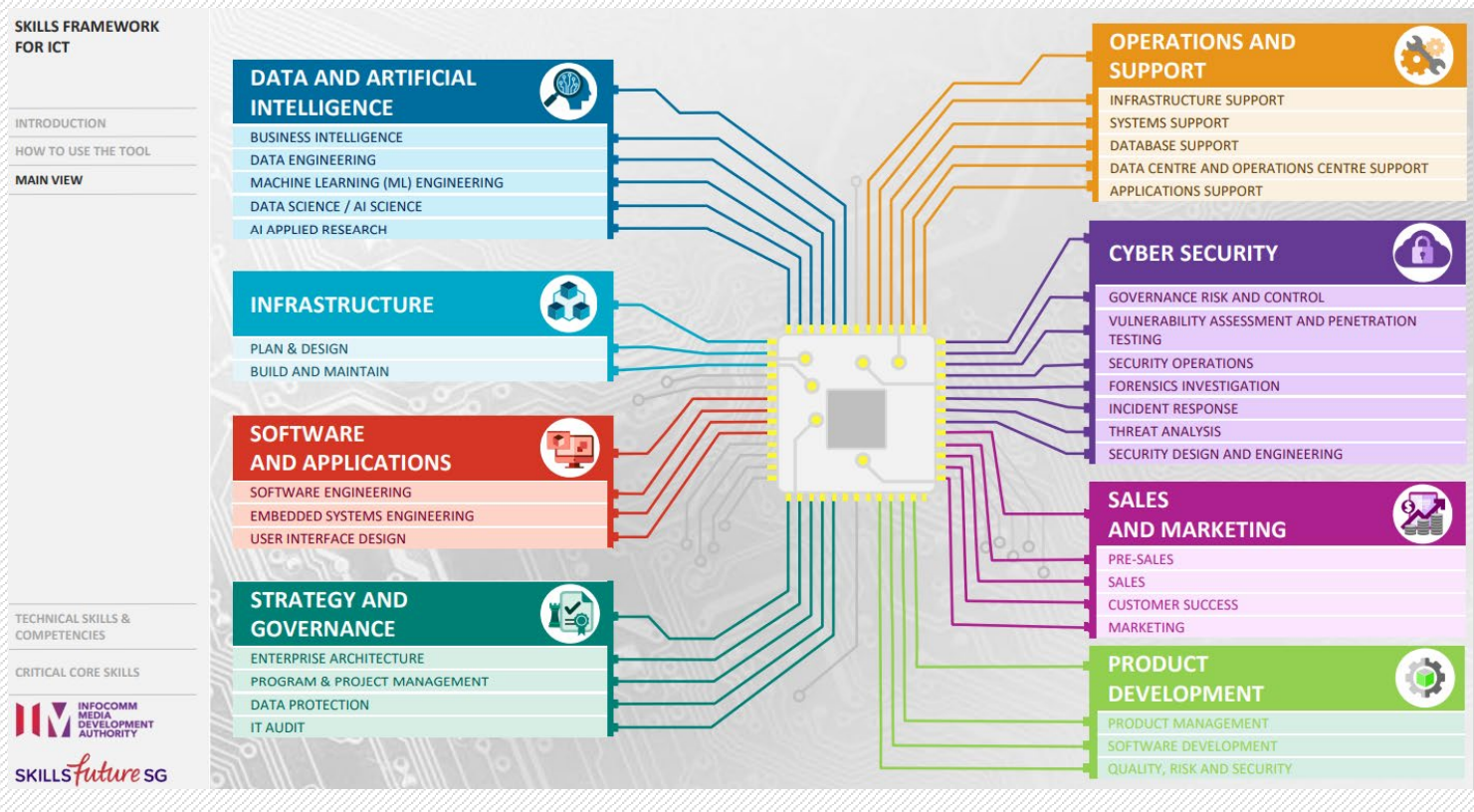
◀ Source: IMDA, SkillsFuture Singapore [4]

Adapting roles for Green by Design

Emerging skills essential for Green by Design illustrate how ICT job roles are evolving. Consider these examples across three key job families:

1. Network & Infrastructure related job roles.
The Network & Infrastructure related job roles family includes positions such as:

- Network & communications manager/IT infrastructure manager
- Network, servers & computer systems administrator
- Network engineer/Telecommunications engineer
- Virtualisation specialist/cloud operations specialist
- Infrastructure architect

To illustrate how these may evolve to encompass Green by Design, take the example of **Infrastructure Architect**. These professionals are responsible for evaluating and enhancing a company's tech infrastructure to align with business strategies.

Under the Green by Design approach, Infrastructure Architects could redefine their role by seeking alternatives to resource-heavy fail-safes and redundancies, such as hot standby systems where secondary systems remain active unnecessarily. Additionally, they could deploy innovative tools to identify and decommission "zombie servers" that waste resources. A critical aspect of their role would involve resource optimisation, leveraging systems like Kubernetes to maximise hardware efficiency.

For a comprehensive breakdown of the skills Infrastructure Architects will require under Green by Design, refer to the **Appendix**.

2. Other Critical Emerging Tech specialists
The Other Critical Emerging Tech specialists job family covers roles such as:

- Data analyst/Data scientist
- Machine Learning/Artificial Intelligence Engineer
- IT Security Operations Analysts/Engineers
- Internet of Things (IoT) Engineer
- Embedded Systems/Firmware Developers

Data Scientist/AI Scientist roles exemplify Green by Design integration. Given the importance of metrics and data in tracking and advancing sustainability, these professionals will adapt their focus to include the sustainability and fairness of AI models.

Their responsibilities will extend beyond performance optimisation to ensure AI systems align with ethical principles and ESG factors. This involves balancing cutting-edge innovation with broader sustainability objectives.

For example, while hardware manufacturers have emphasised the use of resource-intensive large language models, the most advanced companies are exploring the opportunities presented by small language models capable of running on a single device, bringing data storage and processing closer to the data generated, an approach that could be extended to IoT devices. Data-processing efficiency will be paramount, with skills in edge computing and energy-aligned scheduling becoming increasingly valuable.

Data Scientists and AI Scientists will also need to use Gen AI to generate sustainability data, while also working to reduce the carbon footprint of their company's Gen AI operations.

For a detailed breakdown of the new skills that Green by Design will likely entail for Data Scientists/AI Scientists, see **Appendix**.

3. IT Development Roles
The IT Development Roles family covers positions such as:

- Software & application manager
- Software engineer
- Multimedia & games developer

- User Interface (UI) User Experience (UX) designer
- IT business process engineers
- Database administrator
- IT/Software product manager and IT testing/quality assurance specialist/IT auditor

To understand how Green by Design skill will change for this family, take the example of **Software Engineer**. Software engineers lead on key projects, translating user requirements into the design, development, testing, debugging and implementation of software applications and specialised utility programs.

With Green by Design, software engineers will need to rethink how they approach application development, particularly as Generative AI becomes integrated into software solutions targeting sustainability. They will embed sustainability metrics at every stage of the product lifecycle, adopt eco-friendly software engineering techniques, and leverage Gen AI tools to optimise processes. Furthermore, they can deploy efficient programming languages tailored to specific tasks, ensuring minimal resource use without compromising performance.[5]

For a detailed skillset breakdown on how Green by Design will reshape Software Engineer roles, refer to the **Appendix**.

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Supporting Green by Design learning

Implementing Green by Design necessitates both formal training and broader organisational engagement. A fivefold strategy can assist in achieving this:

1. **Encourage cross-functional collaboration** to embed green thinking across the organisation. Involve teams from IT, operations, R&D and sustainability departments to develop and implement green technology initiatives.

2. **Embed circular economy principles** in technology procurement and lifecycle management. This could include selecting hardware and software that are recyclable, have minimal environmental impact and are produced using ethical labour practices.

3. **Share knowledge and best practices**, both in terms of the development and adoption of green practices. Such sharing establishes a business as an advocate of green solutions and helps to flatten the learning curve for itself and the wider community in the nascent field of Green by Design.

4. **Implement sustainable design principles such as energy efficiency and software efficiency**. While green software techniques continue to evolve, organisations can act immediately to emphasise the use of energy-efficient technologies in data centres, servers and other IT infrastructure. This could mean opting for low-power hardware, virtualisation to reduce the need for physical machines, and the use of renewable energy sources (e.g., solar and wind) to power technology operations.

5. **Measuring impact is another crucial consideration**. Leaders in ICT should also be aware of standards for software carbon measurement such as ISO's Software Carbon Intensity (SCI) specification. [6] Singapore provides resources for companies when it comes to carbon monitoring platforms under its Advanced Digital Solutions.[7] Other resources include the SkillsFuture Training Library and the KPMG Academy that can guide companies through what is needed.

Talent as a strategic differentiator

Organisations poised to succeed are those that harness their technology talent strategically. By linking technology decisions to business outcomes, embedding sustainability early, and leveraging government-supported training, companies establish competitive advantages that stand the test of time. Skills mapping provides direction, while nurturing in-house talent promotes agility, resilience and retention.

Success in the green economy isn't about having every cutting-edge tool but knowing how to apply them for meaningful results. A future-focused leadership team that aligns technology and sustainability underpins transformation, ensuring businesses remain innovative, responsible, and competitive well into the future.

CHAPTER 04

Recommendations for businesses

Businesses are navigating a pivotal moment shaped by the rapid convergence of technological innovation and tightening climate regulations. For many, the question is no longer if they should adapt to sustainability demands, but how to do so effectively and at what cost. Green by Design has evolved from being a compliance measure or reputational enhancer to a critical economic driver, transforming how companies compete and create value.

However, focusing solely on costs can misguide strategic decisions. Instead, businesses must begin with their long-term goals—what they aim to achieve, how they plan to remain relevant in global markets, and where sustainability fits into this equation. A thoughtfully crafted roadmap aligned with business objectives will ensure smart investments in sustainability and technology act as a catalyst for growth, innovation, and competitiveness.

Start with business goals

The foundation of any Green by Design initiative lies in clarity about business goals. Companies must evaluate their long-term objectives—spanning five, ten, or even twenty years—to determine where sustainability and digital transformation can add the most value. This approach helps avoid reactivity to trends and ensures investments align with measurable business outcomes.

Seeking guidance from strategic partners or business advisors can play a critical role in shaping this roadmap. External experts offer an invaluable perspective, free from internal biases, enabling companies to take stock of global and regional opportunities. Benchmarking against not just local competitors but also global leaders can further uncover innovation and expansion paths that elevate a company's position in the market.
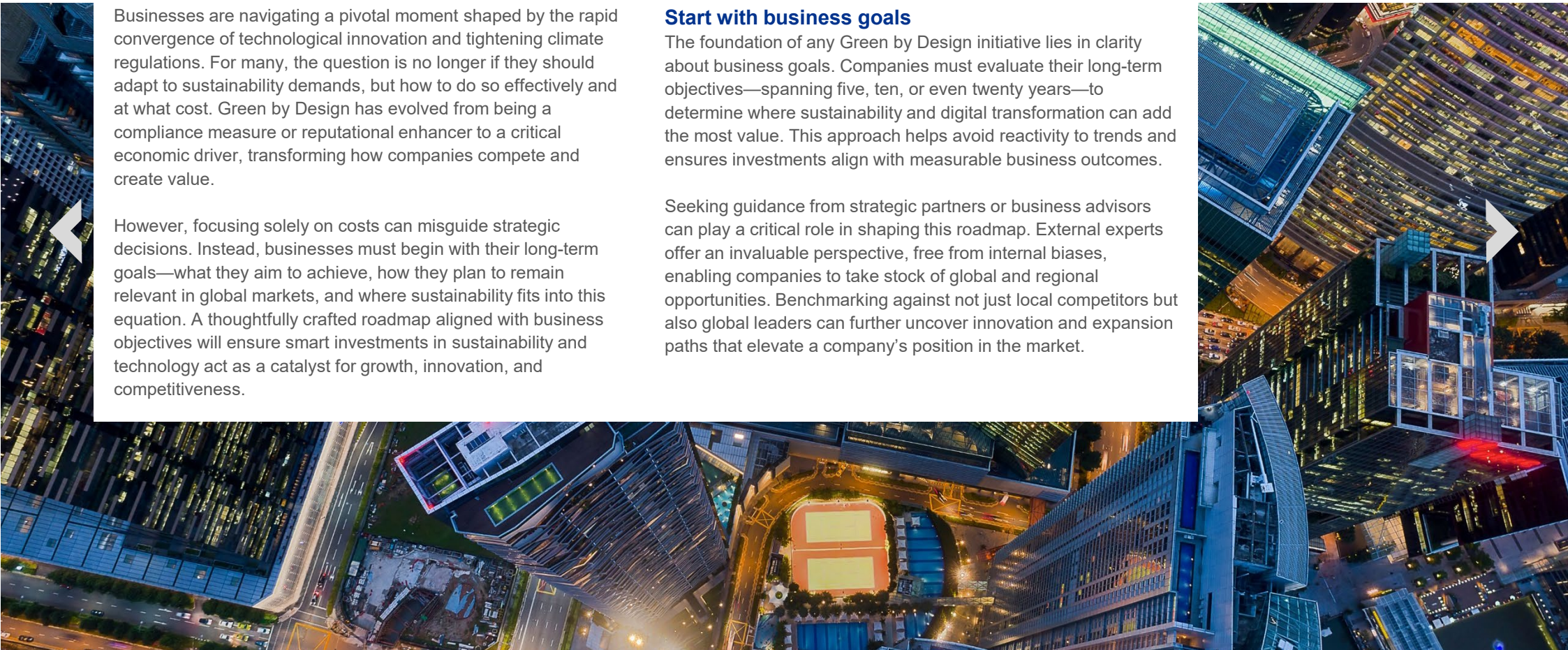
A progressive investment approach

Cost questions—how much and how quickly—are natural when implementing sustainability initiatives. However, companies should view Green by Design as a phased, progressive investment. The initial steps can focus on leveraging grants, subsidies, and other financial incentives to manage short-term costs while building a long-term foundation for sustainable growth.

Singapore is a standout example, offering extensive programmes such as the Enterprise Sustainability Programme and SkillsFuture. These initiatives not only lessen financial barriers for businesses but also provide structured pathways to develop capabilities. Starting small and building momentum allows firms to steadily unlock operational efficiencies, reduce costs, and strengthen their market relevance.

Leveraging internal talent

One of the most underestimated resources in sustainability transformation is the workforce a company already has. Employees possess unique institutional knowledge that is integral to identifying inefficiencies or implementing sustainable innovations. For instance, an IT team may pinpoint energy-intensive infrastructure, while production staff can spot resource wastage.

The key is to focus on skills discovery. By mapping out their workforce's existing competencies, companies can identify overlaps with future needs and pinpoint skill gaps. This exercise should be treated as adaptable and tailored to fit a business's unique circumstances.

Upskilling and reskilling provide a cost-effective alternative to new hiring, fostering internal growth while demonstrating a company's commitment to its employees. Leadership must drive this initiative, embedding sustainability into business processes and actively investing in employee development. The outcome? A motivated, future-ready workforce aligned with corporate sustainability goals.

Strategic collaboration for broader perspectives

Viewing Green by Design as solely an internal effort limits its potential. Collaboration with external stakeholders, including multinational clients, government bodies, and industry peers, can help companies gain critical insights into global developments. Access to broader perspectives is especially valuable for benchmarking performance, identifying market trends, and leveraging innovation opportunities.

This collaboration is becoming increasingly significant as global supply chains demand sustainability-aligned partners. Companies that position themselves as "sustainability-ready" can differentiate themselves in highly competitive marketplaces, gaining trust, loyalty, and security in customer relationships.

Technology and its role in sustainability

Sustainability and digital transformation are increasingly intertwined. Businesses digitising their operations must incorporate energy-efficient technologies, whether through optimised data centres, streamlined cloud solutions, or Gen AI systems with reduced compute power. These measures not only meet compliance benchmarks but also generate revenue opportunities.

For example, companies developing products with embedded sustainability metrics appeal to both regulators and environmentally conscious consumers. However, this requires a workforce equipped with the latest expertise in resource-efficient technologies and green ICT solutions. New growth opportunities will come to those who align their digital transformation strategies with Green by Design principles.

Staying ahead in global competition

Remaining competitive requires a view beyond local benchmarks. Businesses must track how their sustainability metrics compare to global leaders, whether in adopting blockchain, IoT, or other technologies redefined for sustainability. Keeping pace with these advancements ensures relevance in the global marketplace.

Equally important is anticipating how sustainability imperatives will shape supply chain dynamics. Multinational corporations are setting ambitious carbon reduction targets across their networks, and businesses that meet these expectations position themselves as preferred vendors and secure long-term collaboration opportunities.

Green by Design as an opportunity

Green by Design is not simply a cost or compliance overhead; it is a strategic enabler of innovation, growth, and differentiation. Businesses that commit to integrating sustainability into their strategies, starting with clear goals and progressing through calculated investments, will reap substantial benefits.

This transformation requires strong leadership. Executives who champion Green by Design as a core business driver can inspire confidence among employees, customers, and stakeholders while future-proofing their organisations. Green by Design isn't merely about adapting to change—it's about shaping the future. For businesses to thrive amid rapid economic and environmental shifts, the time to act is now.

APPENDIX - Infrastructure and Network Specialists
Infrastructure Architect

1. Emerging Green by Design skills for infrastructure architects

▶ **Context of change**

Infrastructure Architects will need to leverage GenAI tools to forecast needs, evaluate emerging technologies, and ensure compliance with sustainability benchmarks. They will design energy-efficient infrastructures, assess current architectures for weaknesses, and propose sustainable enhancements and alternatives to resource-intensive fail-safes and redundancies, that balance performance with environmental impact.

Through collaboration with ESG experts, AI/Software Engineers and AI/Data Scientists, they will integrate GenAI into workflows, aligning business deliverables with ESG goals through scenario modelling and resource analysis, to reduce redundancies, and offer eco-friendly, cost-saving options.

Additionally, they must ensure disaster recovery, maintenance, and resilience, incorporating monitoring capabilities to promote sustainability and reduce costs.

▶ **Additional considerations for critical work functions**
  - **Formulate the organisation's architecture strategy, governance, roadmap, standards, policies and procedures:** Leverage AI tools for decision-making, ecosystem strategies, and aligning infrastructure standards with sustainability principles. These tools support governance processes, help manage exceptions and enable the development of plans that model future scenarios, improve performance, and reduce resource consumption.

  - **Develop architecture requirements and maintain oversight:** GenAI can assess infrastructure requirements, align with IT strategy and integrate sustainability criteria while evaluating business priorities and environmental impacts. It aids in ensuring compatibility with existing solutions, supports disaster recovery and maintenance planning, and drives post-implementation support to optimise performance and embed sustainability principles.

  - **Manage quality and continuous improvement of architecture:** Implementing GenAI-driven analytics allows for assessing current architecture, identifying weaknesses and resource-intensive redundancies, and proposing sustainable enhancements. These tools also support continuous quality reviews, ensuring designs align with sustainable standards, while meeting needs and expectations.

APPENDIX - Infrastructure and network specialists
Infrastructure Architect

- **Research emerging technologies:** AI tools can be utilised to analyse infrastructure projects by evaluating costs, benefits, risk, impact and environmental priorities, while identifying emerging technologies and market trends to provide data-driven recommendations for project development. These tools can also be used to in scenario analysis to understand as-in state and forecast potential resource needs, optimise its allocation, and support dynamic communication strategies to effectively convey infrastructure plans to stakeholders.

- **Design infrastructure architecture:** GenAI-driven tools can automate and optimise infrastructure architecture design, simulate and model performance, and define principles that align with business requirements, IT strategies and sustainability standards. By integrating AI-based analytics with monitoring data, these tools can evaluate resource utilisation, suggest cost-saving measures, and guide technology selection and configuration, ensuring they meet both performance and sustainability goals.

▶ **Impact on skills**

Technical skills & competencies required

- Artificial intelligence application in product development
- Environment and social governance

Growing demand for core skills

- Collaboration
- Communication

APPENDIX - AI professionals

Data Scientist / AI Scientist

2. Emerging Green by Design skills for data scientists/AI scientists

▶ **Context of change**

Data and AI Scientists will increasingly need to integrate ESG-related considerations into their model development and evaluation processes, with focus both on responsible AI and energy efficiency.

They will need to be familiar with open-source large language models (LLMs) and small language models (SLMs) that can support automation in tasks such as bias detection and mitigation, while optimising resource and energy consumption.

Additionally, they should be aware of government-developed ethical guidelines and regulations to ensure that the use of data and models do not violate any responsible AI framework requirements.

The role will also need to work more collaboratively with roles such as ESG experts, AI/Software Engineers and Infrastructure Architects to understand stakeholder needs, explain use cases for LLMs and SLMs, and achieve solutions which are aligned to organisational goals.

▶ **Additional considerations for critical work functions**

▪ **Manage data preparation & modelling:** Utilise GenAI tools such as LLMs, SLMs and automated machine learning platforms to identify and correct biases in used datasets, improve data extraction and integration processes, and design energy-efficient models that support sustainability goals. While such tools automate ethical evaluations and incorporate sustainability metrics, the role should provide human oversight to ensure adherence to data ethics and minimise environmental risks throughout the model selection and evaluation process.

▪ **Build & assess models:** Integrate sustainability metrics and use utilise LLMs and other GenAI tools to test, scale and deploy models efficiently, ensuring they provide valuable insights even with limited resources (e.g. data availability, infrastructure challenges).

▪ **Present data driven business value of data science/AI models:** Utilise advanced machine learning algorithms and LLMS to analyse and visualise complex sustainability data, provide predictive insights, and automate the generation of real-time reports tailored to specific stakeholder needs.

APPENDIX - AI professionals
Data Scientist / AI Scientist

▶ **Impact on skills**

Technical skills & competencies required

- Artificial intelligence application in product development
- Environment and social governance
- Impact indicators, measurement and reporting
- Sustainability risk management

Growing demand for core skills

- Collaboration
- Adaptability

APPENDIX - Software programmers
Software Engineer

3. Emerging Green by Design skills for software engineers

▶ **Context of change**

The evolving role of software engineers, driven by sustainability and AI, requires a comprehensive understanding of AI capabilities and their application across diverse solutions. Engineers must stay informed about emerging tools and technologies, including open-source platforms, to leverage AI effectively and build secure, scalable solutions tailored to business needs.

Proficiency in programming languages like Python, paired with a commitment to safe and ethical development practices that ensure solutions are functional, responsible, and protective of users, stakeholders, and broader communities, will be essential.

Additionally, software engineers are expected to design solutions that align with sustainability goals, minimizing resource usage while maximising long-term impact. Adaptability, continuous learning, and cross-function collaborations are key to navigating these shifts successfully.

▶ **Additional considerations for critical work functions**

▪ **Analyse user and business requirements:** Collaborate with stakeholders to thoroughly understand user needs and business goals. AI tools can enable rapid prototyping and alignment with business requirements and initial designs, focusing on reusing components and APIs for sustainable, secure, and scalable solutions.

▪ **Manage the design of software:** Oversee software design processes, emphasising component reuse and adherence to standards like WCAG for inclusivity and OWASP for security. AI models assist in reviewing designs, optimizing performance, and ensuring scalability and sustainability, with quick iterations and AI-supported tasks.

▪ **Manage software construction processes:** Software engineers take on increasingly active role in managing software development activities, leveraging agentic AIs, and ensuring efficient performance. They focus on creating energy-efficient code to reduce the carbon footprint and deliver high-quality software that meets both functional and environmental standards.

APPENDIX - Software programmers
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- **Oversee software testing and security provisions in software:** Responsible for ensuring robust testing and security practices throughout the development lifecycle. This includes implementing automated testing frameworks, leveraging AI tools for vulnerability detection, and adhering to industry standards like OWASP to secure applications.

- **Manage Software Management Configuration (SCM):** Manage and maintain software configuration processes, ensuring version control, build automation, and release management are efficient. AI tools streamline SCM, ensuring deployments are consistent, reproducible, and aligned with quality and sustainability goals.

▶ **Impact on skills**

Technical skills & competencies required

- Artificial intelligence application in product development
- Environment and social governance
- Agile software development

Growing demand for core skills

- Adaptability
- Collaboration
- Creative thinking

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