Digital infrastructure's defining moment on climate

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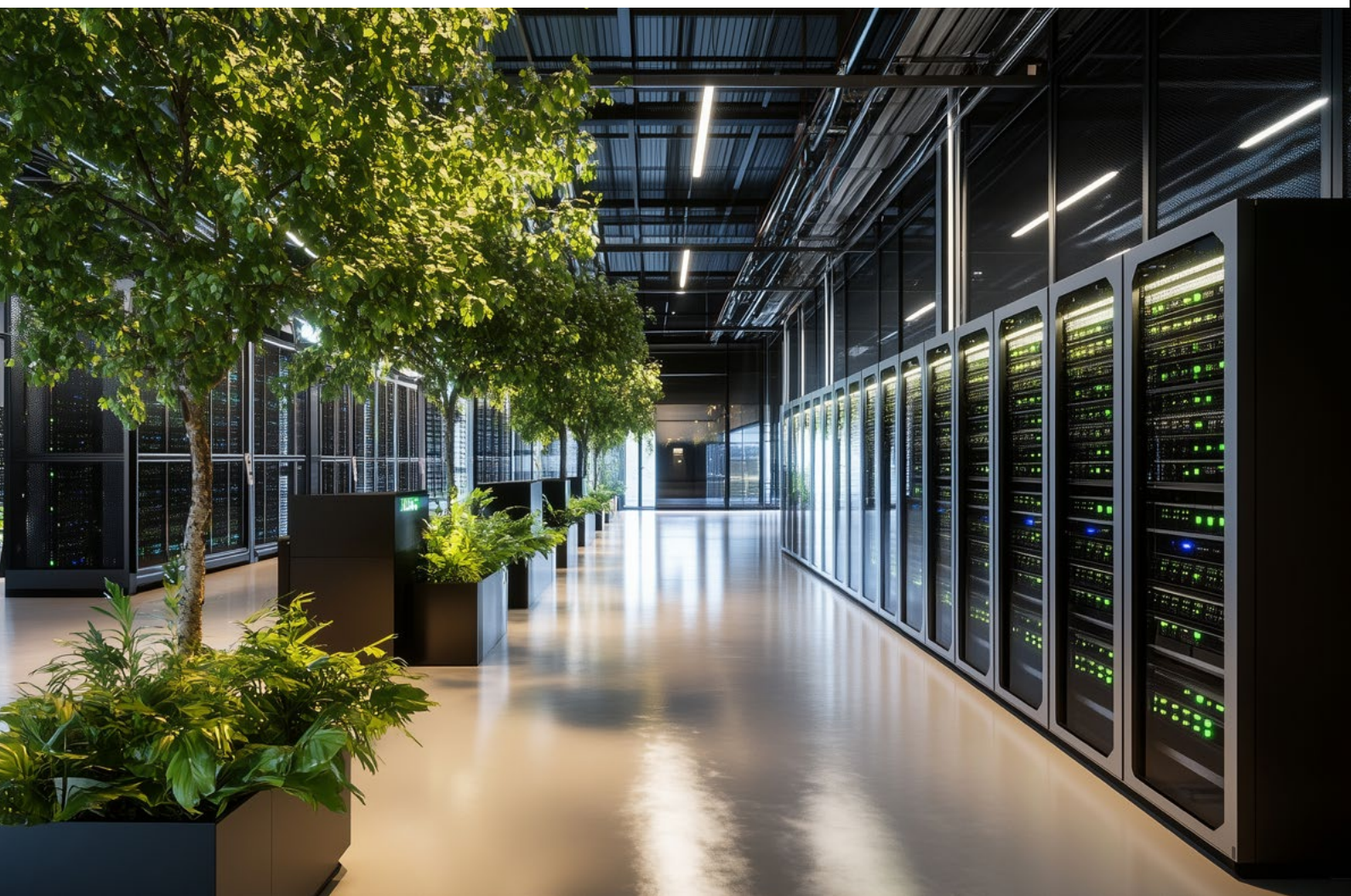


Digital infrastructure's defining moment on climate

To grapple with the rising demand for their services while reducing emissions, leaders must embark upon a comprehensive transformation.

The large and rapidly growing digital infrastructure sector, which includes telecoms and data center service providers, and the electronics and equipment that go into their networks and facilities, is facing an important climate inflection point. Recent **research by the Global Carbon Project** indicates that global carbon emissions from fossil fuels rose to a record high in 2024, and that there's still "no sign" that a peak has been reached. Meanwhile, the demand for telecom and data center services is rising extremely rapidly, in part thanks to the widespread adoption of AI. The sector's headlong growth is driving increasing processing and storage capacity, higher density, and more power-hungry chipsets. The rising demand for energy these developments spur has the potential to negate much of the progress the industry has made on reducing emissions. According to the **International Energy Agency's Electricity 2024 report (PDF)**, data centers worldwide consumed a massive 460 terawatt-hours (TWh) in 2022—but by 2026 this could exceed 1,000 TWh, more than double the 2022 total, and an amount "roughly equivalent to the electricity consumption of Japan."

Along with potential climate impacts, the rising energy use and emissions bring regulatory and reputational risks. Without concerted action, sector-wide emissions might balloon at the very moment that new reporting requirements, such as the EU's **Corporate Sustainability Reporting Directive (CSRD)**, make such metrics highly visible to stakeholders.

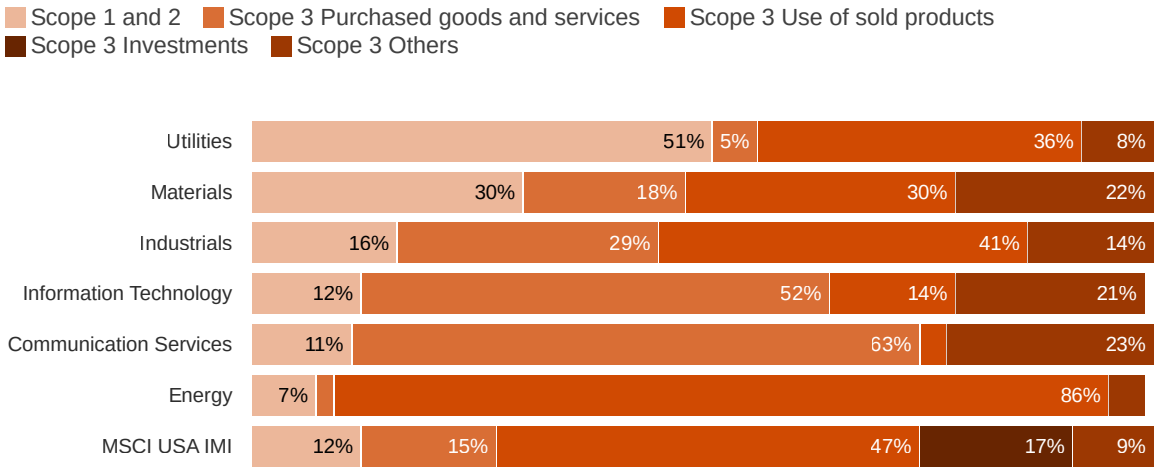
To confront these challenges, companies in the digital infrastructure ecosystem must adopt a hands-on, bottom-up transformation that will enable the industry to decarbonize its operations and activities—and while doing so, build and scale an AI grid infrastructure that can enable the rise of sustainable operations across all sectors of the global economy. Just as each function contributes today to the profit and loss statement, every business function will need to contribute to the reduction of Scope 1, 2, and 3 greenhouse gas (GHG) emissions.

A sizable majority of GHG emissions occur either upstream in the value chain or downstream in how products and services are used by customers. As a result, progress toward net zero will require intensive collaboration across the technology ecosystem and along value chains, together with a willingness to explore new business models. The good news: there are clear upside opportunities for leaders across these businesses to get a clearer view of Scope 3 emissions—and to take action.

The challenge of Scope 3

Until now, most digital infrastructure companies have focused decarbonization efforts on their own operations—i.e., electrifying vehicle fleets, making real estate more sustainable, and acquiring green energy through power purchase agreements (PPAs). These efforts to address Scope 1 and 2 emissions are enabling telcos and data center operators to make progress toward their public climate commitments. But for most ecosystem participants, the potential climate impact of such initiatives is dwarfed by their exposure to Scope 3 emissions—in a nutshell, the emissions involved in making, using, and moving a product. These include, for example, emissions embedded in hardware purchases, the consumption of third-party data center services, the lifetime use of manufactured equipment, and end-of-life electronic waste. In fact, well over 80% of GHG emissions from both the information technology and communication services sectors occur either upstream or downstream of companies' own operations. One large telco we know recently calculated that Scope 3 emissions accounted for 98% of its total carbon footprint.

Industrial emissions by scope



Percentages shown may not total 100 due to rounding.
Source: MSCI ESG Research (2022), PwC Strategy& analysis

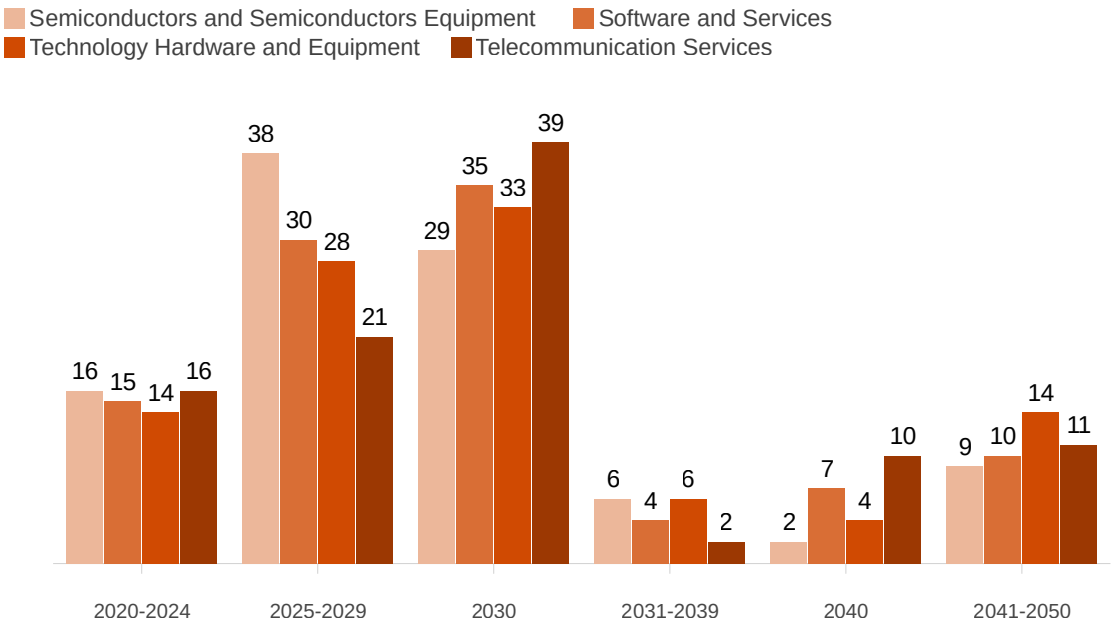
Of the 15 Scope 3 emissions categories identified in the GHG protocol, two are generally the most relevant to companies in the technology and digital infrastructure sector: purchased goods and services and use of sold product. HP sources thousands of components from hundreds of companies to assemble computers and servers. The emissions associated with all aspects of sourcing, manufacturing, and shipping these upstream components or supplies are included in purchased goods and services emissions. The lifetime electricity-related emissions during the use phase of iPhones are part of Apple's use of sold product emissions. To be sure, if the IEA's scenarios for green electricity **by 2050** are accurate, there will no longer be a problem with use phase GHG emissions from handsets and equipment after that date.

Misaligned net zero targets

Net-zero targets—and the timelines for achieving them—are currently misaligned across the industry. The upstream value chain is dominated by a handful of global players: Nokia, Ericsson, and Huawei in network equipment; Apple and Samsung in smartphones; Amazon, Microsoft, and Google in cloud. Given that, it's clear that hundreds of local and regional telecom and data center providers are reliant on the product road maps of other organizations to address their Scope 3 emissions.

But net-zero targets are not broadly aligned across the ecosystem. Some companies have set no carbon targets at all, while others have targets that aren't aligned with the **Science-Based Targets initiative (SBTi)**. Even where companies are using SBTi benchmarks, their self-imposed deadlines vary widely (See the chart below). If they're to address Scope 3 emissions successfully, companies face significant work around agreeing common targets and timelines.

Commitment deadlines of companies' entries (in %) by subsector

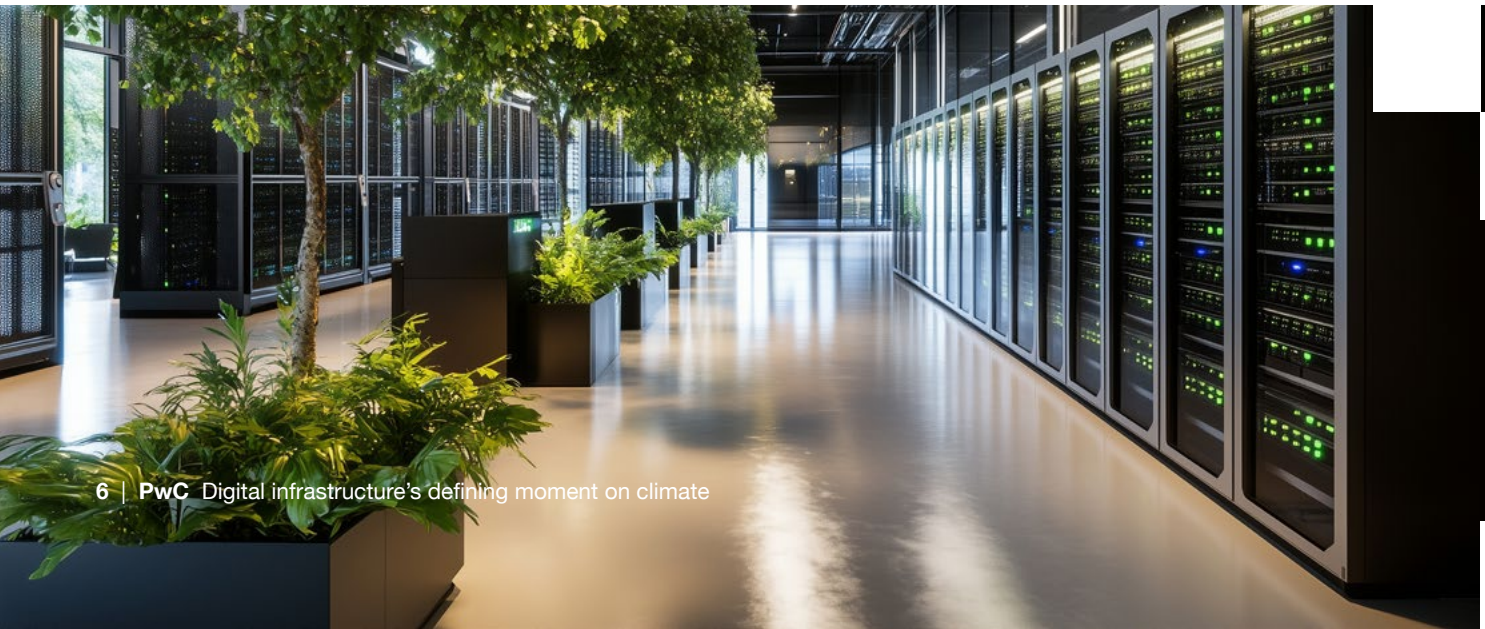


Source: SBTi (2025), Strategy& analysis

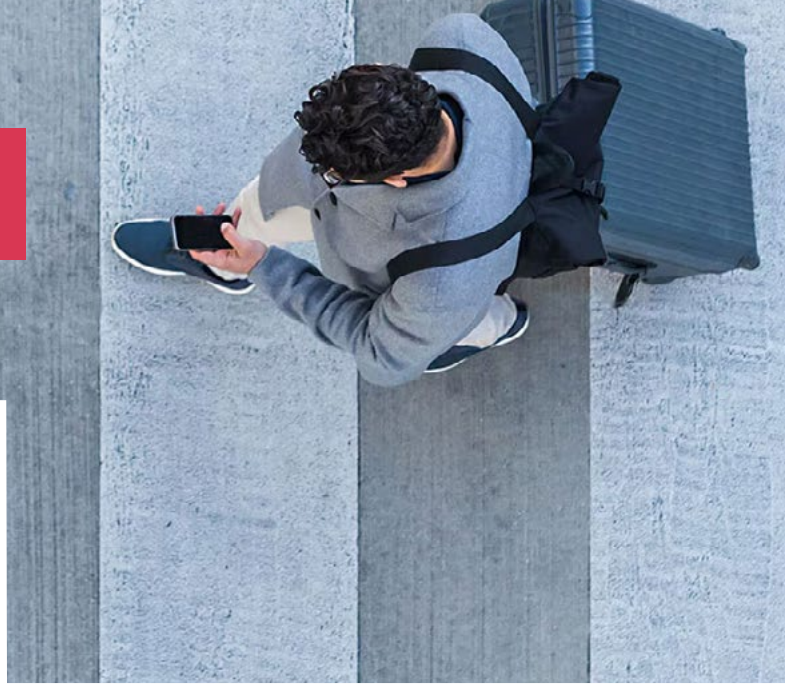
Acting across the C-suite—and along the value chain

While the CEO needs to shape, own, and personify the formulation and execution of the sustainability strategy, every member of the C-suite has a role to play in activating and delivering a clear plan to address Scope 1, 2, and 3 emissions in their respective functional domain and segment of the value chain.

The main priority for chief financial officers (CFOs) is establishing decarbonization budgets and relentlessly tracking implementation, akin to planning and reporting on financial performance. Working with the technology function, finance should also act as the prime mover in establishing an "ERP for ESG"—i.e., embedding a planning-results cycle into every function of the business, enabled by data, software, and AI models, to visualize impact/progress, preview trends, and identify required actions and recommendations. Since the possibility of a carbon cost, pricing, or tax being imposed in various jurisdictions can create a significant financial impact, the CFO needs to model the impact of different pricing and tax scenarios, and anticipate the effects when setting targets and budgets. If the organization has a chief sustainability officer (CSO), that individual will also be influential in planning and coordinating these actions. For the other members of the C-suite, we can categorize the actions they need to take under four key areas of responsibility along the value chain: supply chain activities around procurement and sourcing; infrastructure build, operations, and optimization; product/service development and delivery; and commercial activities including marketing and sales. We'll now look at the potential steps for the C-suite members overseeing each of these areas to bear down on carbon emissions—including those in Scope 3.



The supply chain



With most digital infrastructure companies already starting to embed some sustainability requirements into their procurement processes, chief procurement officers and chief supply chain officers must now overlay a number of perspectives on all procurement activities—from strategic sourcing to energy and other utility services, to labor and logistics.

By implementing and enforcing low-carbon purchasing practices, terms, and financing models, companies can use their buying power and commercial muscle to influence or even compel suppliers in every category to operate more sustainably. Addressing Scope 3 effectively in the supply base requires companies both to conduct sustained and direct engagement with suppliers—spelling out and policing what is expected of them and why—and also to reward those suppliers who provide the lowest-emissions goods with more business. Deutsche Telekom **includes** sustainability criteria weighted at 20% when tendering for suppliers. Vodafone's partnership with Citi and the global nonprofit CDP has established preferential terms on financing for supplier decarbonization—underpinned by requirements including disclosure of emissions data, evidence of sustainable operations, and a high score on environmental performance criteria.

In reshaping procurement to reduce emissions, it's vital to take human and behavioral factors fully into account. Engineers need to be rewarded on making the most efficient product that also attains other goals; and procurement professionals need to be rewarded for purchasing the most cost-effective and lowest-emitting components. The lowest-cost options often have the highest-embedded emissions because they're under-engineered. Spending 2% more on a component might reduce emissions by 30% over the life of the product.

Horizontal partnerships across value chain segments can be a powerful way of aligning supply and demand more closely to sustainable operations. Larger companies **can partner and collaborate (PDF)** with startups to help implement new business models that help to reduce Scope 3 emissions. In the rising "re-manufacturing" and product-as-a-service (PaaS) models, which could trigger an increase in costs and CO2 emissions at the logistics phase, many startups are emerging that can enable larger players to test out these business models so they can better understand and manage their Scope 3 impacts.

Amalgamating buying-power and sustainability policies among a number of major organizations can incentivize and catalyze change across a supply base, even one that includes the biggest global providers. In 2023, the **Joint Alliance for CSR (JAC)**—a not-for profit association of 28 telcos worldwide—published a report setting out **new best practices** for decarbonizing diverse global supply chains.

Finally, logistics present both a challenge and an opportunity. Warehouses and field stock locations can be transitioned to carbon-neutral building management practices, and can be leveraged for renewable energy production and storage. Within these locations, stock levels need to be optimized to minimize waste or carbon-burdened overstock through better matching of demand and supply. Also, shipping routes between locations and network/retail/customer premises need to be optimized (with AI) to minimize mileage, and shifted to carbon-neutral means of transportation, where possible, such as electronic vehicle (EV) fleets.

Infrastructure

For the chief technology officer, chief network officer, or chief information officer overseeing a digital infrastructure company's assets and operations, priorities for driving down emissions should include using AI and predictive software models to optimize energy usage while also introducing circularity into network build and maintenance plans. It's also important to seek out opportunities to couple the company's network (or infrastructure) with adjacent utility grids—for example, by feeding heat emitted from data centers into local utilities for reuse in communities. Sweden has an **ambitious plan** to completely decarbonize its heating and hot water system by 2030 through district heating, using recycled water, the energy generated by data centers, and nonrecyclable waste to heat the entire country.

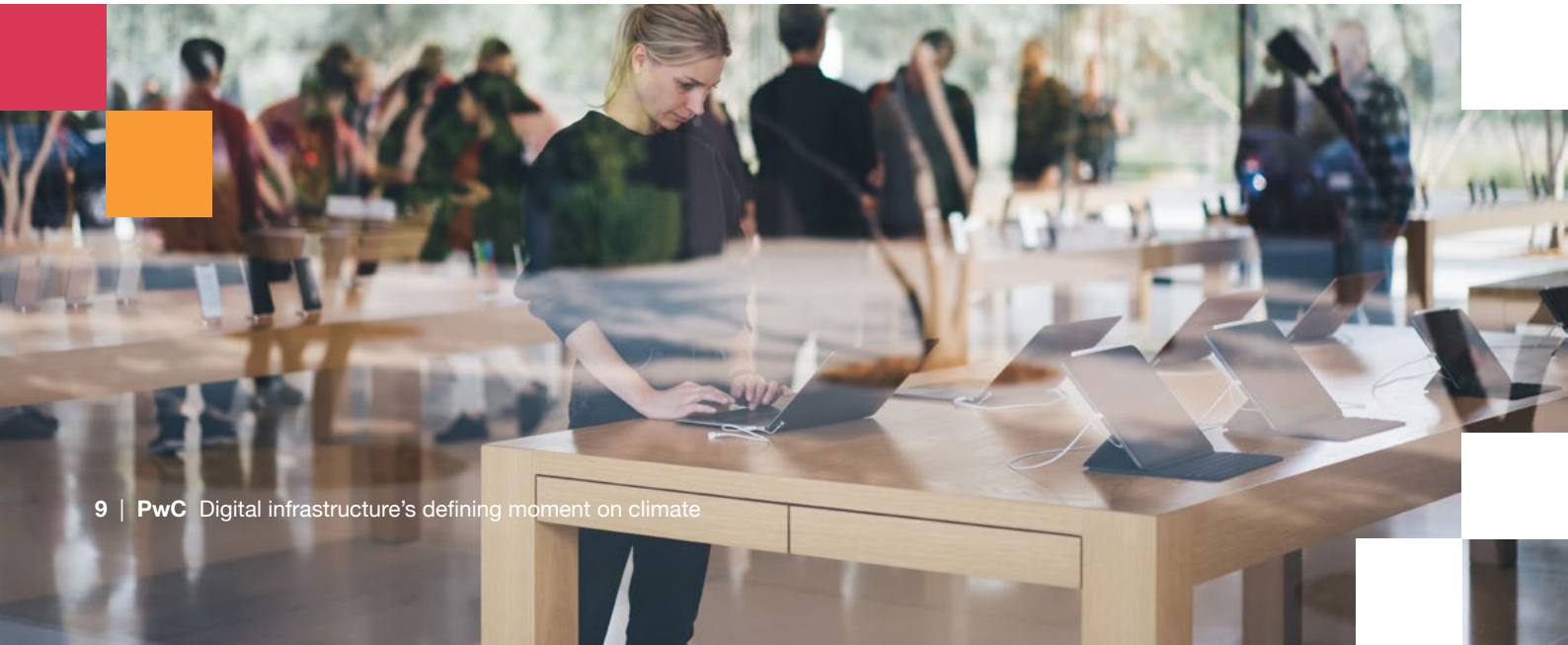
Introducing factors such as emissions, carbon cost, energy cost, electronic waste management, and greater circularity into its network-planning algorithm enables a company to rethink and reprioritize its infrastructure build, refurbishment, and retirement portfolio. A business case founded on financial cost plus carbon cost will have a different return on investment profile from one based just on traditional economics—and will be better positioned to continue to deliver return on investment under various carbon pricing/tax regimes. Further elements of the new network planning model are likely to include an acceleration of copper/coaxial cable decommissioning and the transition to fiber, and more closely integrating renewable energy sources into the network and/or data center build program.

Product/service

The chief product officer's efforts to reduce Scope 3 emissions in the downstream value chain primarily center on smart management and, ultimately, the transformation of the device portfolio, with an emphasis on embedding circularity into the product design and manufacturing process and lengthening the product lifecycle. Some of the principles underpinning a DfE (Design for Environment) approach include designing for future recyclability by avoiding hybrid or composite material that can never be recycled, marking metals with their periodic table identifier, and—most importantly—specifying energy-efficient components rather than simply selecting the lowest-cost components.

Another useful step is ensuring that that all new products go through a life cycle assessment (LCA). This is a formal process that involves modeling the lifetime GHG and water impacts of a potential product, followed by performing if/then scenarios with different design options to see how they impact those emissions over time. Repurposing handsets and previously used network equipment—for example, by selling refurbished products to companies in developing countries—not only extends the equipment's useful service life but also avoids the GHG emissions associated with building a new product.

In offering more sustainable options, digital infrastructure companies are pushing against an open door. **PwC's Voice of the Consumer Survey 2024** found that 85% of consumers are now experiencing the disruptive effects of climate change in their daily lives, and that 46% are buying more sustainable products to reduce their personal impact on the environment. O2 in the UK has introduced an environmental labeling system called Eco Rating to help customers make more sustainable choices when buying mobile handsets.

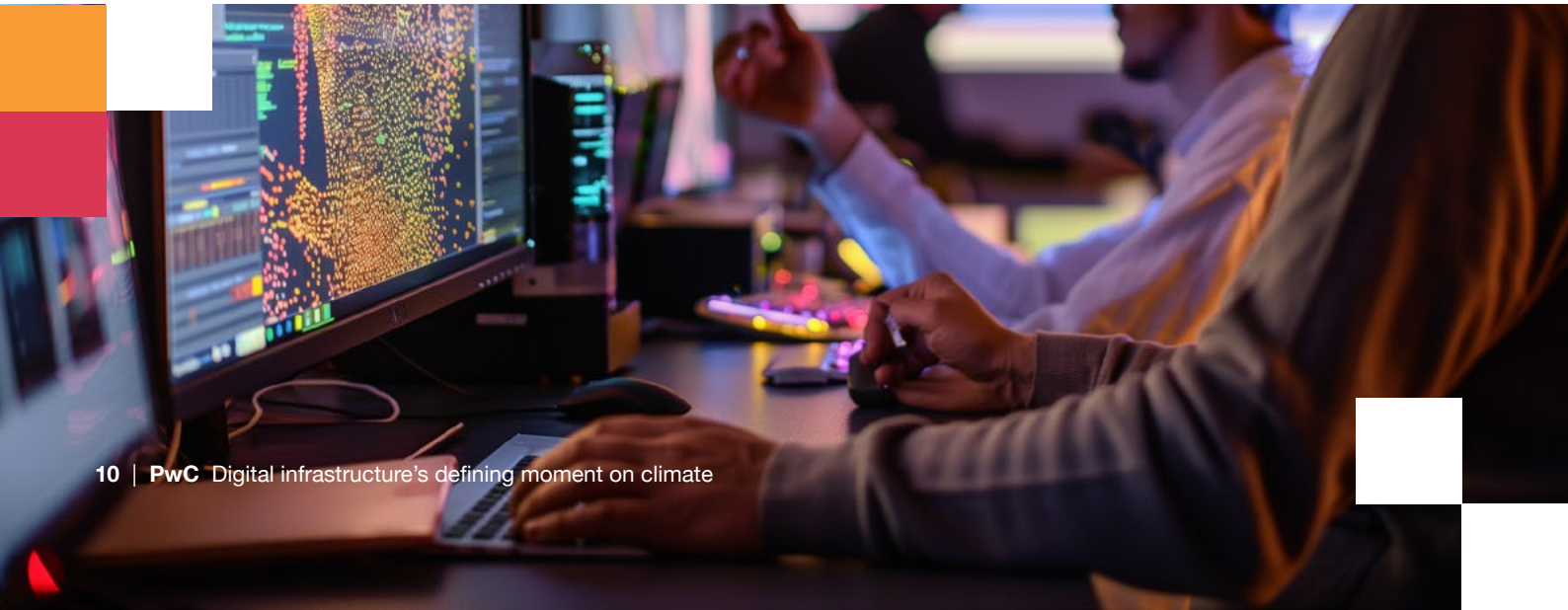


Commercial/marketing and sales

For the chief marketing officer, the priorities for decarbonization include rethinking pricing models and offering loyalty and rewards programs to encourage and incentivize the more sustainable choices that are being offered to consumers. New embedded finance and leasing models can shift consumption behavior from an ownership mindset toward a leasing model—which, in turn, increases return rates so handsets can be refurbished and their lifecycle extended.

Marketing strategies should lean into marketing promotions or incentives that encourage and reward longer device usage lifecycles, higher rates of return for refurbishment and reuse, and more device recycling to increase circularity. Samsung, Philips Monitors, and service provider **Closing the Loop** are collaborating to recover and recycle a volume of broken devices precisely equivalent to the number of devices these original equipment manufacturers (OEMs) have put on the market. **Closing the Loop also works with** the German arm of Vodafone, collecting and recycling one scrap phone in Africa for each new device sold by Vodafone in the country.

Rethinking the partner ecosystem is a further powerful lever for decarbonization in the product lifecycle. This might involve working with suppliers and fintechs to enable sustainable and circular-by-design leasing or subscription models. **Telia Company reports** that in 2023, 27% of the mobile handsets it sold to B2B customers were provided under a circular "device-as-a-service" model. Sales of refurbished handsets are on the rise, with **researchers FMI** estimating the global market will more than treble to almost US$259 billion by 2034. **Vodafone and circular economy specialists Recommerce** collaborate on the reuse and recycling of handsets—and their **joint research** has found that more than half of Europeans are willing to buy a refurbished smartphone.

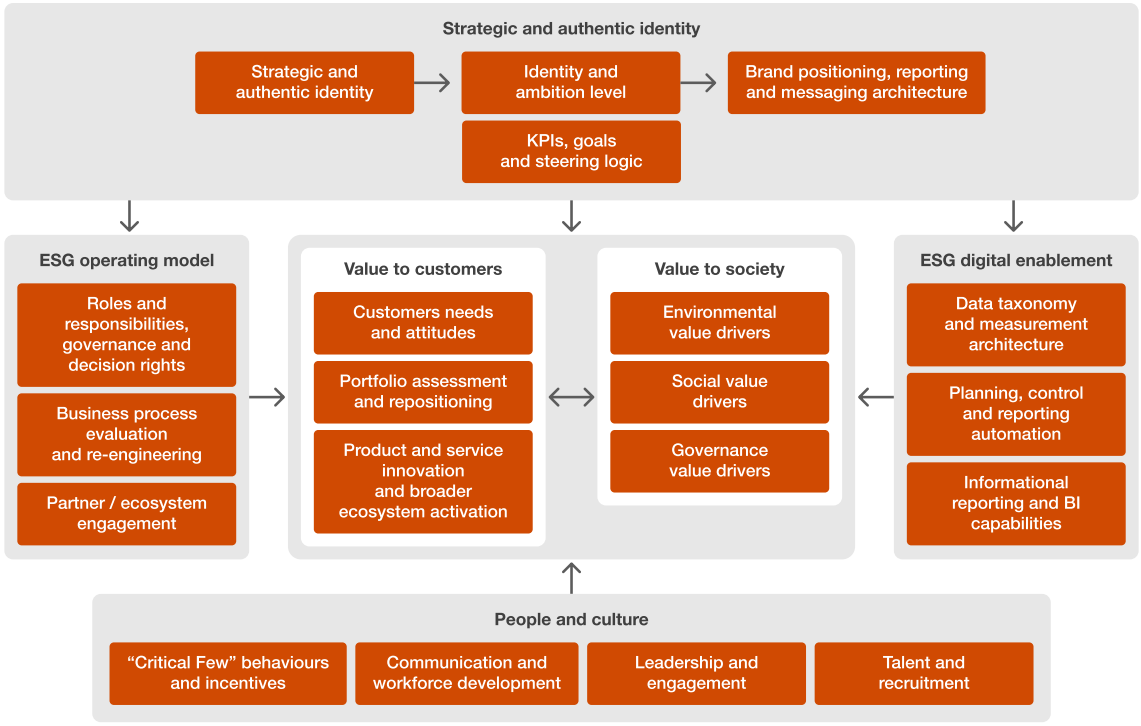


Organising for impact

To meet their publicly declared emissions commitments, digital infrastructure companies will have to adopt the same mindset and approach they have applied successfully to multiyear, enterprise-wide cost or technology transformation programs—including establishing a clear business case for investment in decarbonization.

This pervasive scope and impact is captured in the six-element framework we've developed to guide environmental, social, and governance (ESG) programs, and consists of a three-part strategy empowered by three key enablers. First, clearly articulate and confirm what your company wants to stand for with regards to sustainability. This needs to be expressed in an authentic and credible way that will operationalize how you create value for customers by providing sustainable products and services—and/or by helping your customers achieve their sustainability objectives; and by extension creating value for wider society. The three core required enables are: (1) an operating model that defines roles and responsibilities, and makes sustainability integral to core line management practice as opposed to being just a compliance obligation; (2) migration to enterprise resource planning for ESG through digital enablers that support discipline across planning, measurement, and reporting; and (3) developing an organizational culture and workforce with the sustainability mission front and center.

Some segments of the framework fall primarily within the remit of the C-suite, while others are shared more widely across different executives. The key is that the six elements come together and interact as shown, driving the program forward.



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Authors

Dr. Florian Gröne
Global Telecommunications Leader, PwC United States
florian.groene@pwc.com

Renate de Lange
Sustainability Leader, Global Tax & Legal Services, PwC Netherlands
renate.de.lange@pwc.com

Rich Goode
Assurance, Partner, ESG, PwC United States
rich.goode@pwc.com

Russell Taylor
UK Telecom Leader, Partner, PwC United Kingdom
russell.y.taylor@pwc.com

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