Global Innovation and Impact Council

WORLD ECONOMIC FORUM

Shaping Tomorrow: Responsible Innovation for a Brighter Future

INSIGHT REPORT

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Contents

Foreword

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Across the globe, innovation and technological change continue to accelerate. According to the World Intellectual Property Organization (WIPO), the number of patents granted worldwide surged from 1 million in 1990 to over 3.5 million in 2023.[1] At the same time, hype cycles and expectations around new technologies have intensified.

Social media has amplified the spread of information about emerging technologies, fuelling viral marketing, while investor interest in early-stage innovations has surged as firms race to uncover the next game-changing breakthrough. While many of these new solutions hold great promise, relentless hype cycles can have unintended consequences, diverting attention and investment from other high-impact opportunities. In the rush to embrace emerging technologies, investors may also overlook fundamental business considerations or broader societal implications, leading to challenges down the line.

To address this, the World Economic Forum, in collaboration with the Global Innovation and Impact Council and other key stakeholders, developed a framework and guiding principles to support the responsible development, rollout and scaling of high-impact innovation.

Grounded in extensive multistakeholder input, the framework explores key questions: what defines "good innovation"? What values and drivers maximize positive social, environmental and economic outcomes? Finally, how can we promote and scale such innovation?

The eight principles outlined in this report provide guidance for innovators – from early-stage start-ups to multinational corporations – on developing products, services and business models that drive shared prosperity and advance sustainability goals. The principles also enable decision-makers to create lasting social value. Case studies from diverse industries and geographies, spanning from Las Vegas to São Paulo, illustrate how aligning on a shared set of principles can drive meaningful impact.

By cultivating a more informed and strategic approach to innovation, this work also aims to help investors direct funding towards solutions with the greatest potential for positive impact on people and the planet – while shaping the next generation of responsible, high-impact businesses.

Executive summary

A principles-based approach to innovation can drive impact, help de-risk investment and transform communities.

The rapid development and adoption of technology – driven by the potential for transformation, media amplification and venture capital investment – has contributed to economic growth and reshaped how people live and work. However, not all advancements have delivered the societal impact initially envisioned.

This report outlines a framework for responsible innovation to guide decision-makers in navigating emerging technologies, ensuring that investments support solutions with meaningful, sustainable impact.

The framework introduces eight guiding principles which provide a foundation for designing, developing and scaling innovations that address pressing global challenges. Responsible innovation should be: 1) collaborative, 2) sustainable, 3) resilient, 4) human-centric, 5) transparent, 6) accessible, 7) efficient and 8) scalable.

Additionally, the report highlights case studies that demonstrate how organizations have successfully applied these principles, achieving both business growth and positive social and environmental outcomes.

Key findings

1. **Hype cycles can misdirect resources**: Novelty-driven investment often prioritizes emerging technologies over solutions that address real-world needs, leading to inefficiencies and missed opportunities.

2. **Principles-based innovation can enhance long-term impact**: Companies that align their innovation strategies to advance solutions that are collaborative, sustainable, resilient, human-centric, transparent, accessible, efficient and scalable are more likely to create meaningful change and minimize the risk of societal harm.

3. **Real-world examples are helpful in translating concepts into practice**: Insights from case studies demonstrate how organizations have successfully implemented these principles, highlighting the factors that contributed to their success and the investments required to scale.

Recommendations

- **Align investment and development with principles for responsible innovation**: Companies and investors should use a principles-based approach to evaluate opportunities, prioritize resources and assess impact, ensuring innovations meet societal needs, mitigate risks and drive sustainable growth.

- **Integrate responsible innovation into day-to-day operations**: To drive impact, organizations need to embed the principles of responsible innovation into processes related to people and culture, partnerships and ecosystems, and product development and governance.

- **Strengthen multistakeholder collaboration**: Public and private sector leaders should work together to align incentives, share best practices and create an ecosystem that encourages responsible technological development.

- **Balance agility with accountability**: As emerging technologies gain traction, businesses and governments must remain adaptable while ensuring that risks, societal implications and ethical considerations are addressed.

By adopting these strategies, stakeholders across industries can cultivate an environment where innovation is not only fast-moving but also responsible, impactful and sustainable.

Introduction

As new breakthroughs emerge, the ability to distinguish between transformative solutions and mere hype is more critical than ever.

Business leaders across industries are facing pressure to stay competitive in a rapidly changing landscape. Over the past eight decades, the average lifespan of a US S&P 500 company has decreased from 67 years to 15, reflecting a decline of 80%.[2] As a result, many executives are prioritizing innovation to fuel growth, with technology spending rising steadily from 3.3% of revenue in 2016 to 5.5% in 2022.[3]

The current wave of innovation, amplified by media coverage, is driving substantial levels of investment. In 2024, global venture capital investments increased to $369 billion, up 5.4% from the previous year.[4] As new technologies continue to evolve rapidly, investments are shifting between emerging areas and applications, often without sufficient time to fully assess their commercial viability and societal impact.

In total, six in 10 executives report challenges in quantifying the benefits of individual technology investments.[5] As a result, industries increasingly view adoption and scaling as long-term endeavours, diversifying their investments across a portfolio of technologies to maximize potential impact.[6]

Moving beyond the hype

Hype cycles around emerging technologies can lead to unrealistic expectations, misallocated resources, and unintended social, economic and ethical consequences. As new technologies capture media attention, they often trigger price increases, raising expectations.[7] These cycles can influence funding decisions, with venture capital, corporate R&D and governments often drawn towards unproven innovations with uncertain commercial potential.

In 2024, over 1,400 start-ups worldwide were valued at more than $1 billion, underscoring the scale of speculative investment.[8] The gap between initial excitement and the practical application or maturity of these technologies has created an imbalance, diverting resources from innovations that could address real-world needs, such as modernizing ageing energy infrastructure, expanding connectivity for small- and medium-sized businesses, and advancing preventative healthcare.

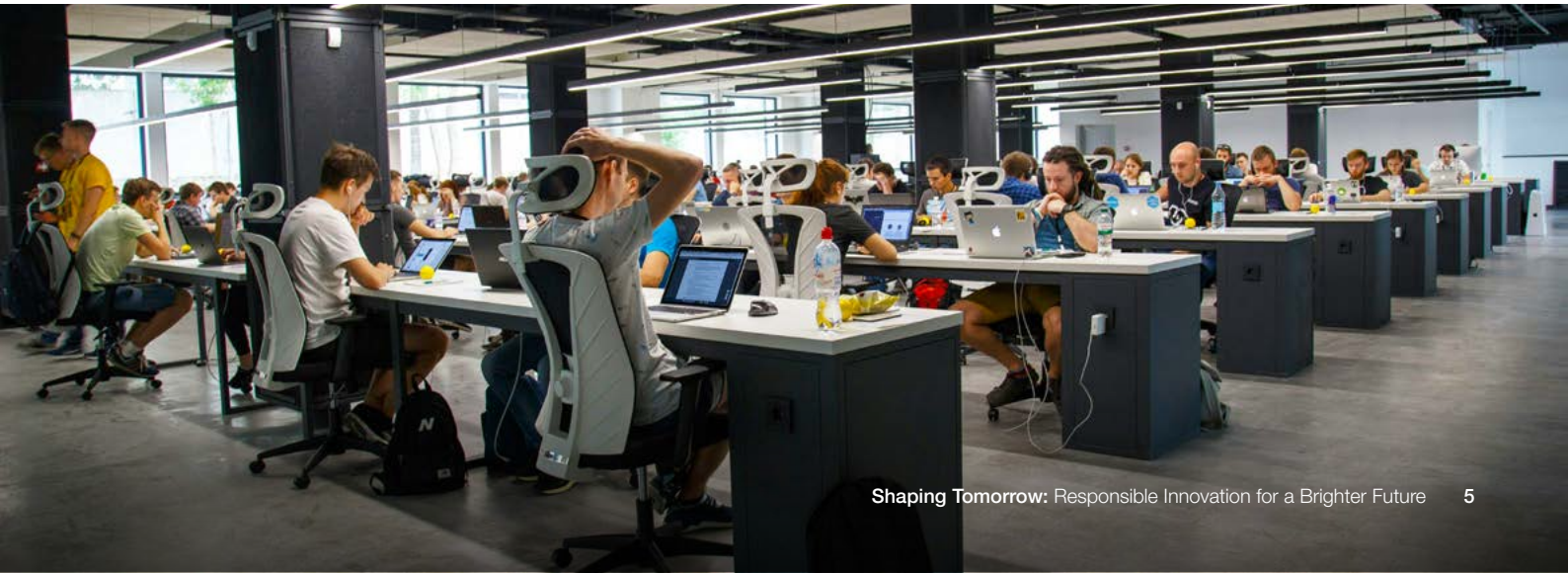
Navigating new opportunities and unintended consequences

Innovation has the potential to unlock new opportunities, drive benefits and address complex challenges. However, without careful consideration, it can also lead to unintended consequences and unforeseen harm.

The World Economic Forum's *Global Risks Report 2025* reveals an increasingly fractured global landscape where technological challenges threaten stability and progress.[9]

Opportunities and benefits presented by new technological innovation includes sustainability solutions, enabling cleaner energy, circular economies and more efficient resource use; advancements in healthcare, improving diagnostics, enhancing treatments and strengthening disease prevention; process optimization and automation, reducing costs, enhancing productivity and streamlining operations; and expanded digital connectivity, increasing access to information, education and global collaboration.

> Innovation has the potential to unlock new opportunities, drive benefits and address complex challenges ... it can also lead to unintended consequences and unforeseen harm.



> A more responsible approach to innovation is needed – one that balances speculative bets on new innovations with real-world applications that generate tangible returns.

Meanwhile, the unintended consequences and harms of these technologies may include misinformation and disinformation, spreading through media networks and significantly shifting public opinion towards distrust in facts and authority. In 2024, disinformation campaigns reached new levels of complexity, driven by artificial intelligence (AI), large language models (LLMs) and deep-fake videos, with at least one-third of elections influenced by AI-generated content, according to Check Point's *The State of Cyber Security 2025* report. These advancements have further fuelled political and societal polarization, distorting facts and eroding trust in media. Additionally, censorship and surveillance have been expanded by government and "big tech" corporate monitoring, while cyber espionage and warfare continue to threaten digital security, disrupt operations and compromise critical infrastructure.

Building responsibility into innovation

To drive more meaningful progress, stakeholders need better guidance to help adopters distinguish between hype and substance, mitigate risks, and assess the economic potential of emerging technologies with a more strategic and grounded approach.

A more responsible approach to innovation is needed – one that balances speculative bets on new innovations with real-world applications that generate tangible returns while taking its societal impact into consideration.

BOX 1

What is responsible innovation?

Innovation is the process of transforming creative ideas into practical solutions, leading to new or improved products, services, models and processes that address specific needs or challenges.

Responsible innovation involves developing trustworthy, scalable solutions that maximize societal, environmental and economic benefits while minimizing unintended negative impacts.[10,11]

Spotlight on B Corporations

Founded in 2006, B Lab introduced a new approach to business, emphasizing that a stakeholder/rightsholder-driven economy is both essential and achievable. Unlike traditional business certifications that focus primarily on corporate disclosures, the B Corp Certification evaluates companies based on their actions and overall impact. This certification sets rigorous performance standards, requiring businesses to uphold transparency, accountability and continuous improvement.

To become a certified B Corporation, a company must:

- Meet high standards of verified performance, accountability and transparency across areas such as employee benefits, charitable contributions, supply chain practices and material sourcing.
- Be accountable to all stakeholders/rightsholders – not just shareholders – by adopting a governance structure that aligns with this principle, including benefit corporation status where applicable.
- Ensure transparency by publicly sharing performance data assessed against B Lab's established standards.

Image credit: B Lab

Spotlight on top emerging technologies

Since 2011, the *Top 10 Emerging Technologies* report has been a critical resource for professionals seeking strategic intelligence on innovations poised to shape societies and economies in the next three to five years.[12] By spotlighting breakthrough technologies at their inflection points, the report catalyses forward-looking dialogues and supports decision-makers in navigating technological transformations that strengthen society's capacity to adapt and thrive.

Drawing on insights from leading scientists, researchers and futurists, the report highlights key technological advancements with the potential for significant, long-term societal and economic impact. This rigorous, multi-phase selection process ensures a comprehensive and objective assessment of each technology's readiness and transformative potential.

In 2025, more than 250 valid technology nominations were submitted by experts across industry and academia. To screen these submissions, the AI Trend Analyzer – developed by Frontiers – was employed to classify and cluster nominations based on trending topics identified through academic research. Each technology was evaluated using the World Economic Forum's Resilience Consortium's framework for sustainable inclusive growth, focusing on their potential to address systemic challenges and contribute to building adaptive capacity for future generations.

The shortlist of 20 technologies was then assessed by a steering group of world-leading experts from a diversity of fields and regions, who applied the following selection criteria:

- **Novelty**: Early adoption is emerging, but widespread use is not yet achieved
- **Impact**: Potential for significant societal and economic benefit
- **Depth**: Developed across multiple entities, with broad and sustained interest

Since its inception in 2011, the *Top 10 Emerging Technologies* report has identified lesser-known innovations that have gone on to make a global impact. For example, CRISPR-Cas9, featured in 2015, revolutionized genetic engineering and later became Nobel Prize-winning science. It is now being used to develop insect- and drought-resistant crops in some of the world's harshest growing conditions. In 2017, mRNA technology was spotlighted, and it became the foundation for the COVID-19 vaccines, protecting millions globally. Additionally, AI-led molecular design, which made the list in 2018, led to DeepMind's AlphaFold predicting the structure of 200 million proteins, and the first AI-discovered drugs have since entered clinical trials.

Spotlight on UpLink Innovation Ecosystem

UpLink is a World Economic Forum initiative, founded in partnership with Deloitte and Salesforce, focused on impactful early-stage innovation. It builds ecosystems that enable purpose-driven, early-stage entrepreneurs to scale their businesses for the markets and economies that are essential to a net-zero, nature-positive and equitable future. Thanks to these, entrepreneurs are enabled to secure funding, expand their workforce, grow their customer base and scale impactful solutions, thereby driving meaningful progress towards the UN Sustainable Development Goals (SDGs).

UpLink's selection process involves a rigorous evaluation of business viability and potential impact. Once selected, these start-ups are recognized as Top Innovators and gain access to a unique engagement programme, which includes participation in events, capacity-building workshops, visibility and brand exposure, and support for business growth through connections with partners, decision-makers, domain-specific experts and investors.

In 2024 alone, UpLink Top Innovators raised $633 million in investment capital, an increase of 45% compared to 2023, mainly through equity, debt or grants. In addition, nearly half of the Top Innovators experienced more than 40% growth in their customer count compared to the previous year.

Between 2023 and 2024, UpLink Top Innovators' solutions have resulted in the following impact:

- Creation of 19,000 new jobs
- Increased income of 20,000 people from underrepresented groups
- A total of 28 million tonnes of waste tracked and traced through digital platforms
- A total of 142,400 tonnes of CO_2 emissions avoided through clean electricity, sustainable agriculture, manufacture and other processes
- A total of 2.5 billion litres of wastewater and hazardous wastewater treated
- A total of 140 million hectares of aquatic or terrestrial area protected or actively managed for protection

Looking ahead, UpLink is focused on strengthening multi-year projects by deepening engagement with partners and ecosystem members. Harnessing their expertise and support, the goal is to elevate key thematic areas in global dialogue on innovation and sustainability.

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Innovation Ecosystems	Innovation Challenges	Top Innovators	Ecosystem Partners	Top Investors

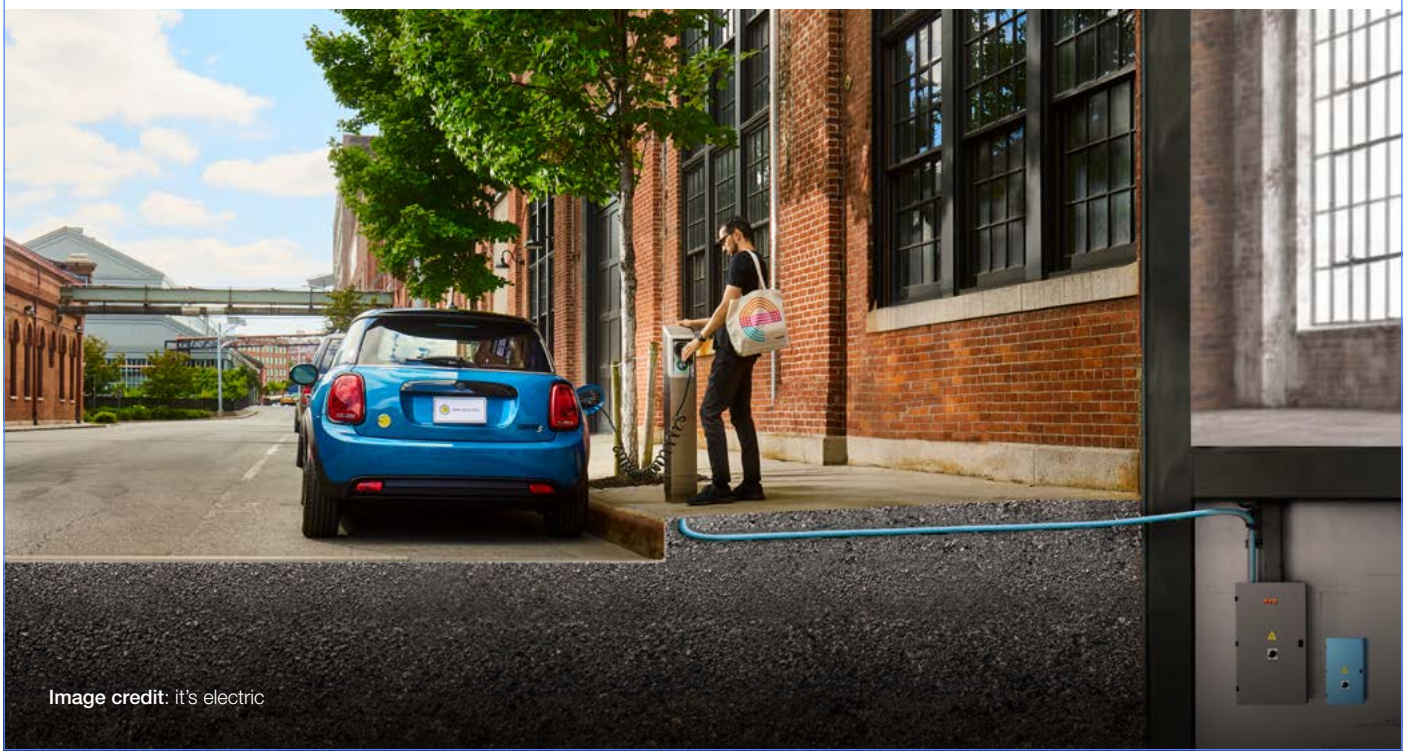


Image credit: it's electric

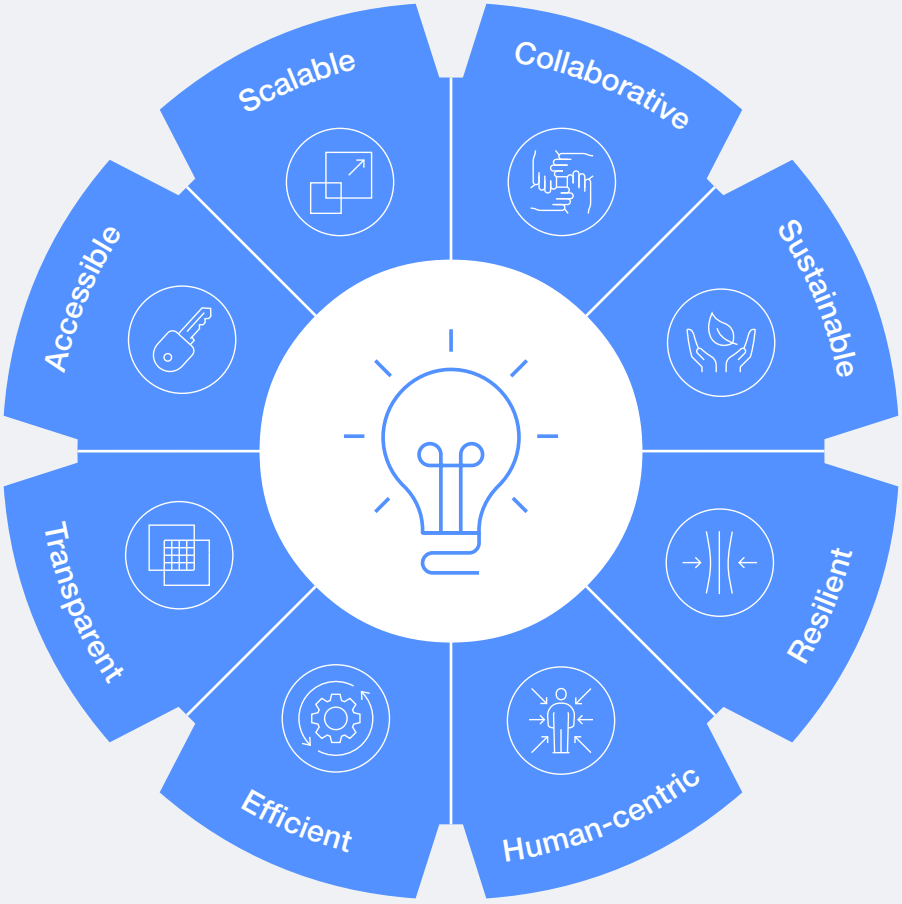
1 Framework for responsible innovation

A balanced approach to investment is needed to drive innovation, mitigate risks and maximize societal benefit.

Many organizations strive to advance responsible, high-impact innovation, but it can be challenging to put these concepts into practice. Centred on eight core principles, the following framework aims to support the public and private sectors as they navigate the complexity of designing collaborative business models and assessing new technologies and innovations. These principles were shaped through consultations and interviews with multiple stakeholders and informed by established definitions and organizations.

When integrated into organizational systems and processes, these principles are intended to help stakeholders accelerate the design, development and implementation of capable solutions that can be economically sustainable and socially impactful, while reducing short- and long-term risk and uncertainties. The framework also identifies key enablers to help organizations shape strategies and achieve this vision.

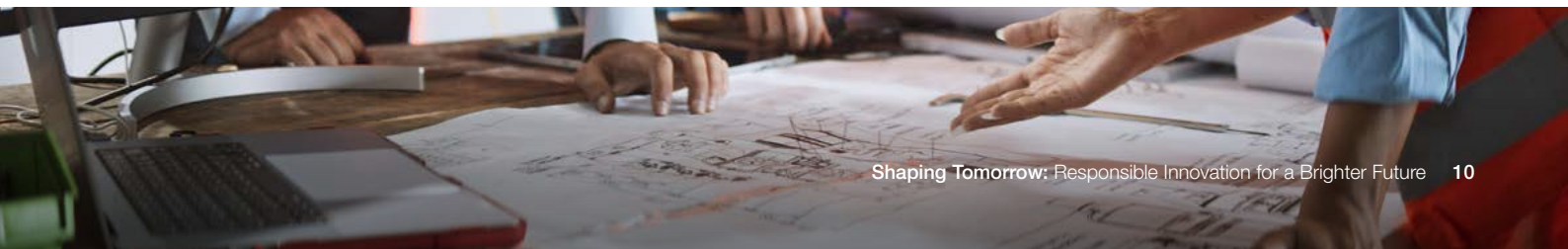
FIGURE 1 **Guiding principles**



Collaborative

Is the innovation informed by key multistakeholders and individuals across the value chain, uniting around shared challenges?

Collaboration enables innovators to integrate diverse perspectives, skills and expertise, creating greater value than any single entity could achieve alone. Many successful innovators have adopted business models that use ecosystems, benefiting from network effects – especially in the digital era. An increasing number of chief executive officers (CEOs) are embracing collaborative strategies, with businesses operating within at least one ecosystem generating an average of 13.7% of their total annual revenue from these partnerships.[13] These collaborations can also open the door to new opportunities. In 2024, nearly 40% of CEOs reported that their companies had entered new sectors within the past five years.[14]



Sustainable

Will the innovation meet the demands of the present generation without compromising the demands of the future generation, accounting for long-term socio-ecological and economic outcomes?

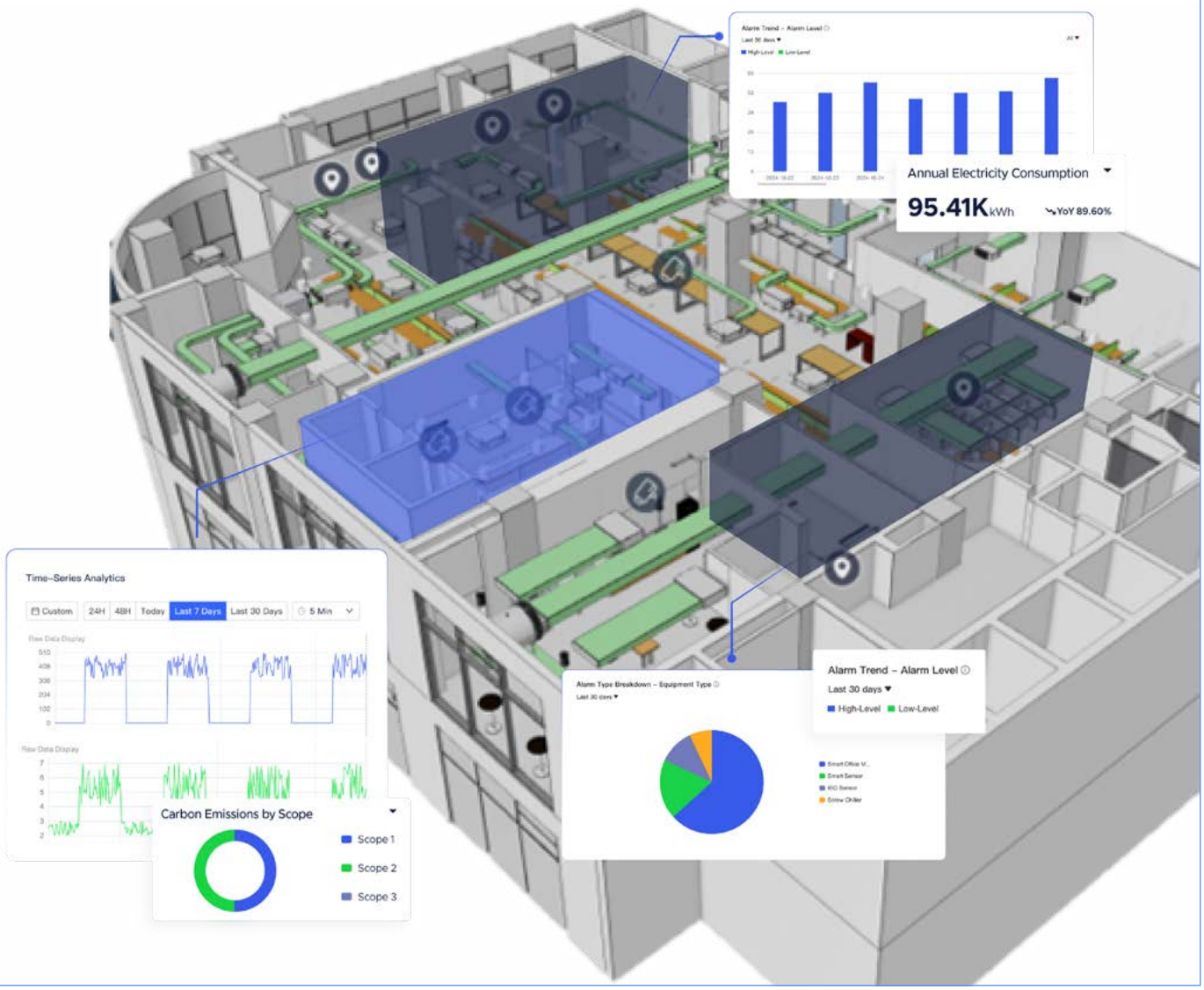
As environmental and social challenges intensify, sustainability has become a business imperative. Companies are increasingly integrating sustainable practices to drive long-term growth, mitigate risks, enhance societal well-being, and strengthen their long-term resilience and success.

A strong commitment to environmental sustainability has been shown to enhance financial performance. One in three CEOs report that climate-friendly investments over the past five years have boosted revenue, while two-thirds say these investments have either reduced costs or had no significant cost impact.[15] As momentum grows to tackle global challenges, businesses must also stay attuned to evolving consumer expectations and regulatory requirements.

INNOVATOR SPOTLIGHT

Akila – driving carbon accountability and efficiency in real estate with digital twins

Akila, a digital twin platform for real estate management, helps companies set and track carbon neutrality goals by optimizing live facility data. Its technology reduces energy waste, cutting heating, ventilation and air conditioning (HVAC) costs by 20% and overall spend by 10%. Partnering with major retailers, Akila enabled one European brand to cut 10 million tons of carbon dioxide (CO_2) across 15% of its stores. Beyond cost and emissions savings, Akila sees digital twins as a catalyst for safer, more inclusive and revitalized urban spaces.



Resilient

Does the innovation have the ability to withstand, cope with and reorganize around challenges, disruptions and global uncertainties to maintain function and the capacity to transform?

In a world of growing global uncertainties, embedding resilience into innovation can help mitigate the risk of economic fluctuations, geopolitical instability and other unforeseen challenges. When introducing solutions, it is important to approach problems holistically. Often, new innovations target specific issues without considering the broader system, implications or potential negative consequences.[16]

To address unforeseen challenges, solutions must be agile, adaptive and forward-thinking. As innovations move from the early stages to rapid scaling, there is a risk of becoming locked into sub-optimal technologies, limiting the ability to adapt to disruptions and address evolving challenges.[17] Building resilience requires innovators to strategically balance sustaining and disruptive innovation, considering both emerging threats and new opportunities.

INNOVATOR SPOTLIGHT

BasiGo – building a resilient, clean-energy future for East African transport

BasiGo is creating the future of clean, electric public transport in East Africa. Buses are the primary mode of transport for the vast majority of people living in East Africa, accounting for 40% of all passenger trips. Furthermore, countries like Kenya generate over 90% of their energy from clean, renewable sources. BasiGo has deployed 55 electric buses to date, which have driven over 3.5 million km, carried 5 million passengers and mitigated over 1,500 tonnes of CO_2 emissions. Over the next three years, BasiGo will deploy 1,000 electric buses in East Africa.

Human-centric

Is the innovation designed with a user-focused approach, incorporating feedback loops to adapt and deliver long-term value as needs evolve?

Human-centric innovation prioritizes the needs, preferences and contexts of users to create solutions that deliver empathetic and relevant experiences. By balancing designs aimed at individuals with those intended for broader audiences, organizations can minimize risk in the early stages of ideation while keeping people at the core of the process.[18] A continuous feedback loop from users is essential to refine ideas, uncover unforeseen challenges and ensure that solutions remain aligned with real-world needs.

Responsible innovation goes beyond mere functionality; it emphasizes safety, security, equity, transparency and accountability. By embedding these principles, organizations can develop solutions that reduce risks such as data misuse, bias and misinformation.[19] More importantly, designing technology that respects and enhances human dignity helps build trust, strengthen relationships and ensure that innovations serve society in meaningful ways.[20]

> The innovation economy must be expanded to make new technologies and opportunities available not only to large corporations but also to smaller businesses and a broader segment of the workforce.

Transparent

Are information and decisions related to the innovation shared honestly with key stakeholders for building trust and accountability?

Building transparency into solutions, processes and organizational systems delivers tangible benefits and build long-term trust with stakeholders. For data-driven innovations, transparency also supports more informed decision-making and can improve operational efficiency.

At the leadership level, cultivating a culture of transparency is equally important. This requires not only developing interoperable systems, adopting open standards and using an ecosystem strategy to enhance collaboration, but also facilitating a culture of open information sharing. Encouraging the free exchange of insights, challenges and learnings across teams and organizations helps break down silos, accelerates innovation and ensures the free flow of information across stakeholders.

Accessible

Will the innovation be readily and easily obtainable for users while serving diverse needs and overcoming barriers to participation?

Today's innovations do not always benefit everyone and, in some cases, can exacerbate inequality. To maximize their impact, organizations must ensure innovations are accessible and equitable. This means ensuring new products and services are reliable, usable and available to those who need them most. Without equitable access, even the most groundbreaking technologies can remain underused or inaccessible to certain groups.[21]

To address this, the innovation economy must be expanded to make new technologies and opportunities available not only to large corporations but also to smaller businesses and a broader segment of the workforce.[22] Creating an environment where innovation is open and democratized requires a foundation that prioritizes access, understanding and adoption across diverse populations.[23]

Efficient

Does the innovation function cost-effectively for users while the innovation life cycle is optimized for resources, time and waste reduction?

Efficiency is crucial for developing and scaling innovations. It provides stability and predictability in times of growth by introducing standardization, integration and predictability within organizations.[24] This is especially important for innovations at key inflection points or for early-growth companies expanding into new segments, regions or industries.

However, balancing efficiency with adaptability is essential to allow room for exploration, tinkering and experimentation – critical drivers of learning and innovation. Relying solely on efficiency, particularly when tied to centralized and rigid governance, can stifle the flexibility needed to encourage experimentation and progress.

> Integrating responsible innovation into an organization's strategy requires a structured approach that moves from principles to action.

Scalable

Can the innovation expand across different markets, cultures and challenges, ensuring continuous impact without losing effectiveness, quality and sustainability?

Scaling innovation involves more than just expanding a solution to a larger market. It requires adapting the solution to fit diverse contexts, strengthening the capabilities of the innovation team, securing the resources needed to unlock new delivery channels, and building a robust network of complementary assets to ensure sustainable growth and impact.[25]

However, without careful consideration of who will be affected and how the innovation must be adapted, scaling can unintentionally lead to negative consequences or even exacerbate existing harms. By implementing structured review mechanisms, organizations can identify and mitigate potential risks during the scaling process.[26]

How do you use the framework?

Integrating responsible innovation into an organization's strategy requires a structured approach that moves from principles to action. This framework serves not only as guidance for steering innovation that is a net positive for society, but also as a practical guide to help decision-makers embed processes into core business functions and help their organizations remain agile and responsive to evolving challenges.

To operationalize the framework, organizations can follow a three-step approach:

1. **Identify the vehicles for integration**: Determine where responsible innovation principles can be embedded within existing structures and workflows. This could include onboarding and staff training, professional development programmes, product development cycles or hiring practices.

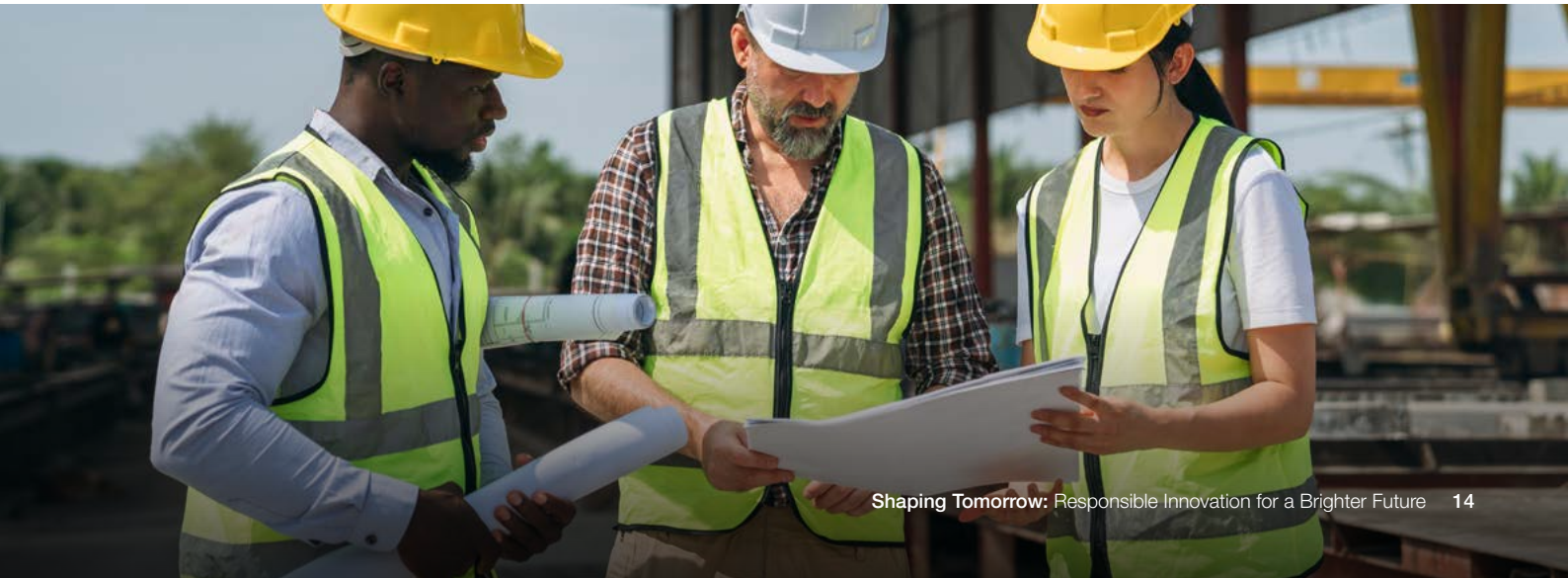
2. **Assess for gaps**: Conduct a systematic evaluation of current processes to identify misalignment with responsible innovation principles. This assessment should examine key areas such as governance, accessibility, sustainability and scalability, ensuring that innovation efforts address long-term societal needs.

3. **Adopt a modular approach**: Instead of overhauling entire processes, organizations can incrementally introduce responsible innovation elements where they will have the greatest impact. This could involve enhancing transparency in hiring, integrating sustainability metrics into product roadmaps, or facilitating cross-sector collaboration to improve solution scalability.

In addition to these steps, the following three action areas offer practical ways to align innovation with responsible principles. These include strategic mechanisms that organizations can integrate across functions.

TABLE 1 **Applying responsible innovation: key action areas for companies**

People and culture	Partnerships and ecosystems	Product development and governance
– Strategic leadership and management – Skills development and talent cultivation – Monitoring and auditing frameworks	– Sustainable business models – Financing mechanisms and incentives – Knowledge sharing and resource networks – Policy advocacy and regulatory alignment	– Testbeds, incubators and experimentation environments – Security, privacy and safety measures – Data governance and stewardship



The framework for responsible innovation builds on a robust series of principle-based tools, certifications and standards that have been developed to advance business as a force for good.

TABLE 2 **Related principles-based frameworks**

Organization	Standard/certification
B Lab	The B Corp Certification verifies companies that meet high standards of social and environmental performance, transparency and accountability.
Global Impact Investing Network (GIIN)	The IRIS+ System provides an impact measurement and management framework for investors to assess the social, environmental and financial performance of their investments.
Global Reporting Initiative (GRI)	The GRI Standards offer a framework for sustainability reporting, helping organizations disclose their economic, environmental and social impacts.
UN Global Compact	The Ten Principles of the UN Global Compact provide a framework for businesses to align their strategies and operations with universal principles on human rights, labour, environment and anti-corruption.
Social Accountability International	The SA8000 Standard is a leading social certification for workplaces, ensuring ethical labour practices by setting requirements for fair wages, safe working conditions and workers' rights.
The Science Based Targets initiative (SBTi)	The SBTi framework provides businesses with a science-based methodology to set emissions reduction targets in line with the Paris Agreement's goal of limiting global warming to 1.5°C.
International Financial Reporting Standards Foundation	The Integrated Reporting Framework guides organizations in integrated reporting, emphasizing how financial and non-financial factors create value over time.

2 Case studies

Sharing insights from diverse deployments helps promote collective learning.

2.1
Rethinking urban infrastructure with innovative financing

Shahid Ahmed
Group Executive
Vice-President, New Ventures
and Innovation, NTT DATA

> Cities worldwide are now following suit to explore private 5G networks and by 2030, these private networks could account for as much as one-fifth of all mobile network infrastructure spending.

Context

- Affordable broadband internet access is increasingly critical for driving local economic growth and improving the quality of life in cities.[27]
- Cities worldwide are exploring new partnerships with the private sector to deploy private 5G networks that are financially and technologically sustainable.
- These partnerships ease financial pressures, allowing cities to enhance health, expand education and boost economic growth.

Connectivity – the wired and wireless foundations of our digital economies and digital societies – is increasingly as essential a utility for cities as electricity, gas and water.[28]

A connected, data-driven urban environment not only enhances public services – it provides the underlying infrastructure needed to improve health, expand educational opportunities and boost economic prosperity. A 10-percentage point increase in broadband penetration would increase GDP (gross domestic product) growth by 1.2-1.4%.[29]

As cities accelerate investments to enable remote working and learning, e-commerce, digital public service delivery, as well as providing standard and critical communications, fibre-optic broadband rollout is increasing in pace – with an over 12% growth rate year-on-year.[30]

The financial strain of scaling city networks

As cities grow and digital services become more essential, the demand for reliable, high-speed internet and communication networks continues to increase. To address this growing need for network coverage and capacity, mobile network operators are rolling out 5G networks. However, cities are left with significant design, installation and maintenance costs, making it difficult to finance more advanced technologies.

In many instances, scaling connectivity in cities has become unsustainable. Connected devices such as cameras or air quality and light sensors have become increasingly critical for cities, however, traditional business models have proven unscalable. In some cases, cities that use commercial carriers for connectivity incur monthly costs between $10 and $30 per connected device.[31] For cities to become hubs of economic activity and innovation, they must first have affordable, scalable models to do so.

Private 5G networks offer a new approach to affordable broadband

As cellular networks advance and regulators facilitate the creation of private 5G networks, new opportunities for collaboration are rapidly emerging.

The cost of high-speed networks once limited deployment in cities. This is changing rapidly as governments and regulators recognize the importance of allocating dedicated spectrum – the radio frequencies that networks use to transmit data – to non-telecommunications enterprises. Dozens of regulators worldwide, including the US, Germany, Japan, Denmark and the United Kingdom, are releasing spectrum specifically for private networks.[32]

Cities worldwide are now following suit to explore private 5G networks and by 2030, these private networks could account for as much as one-fifth of all mobile network infrastructure spending.[33]

> The opening and sharing of spectrum that is currently only available for public network operators will only increase, unlocking new opportunities for mutually beneficial partnerships.

Innovative investment models ease financial risks for cities

Cities are increasingly turning to the private sector to address the growing need for affordable broadband and the services they enable. Shared investment models have significantly eased the financial burden on cities.

Meanwhile, the decreasing costs of 5G infrastructure, the availability of shared spectrum, and the collaborative distribution of capital and operational expenses are making private 5G networks a more accessible solution for urban connectivity.

By building and owning private cellular networks, cities can reduce operational expenses while providing bespoke coverage and speeds that public networks cannot support. Unlike public cellular networks that use pay-per-device models, private 5G networks allow cities to sustainably scale the number of endpoints without incurring expensive per-device access costs.[34] A municipality's ownership of the network allows it to take advantage of economies of scale as the number of net new devices it uses is nominal as network capacity and technologies continue to improve.

The opportunity cost of not implementing these innovations would have been the continued strain on city resources and missed opportunities to improve public safety and digital equity.

Improving public safety and digital equity in Las Vegas

In 2023, the City of Las Vegas and NTT DATA formed a partnership to deploy a private 5G network.[35] The partnership addressed two key challenges: improving broadband access in underserved areas and enhancing the city's decision-making through real-time data analytics.

NTT DATA's smart solutions in Las Vegas were justified through measurable outcomes and cost savings. The partnership has led to several positive outcomes for the city, including:

- Enabled reliable, low-latency communication, crucial for expanding internet access to over 1,000 students and families in low-income areas
- Reduced wrong-way driving incidents by over 90%, which translates into more than $1 million in annual savings from avoided accidents and reduced patrol costs
- Improved city planning with data-driven insights from smart parks and traffic management systems, enabling better resource allocation and infrastructure development

Its success can be attributed to a few key factors: strong leadership and personal sponsorship from city officials, a clear vision for digital transformation and the flexibility of solutions to scale with the city's changing needs.

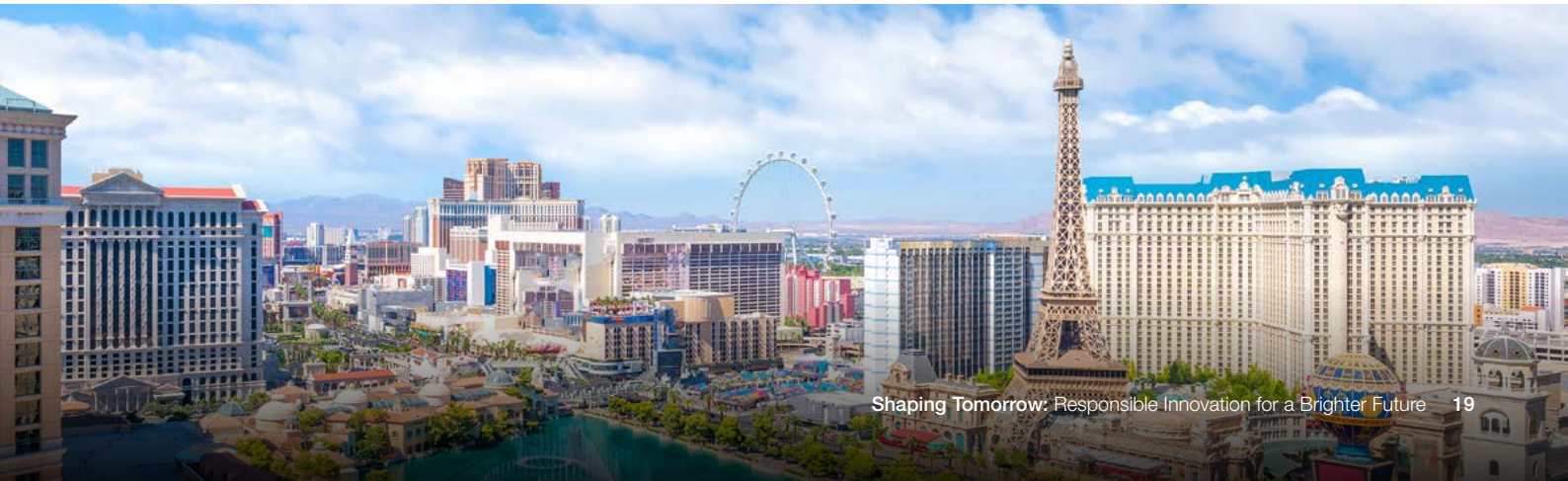
The partnership in Las Vegas may serve as an example for other cities to follow.

Scaling business models to new cities

The opening and sharing of spectrum that is currently only available for public network operators will only increase, unlocking new opportunities for mutually beneficial partnerships.

As cities explore collaborative models for deploying broadband, the following factors can be taken into consideration:

- The importance of continuous stakeholder engagement and the need for adaptable solutions that can evolve with the city's changing needs
- The value of a phased approach, starting with pilot projects and gradually expanding the scope to maximize impact and minimize risks
- The appropriation of seed funding from national and local sources to jump-start various cities to activate connectivity initiatives
- The investment into technological talent, including training and hiring a workforce with expertise in private 5G networks and AI to catalyse greater innovation in cities.



2.2
Modernizing buildings for long-term resilience

Vijay Sankaran
Vice-President and Chief Digital and Information Officer, Johnson Controls

> Modernizing buildings for greater resilience requires long-term, partnership-driven approaches tailored to the needs of owners and operators.

Context

- Around 80% of buildings today will exist in 2050, raising concerns about safety, energy inefficiencies and costly maintenance.[36]
- Enhancing buildings' resilience requires owners and operators to have greater visibility into their assets.
- Children's of Alabama medical centre, in partnership with Johnson Controls, installed a central utility plant for five buildings, reducing natural gas use by 76% and saving $681,000 annually, offering a replicable model for long-term resilience.

Well-maintained buildings are safer, more energy-efficient and less expensive to operate.

Retrofitting isn't just a sustainability measure – it's an economic necessity. Studies show that modernizing ageing buildings could cut global energy demand by 12%, generating billions in savings while strengthening resilience against extreme weather, cyber threats and operational disruptions.[37]

The question is no longer whether to modernize, but how we can scale solutions that make buildings more resilient, efficient and cost-effective.

The challenge: ageing buildings are costly and inefficient

Ageing buildings worldwide present significant challenges and opportunities. In Europe, over 35% of buildings are more than 50 years old, with nearly 75% considered energy inefficient.[38] Similarly, many older structures in North America and Asia require modernization to meet current safety and sustainability standards. Meanwhile, occupants may face risks such as unexpected downtime and weakening structure or health hazards such as air quality or fire hazards.

Traditional efforts have largely been fragmented and opaque, with building owners taking a project-by-project approach with single-measure or single-system retrofits. These approaches, while well-intentioned, are slow, costly and inefficient, taking years per building and generating isolated reports that make it difficult to develop long-term strategies.

Without integrated planning, building owners risk unnecessary capital expenditures – whether by prematurely replacing equipment or missing opportunities to optimize energy systems at scale.

A strategic approach to resilient buildings

Modernizing buildings for greater resilience requires long-term, partnership-driven approaches tailored to the needs of owners and operators.

One of the most effective ways to enhance energy efficiency is retrofitting ageing buildings with modern equipment, control systems and smart technologies. These systems improve asset visibility, empowering owners, operators and facility managers with real-time data, deeper insights and better decision-making for investments. They also provide sustainability managers with critical information on energy consumption, helping to advance net-zero goals.

> The implementation of energy-efficient innovations ensures that ageing buildings and campuses can modernize without resorting to full-scale equipment replacement.

Modernizing Children's of Alabama digital campus

Children's of Alabama, the third-largest paediatric medical centre in the US, partnered with Johnson Controls to enhance their ageing digital campus infrastructure while maintaining reliability for patient and staff safety. As their 20-year partner, Johnson Controls helped the hospital meet and exceed efficiency goals by retrofitting equipment, modernizing controls and applying OpenBlue Enterprise Manager (OBEM) smart building software.

Using OpenBlue Enterprise Manager Central Utility Plant, Johnson Controls designed, built and managed a new central utility plant, resulting in significant cost savings and energy efficiency improvements. The company also retrofitted hospital equipment such as boilers, air handlers, heating coils and variable speed drive pumps, and replaced outdated control systems with its building automation system. The project was successful in addressing Children's of Alabama's goals:

1. **Energy efficiency and infrastructure improvements**: The project achieved a 76% reduction in natural gas use, resulting in annual savings of approximately $681,000. This was measured by comparing energy consumption before and after the implementation of a heat pump chiller, steam to hot water conversion, OpenBlue Enterprise Manager and the Metasys building automation system.

2. **Operational cost savings**: Modernizing infrastructure, including buildings from the 1960s and 1980s, led to significant operational cost savings. Strategic equipment upgrades and digital solutions streamlined energy efficiency across the campus, saving the hospital the cost of capital equipment and depreciation expenses.

3. **Protecting and enhancing patient care and safety**: By maintaining essential utilities and ensuring reliable access to critical resources, the project has increased the performance of buildings with specific needs, improving patient care and safety. This was measured by increased reliability and reduced system downtime, directly impacting the overall patient experience.

With the data and insights from OpenBlue, the hospital's facility team can more easily substantiate funding requests. If the team is seeking funding to tie chilled water into other buildings, they can demonstrate what the maintenance costs would be, the expected lifespan of equipment, and how much they could save from retiring older equipment and relying on the plant.

Children's of Alabama is building off these successes to explore new opportunities to use digital systems in critical care areas like operating rooms, catheterization labs, neonatal intensive care units, post anaesthesia care units or stem cell units to identify and correct any pressurization or airflow issues in real time.

Models to scale innovation across building portfolios

The Children's of Alabama modernization project has uncovered key success factors that can be replicated across hospital networks, municipalities and educational campuses:

- Building trust and long-term partnerships while taking a customer-centric approach to problem-solving
- Reinvesting energy savings to expand services and improve patient outcomes
- Designing adaptable solutions to create more flexible, resilient infrastructure[39]

The implementation of energy-efficient innovations ensures that ageing buildings and campuses can modernize without resorting to full-scale equipment replacement – saving costs that can be reinvested in future growth and essential services.

2.3
A collaborative model for greater accessibility in cities

Victor Santiago Pineda
Executive Chairman,
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Context

- The World Bank estimates that the global GDP loss due to disability is between $1.7 trillion and $2.2 trillion annually.[40]
- A collaborative model driven by continuous community feedback enabled AI-powered solutions to tackle accessibility challenges effectively.
- As cities worldwide work towards greater inclusivity, the Amsterdam for All project provides a scalable model for addressing real societal needs.

Urban systems exist to serve the entire population, including 16% of the global population, or 1.3 billion people with disabilities. However, cities still fall short in terms of accessibility.[41]

Urban environments often fail to accommodate the needs of people with disabilities and older adults, particularly in areas such as infrastructure, transport and public services.

While digital accessibility maps have proliferated, they may reinforce trends in inaccessible smart-city technologies. Sixty percent of experts report that people with disabilities are left behind by these new urban technologies.[42]

> Urban environments often fail to accommodate the needs of people with disabilities and older adults, particularly in areas such as infrastructure, transport and public services.

A collaborative, AI-driven model to make urban environments more accessible

Local governments have begun using AI to enhance physical and digital infrastructure to better serve the growing needs of both residents and visitors. Technological advancements in the public sector are providing new opportunities for more inclusive urban planning.

By bringing together a diverse group of stakeholders, from local governments including city IT teams and urban planners with advocacy groups and community service organizations, innovators can better assess the feasibility of AI-based solutions and how they can be integrated into urban environments.

The City of Amsterdam brings together diverse stakeholders, using AI tools

The City of Amsterdam, in partnership with the Victor Pineda Foundation and World Enabled, has developed the Amsterdam for All initiative, a groundbreaking project that uses AI to facilitate inclusivity and accessibility in urban environments.

The Amsterdam for All initiative focuses on using AI to identify and mitigate barriers in both the physical and digital realms. By employing cutting-edge technologies, the City of Amsterdam is tackling challenges like sidewalk accessibility, real-time navigation for people with disabilities, and more inclusive public transport systems.

At the heart of Amsterdam for All's success is the city's inclusive, collaborative approach. The partnership with World Enabled brought together multiple stakeholders – city officials, accessibility experts, AI researchers and community organizations.

The initiative involved continuous feedback from people with disabilities and community groups, ensuring that solutions were grounded in lived experiences. This collaborative model resulted in AI-powered solutions that were highly tailored and effective for Amsterdam's unique urban challenges. Key success factors include:

- **Stakeholder engagement**: Continuous involvement of community groups and disability advocates to identify accessibility barriers and co-create solutions
- **Human-centred design**: Ensuring that AI tools were user-friendly and responsive to the needs of all users, especially marginalized communities

> Successful implementation of inclusive AI requires robust participation from those directly affected – people with disabilities and older individuals.

– **Transparent governance**: Open communication about the goals, data use and ethical implications of AI, with transparent reporting mechanisms for accountability

By improving accessibility, Amsterdam not only enhances the quality of life for residents and visitors with disabilities but also creates broader economic benefits. Increased accessibility drives higher levels of tourism, employment and public participation, which translates into long-term social and economic returns.

In Amsterdam's case, using AI to prioritize infrastructure projects based on accessibility needs also optimizes the use of municipal resources. This results in more efficient public spending and long-term savings by addressing critical needs pre-emptively.

Factors for a successful collaborative approach

For stakeholders considering the scalability of the Amsterdam for All model, there are several core principles that need to be understood to make inclusive innovation successful:

– **Community engagement**: Successful implementation of inclusive AI requires robust participation from those directly affected – people with disabilities and older individuals.

– **Diverse data representation**: AI systems must be trained on diverse datasets to avoid algorithmic bias and ensure that solutions are equitable across demographic groups.

– **Sustainability and scalability**: Ensure that the systems and solutions developed are scalable across larger urban environments and sustainable over time by securing long-term funding and partnerships.

– **Cross-sector partnerships**: Public-private collaborations can provide the resources, expertise and tools needed to integrate AI across sectors, from transport to health services.

Scaling an accessible model to cities, globally

The Amsterdam for All initiative offers a framework that other cities can adopt to improve urban accessibility. With the integration of AI-powered tools, such as real-time navigation apps for individuals with mobility challenges and predictive maintenance of infrastructure, cities can better serve all residents. By sharing Amsterdam's successes and methodologies, the Cities for All campaign aims to drive a global movement towards inclusive urban design.

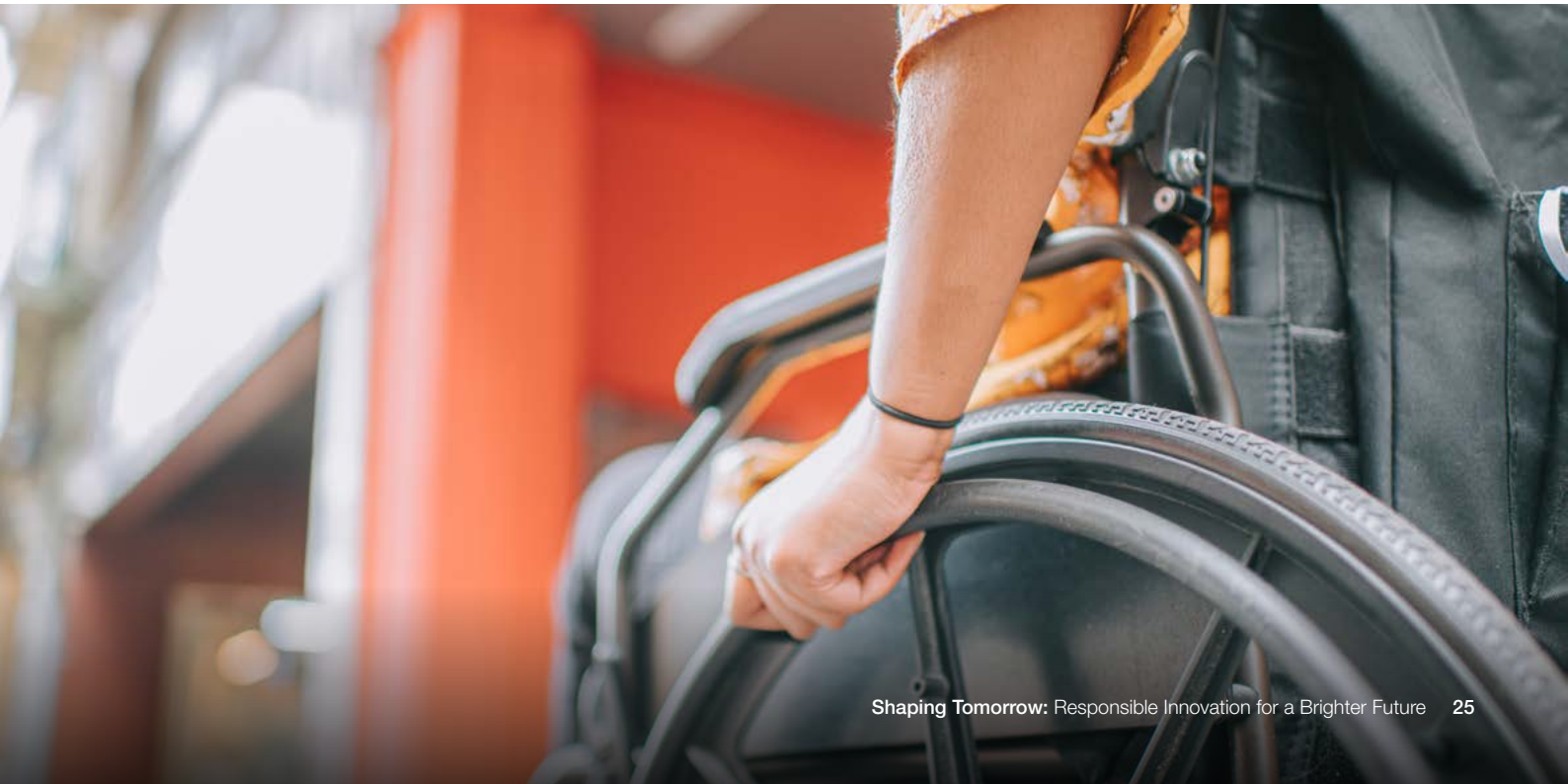
The Amsterdam for All initiative is a powerful example of how inclusive innovation can be scaled to create cities that leave no one behind. By combining AI technology with a human-centred, collaborative approach, this project sets a new standard for urban accessibility and inclusivity. The potential return on investment – from economic benefits to enhanced quality of life – makes this a compelling model for cities worldwide to adopt.

Key takeaways for stakeholders:

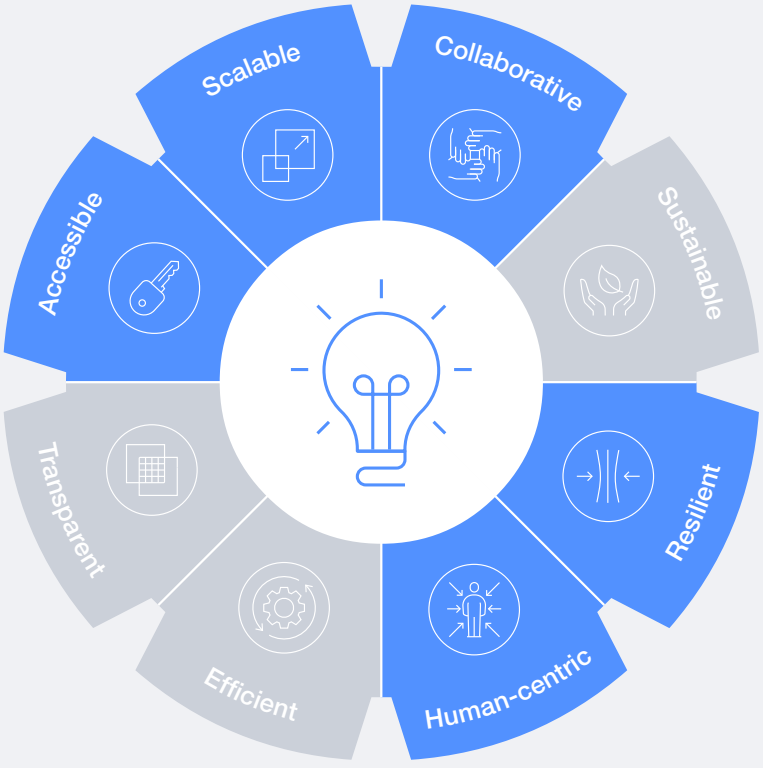
– Engage diverse communities early and throughout the project life cycle.

– Build AI solutions that are transparent, equitable and focused on real-world accessibility challenges.

– Secure long-term partnerships to sustain and scale these efforts globally.



2.4
Bridging the urban health gap with accessible screening models



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> Quality, affordable and accessible healthcare provides the foundation for stable communities, societies and economies.

Context

- Over half of the global population lacks health service access, and rapid urbanization has significantly strained urban health systems.
- Early disease detection can alleviate downstream pressure on health systems. However, the absence of user-friendly and people-centred solutions leaves early risk detection underused.
- As part of the CARDIO4Cities public-private partnership (PPP) initiative, a screening approach for early detection of hypertension has been scaled in three Brazilian cities, resulting in 22% increased blood pressure measurements and rapid improvement of blood pressure control levels in the city populations.

Quality, affordable and accessible healthcare provides the foundation for stable communities, societies and economies. However, more than half of the global population, or 4.5 billion people, do not have full access to essential health services.[43]

In 2021, 20.5 million people died from cardiovascular disease (CVD), many of those prematurely before the age of 60.[44] Most acute cardiovascular (CV) events, such as heart attacks or strokes, can be prevented through early detection and adequate management of the main risk factors for CVD. That makes proactive early detection and prompt management of hypertension key to reducing the burden of CVD on health systems.

Despite ample evidence on how to manage CVD and great progress over the past decades, CVD is on the rise – specifically in underserved populations. Rapid urbanization, often leading to increased sedentary lifestyles, decreased access to nutritious diets, reduced social connections and higher exposure to air pollution, fuels this increase in CVD. Yet cities also offer new opportunities to become drivers of CV population health. This makes cities the ideal place to start.

How can urban health systems inverse their current burden?

Health systems in cities need to address multiple priorities, making it sometimes challenging to engage health professionals and integrate new solutions without disrupting existing workflows. Improving population health requires a deep understanding of the interaction between health systems, health providers and their patients. To re-engineer urban CV health, new approaches have to engage end users and take a people-centred approach to the design phase of the innovation. This highlights the need to bring early detection of CV risk closer to people and provide it where and when they need it.

Currently, health systems face a significant gap between the number of people at risk for CV health risks and the number of diagnosed patients who are managed for those risks.[45] To reduce this gap, early detection and subsequent adequate management of people with CV risk is a priority and innovative methods are needed, particularly in primary healthcare settings, within high traffic venues in the cities and within communities.

Accessible solutions for early detection of CV risk relieve pressure on the health system

Strengthening primary healthcare through early detection and adequate management of CV risk can lead to improved health outcomes, reduce the burden on health systems and lower long-term costs by avoiding complications, hospitalizations or acute events of CVD.[46]

One opportunity to strengthen primary healthcare is to take advantage of waiting times in health facilities by offering CV risk screening to every person visiting the facility (regardless of the reason) and expediting doctor-patient consultations for those who screen positive. In addition, primary healthcare and high-traffic spaces in the city, such as vaccination sites, street markets, football stadiums and schools, offer possibilities to proactively reach people and guide them into routine health services when needed.

Innovations alone have limited impact. To be effective, they must be combined with critical enablers such as PPPs that empower providers and patients to co-create impactful, cost-effective and scalable solutions.

The “screening corner” as an example of impactful CV innovations

Within its CARDIO4Cities initiative, the Novartis Foundation co-designed the “screening corner” to accelerate early detection of CV risk factors.[47] Developed, implemented and evaluated by a consortium of public and private partners, this tool focuses on accelerating the detection of CV risk within and outside of primary care settings. A screening corner is equipped with a blood pressure measurement device, a digital stadiometer,

> To re-engineer urban CV health, new approaches have to engage end users and take a people-centred approach to the design phase of the innovation.

a bodyweight scale, measuring tapes, a tablet, and visually engaging instructions and record-keeping materials for health professionals and patients. The tool also contains a foldable stand and a backpack for use beyond the health facility. The devices can be operated by the patients themselves, or with the assistance of a medical professional. Over 500 primary healthcare facilities across three cities in Brazil – São Paulo, Patos and Aracaju – have adopted this innovation. The screening corner in primary healthcare centres initially offered mainly blood pressure measurement, and following its success, was expanded to include measurements for the other main CV risk factors (diabetes, high cholesterol and obesity). Positively screened people are promptly referred to consultation.

- Rolling out the screening corner in the first health centres of São Paulo led to a 22% increase in the average monthly blood pressure measurements, totalling approximately 150,000 additional measurements over the 24-month study period (56 additional monthly measurements per facility).

- The average cost per additional blood pressure measurement was less than $1, calculated by dividing the total cost of installing the screening corner by the incremental number of blood pressure measurements.

- In a second phase, a portable version of the screening corner in a backpack was developed, delivering blood pressure measurements for $0.44, which is 85% below the external benchmark for incremental cost-effectiveness per blood pressure measurement.

A replication roadmap has been developed with the municipal health departments to quickly adapt and implement the screening corner. To ensure that this innovative approach to early detection is integrated into the workflow of managing CV risk in the health centres, a formal integration process was developed with the health providers.

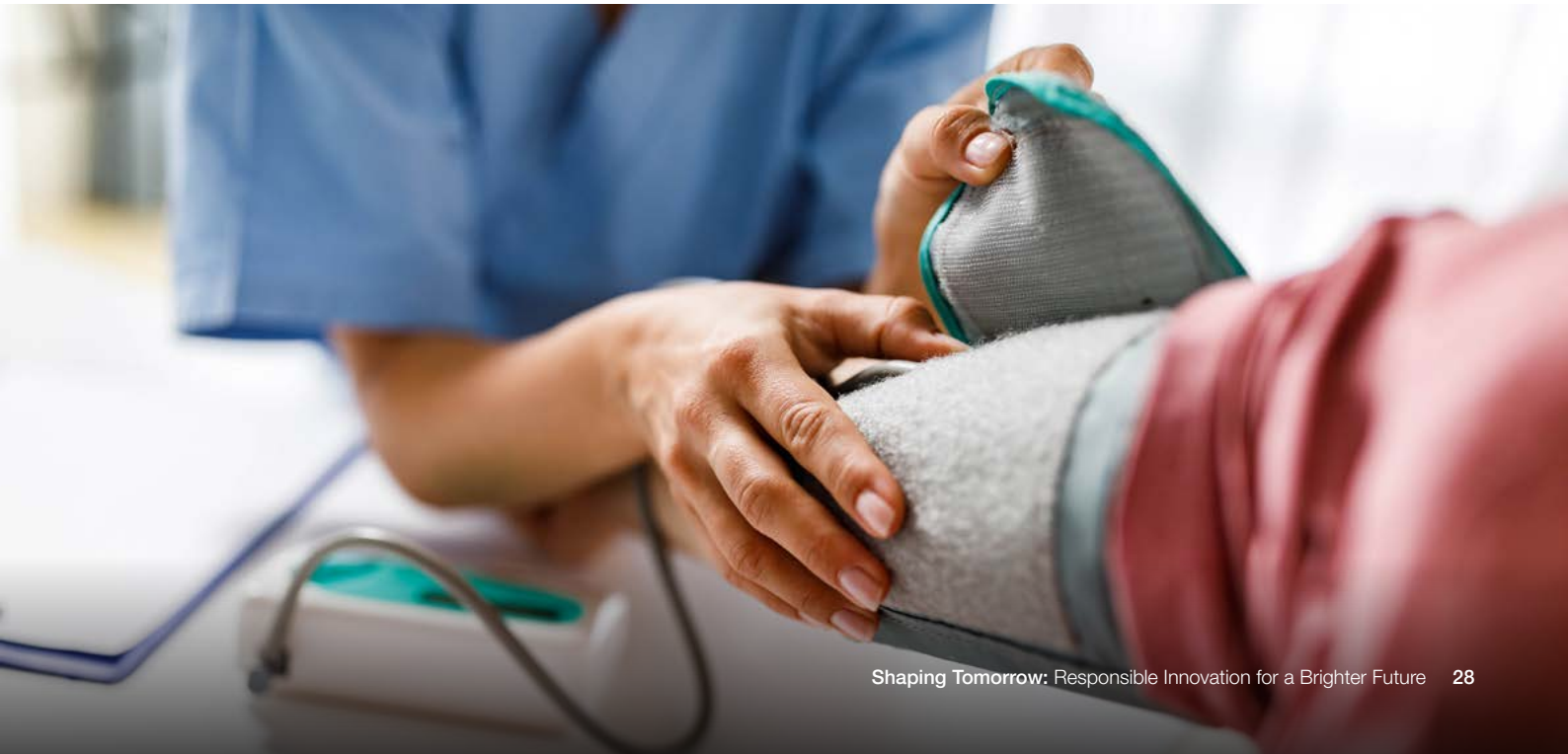
A collaborative model to scale early detection of CV risk

The screening corner's success was driven by a combination of people-centred and iterative innovation. While the screening corner contains technology and produces data to ensure evidence-based healthcare improvement, the concept is fully integrated into CV risk management in primary healthcare. This proved essential to ensure the innovation addresses the need and transforms primary healthcare from being reactive to more proactive and potentially preventive.

During the design phase, it was ensured that the innovation was sustainable and scalable, both operationally and financially. Integrating the innovation into the standard operating procedures of the health centres and the local budgets while using real-time data on its results to monitor progress and impact, were crucial for this PPP to achieve impact.

The design thinking approach played a crucial role in engaging all partners, including city health officials, primary healthcare providers and health system managers.[48] It allowed for the co-creation of this simple yet transformative solution. Continuous improvement of the innovation was central to the optimization of the screening corner.

Moving forward, including this innovative way to accelerate early detection of CV risk in urban populations requires cities to invest in a minimal infrastructure to expand the screening corner. While fully digitized screening models are now also available for self-screening in health facilities of certain high-income countries, the model developed in Brazil proved highly cost-efficient and rapidly deployable in any kind of setting. That is why the Novartis Foundation makes the solution publicly available for replication and expands its reach through the CARDIO4Cities initiative, which is being implemented in many more cities worldwide.



Conclusion

Now more than ever, both the public and private sectors must reassess their approach to innovation – putting substance above hype and prioritizing solutions that deliver meaningful, sustainable impact over those driven solely by novelty or media attention. The opportunities are immense and so are the stakes. To drive real value creation for businesses and society, aligning around a shared vision – and practical tools – for responsible innovation is essential.

The eight principles outlined in this report offer a starting point to help realign investments towards solutions that benefit individuals, communities and society. They lay the foundation for new, scalable models that balance economic analysis, value proposition and cost structures while ensuring long-term growth.

These principles also seek to guide and support innovators in the design, development and deployment of impactful solutions, while the enablers provide the mechanisms for building adaptive strategies. Innovators can tailor their approach by selecting the most effective tools to strengthen their value proposition.

Collaboration among diverse stakeholders will be crucial throughout this journey. Trust is needed to establish innovative financing approaches that de-risk investments and unlock new business models. Embracing responsible innovation is not only a strategic business decision; it's an essential pathway to a brighter future.

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Endnotes

1. World Intellectual Property Organization (WIPO). (2024). *World Intellectual Property Indicators 2024*. https://www.wipo.int/publications/en/details.jsp?id=4759.
2. Toegel, I. (2025). *The shrinking lifespan of teams – and how to navigate it*. International Institute for Management Development (IMD). https://www.imd.org/ibyimd/2025-trends/four-steps-to-give-your-high-turnover-teams-staying-power/#:~:text=Why%20is%20the%20makeup%20of,in%20a%20role%20are%20shifting.
3. Deloitte. (2023). *2023 Global Technology Leadership Study*. https://www2.deloitte.com/us/en/pages/chief-information-officer/articles/global-technology-leadership-survey.html.
4. National Venture Capital Associations (NVCA). (2024). *Q4 2024 Pitchbook-NVCA Venture Monitor*. https://nvca.org/document/q4-2024-pitchbook-nvca-venture-monitor-2/.
5. DiLorenzo, L., T. Smith, J. Gill, M. Wilson, et al. (2023). *From tech investment to impact: Strategies for allocating capital and articulating value*. https://www2.deloitte.com/us/en/insights/topics/leadership/maximizing-value-of-tech-investments.html.
6. Yee, L., M. Chui and R. Roberts. (2024). *McKinsey Technology Trends Outlook 2024*. McKinsey & Company. https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-top-trends-in-tech.
7. Funk, J. L. (2019). What's Behind Technological Hype? Start-up losses are mounting and innovation is slowing. We need less hype and more level-headed economic analysis. *Issues in Science and Technology*, 2019, p. 36-42.
8. PricewaterhouseCoopers (PwC). (2024, October 28). *Global Top 100 Unicorns*. https://www.pwc.co.uk/services/audit/insights/global-top-100-unicorns.html.
9. World Economic Forum. (2024). *Global Risks Report 2025*. https://www.weforum.org/publications/global-risks-report-2025/.
10. Organisation for Economic Co-operation and Development (OECD). (n.d.). *Responsible innovation*. https://www.oecd.org/en/topics/sub-issues/responsible-innovation.html.
11. UK Research and Innovation (UKRI). (n.d.). *Responsible innovation*. https://www.ukri.org/manage-your-award/good-research-resource-hub/responsible-innovation/.
12. World Economic Forum. (2024). *Top 10 Emerging Technologies of 2024*. https://www3.weforum.org/docs/WEF_Top_10_Emerging_Technologies_of_2024.pdf.
13. Sarafin, G. (2022). *The CEO Imperative: How mastering ecosystems transforms performance*. EY. https://www.ey.com/en_ly/alliances/the-ceo-imperative-how-mastering-ecosystems-transforms-performance.
14. PricewaterhouseCoopers (PwC). (2024). *PwC's Global Investor Survey 2024: Cautiously optimistic, investors expect growth*. https://www.pwc.com/gx/en/issues/c-suite-insights/global-investor-survey.html.
15. PricewaterhouseCoopers (PwC). (2025). *PwC's 28th Annual Global CEO Survey: Reinvention on the edge of tomorrow*. https://www.pwc.com/gx/en/issues/c-suite-insights/ceo-survey.html.
16. Westley, F. (2013). *Social Innovation and Resilience: How One Enhances the Other*. Stanford Social Innovation Review. https://ssir.org/articles/entry/social_innovation_and_resilience_how_one_enhances_the_other.
17. Van der Loos, A., K. Frenken, M. Hekkert and S. Negro. (2023). On the resilience of innovation systems. *Industry and Innovation*, Issue 1, pp. 42-74.
18. McKinsey & Company. (2023). *Here's why human-centric innovation is necessary*. https://www.mckinsey.com/featured-insights/themes/heres-why-human-centric-innovation-is-necessary.
19. Deloitte. (2023). *Ensuring a human-centered approach to AI*. https://www.deloittedigital.com/us/en/insights/perspective/human-centered-ai.html.
20. Biersay, L., T. Pogge and P. K. Yu. (2022). *A Human-Centered Approach to Health Innovations: Reconciling Intellectual Property with Human Rights*. Yale Global Justice Program. https://globaljustice.yale.edu/human-centered-approach-health-innovations-reconciling-intellectual-property-human-rights-edited.
21. Parthasarathy, S. (2022). Innovation as a Force for Equity. *Issues in Science and Technology,* Vol XXXVIII, No. 2, 2022. https://issues.org/health-innovation-system-force-equity-shobita-parthasarathy/.
22. Qureshi, Z. (2020). *Democratizing innovation: Putting technology to work for inclusive growth*. Brookings. https://www.brookings.edu/articles/democratizing-innovation-putting-technology-to-work-for-inclusive-growth/.
23. Von Hippel, E. (2005). *Democratizing Innovation*. Massachusetts Institute of Technology. https://web.mit.edu/evhippel/www/books/DI/DemocInn.pdf.
24. Hagel III, J. and J. S. Brown. (2013). *Institutional innovation*. Deloitte. https://www2.deloitte.com/us/en/insights/topics/innovation/institutional-innovation.html.
25. Bessant, J., I. Gray and P. Loh. (2022). *Scaling The Summit: A primer on how to scale innovations for impact for the UN System*. UN Global Pulse. https://www.unglobalpulse.org/document/scaling-the-summit-a-primer-on-how-to-scale-innovations-for-impact-for-the-un-system/.

26. Bucic, T. and G. C. O'Connor. (2024). *Avoiding Harm in Technology Innovation*. MITSloan Management Review. https://sloanreview.mit.edu/article/avoiding-harm-in-technology-innovation/.

27. United Nations Educational, Scientific and Cultural Organization (UNESCO). (2023). *The state of broadband 2023: digital connectivity a transformative opportunity*. https://unesdoc.unesco.org/ark:/48223/pf0000387841.

28. World Economic Forum. (2023). *Model Policy: Public Sector Asset Use*. https://www3.weforum.org/docs/WEF_Public_Sector_Asset_Use_2023.pdf.

29. World Bank. (2015). *Digital Dividends: Exploring the Relationship Between Broadband and Economic Growth*. https://documents1.worldbank.org/curated/zh/178701467988875888/pdf/102955-WP-Box394845B-PUBLIC-WDR16-BP-Exploring-the-Relationship-between-Broadband-and-Economic-Growth-Minges.pdf.

30. Organisation for Economic Co-operation and Development (OECD). (n.d.). *Broadband statistics*. https://www.oecd.org/en/topics/sub-issues/broadband-statistics.html.

31. Brannon, I. (2023). *How Las Vegas' private 5G network is making roads safer and getting local kids online for free*. Business Insider. https://www.businessinsider.com/las-vegas-private-5g-network-2023-9.

32. iBwave. (2023). *Private LTE & 5G Networks: Accelerating Towards a Mature Marketplace*. https://www.ibwave.com/storage/app/media/pdf/ebooks/ebook-Private-LTE-5G.pdf.

33. SNS Telecom & IT. (2024). *The Private LTE & 5G Network Ecosystem: 2024 – 2030 – Opportunities, Challenges, Strategies, Industry Verticals & Forecasts*. https://www.snstelecom.com/private-lte.

34. Silber, M. (2023). *Private 5G Networks: The Spark 5G Needed All Along*. Forbes. https://www.forbes.com/councils/forbestechcouncil/2023/11/01/private-5g-networks-the-spark-5g-needed-all-along/.

35. NTT DATA. (2024). *The City of Las Vegas shapes the future of urban living*. https://us.nttdata.com/en/case-studies/city-of-las-vegas-client-story.

36. Grainger, G. (2022). *To create net-zero cities, we need to look hard at our older buildings*. World Economic Forum. https://www.weforum.org/stories/2022/11/net-zero-cities-retrofit-older-buildings-cop27/.

37. World Economic Forum. (2024). *Transforming Energy Demand*. https://www.weforum.org/publications/transforming-energy-demand/.

38. European Commission. (2023). Commission welcomes political agreement on new rules to boost energy performance of buildings across the EU. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_6423.

39. Johnson Controls. (2023). *Children's of Alabama - Birmingham Alabama, USA*. https://www.johnsoncontrols.com/insights/2023/case-study/childrens-of-alabama-birmingham.

40. Metts, R. L. (2000). *Disability Issues, Trends and Recommendations for the World Bank*. World Bank. https://documents1.worldbank.org/curated/zh/503581468779980124/pdf/multi0page.pdf.

41. World Health Organization. (2023). *Disability*. https://www.who.int/news-room/fact-sheets/detail/disability-and-health.

42. Smart Cities for All. (n.d.). *About Smart Cities for All*. https://smartcities4all.org/#our-data.

43. World Health Organization (WHO). (2023). *Tracking Universal Health Coverage: 2023 Global monitoring report*. https://www.who.int/publications/i/item/9789240080379.

44. World Heart Federation. (2023). *World Heart Report 2023: Confronting the World's Number One Killer*. https://world-heart-federation.org/resource/world-heart-report-2023/.

45. World Heart Federation. (2021). *Roadmap for Hypertension*. https://world-heart-federation.org/cvd-roadmaps/whf-global-roadmaps/hypertension/.

46. Reiker, T., S. Des Rosiers, J. Boch, G. Partha, et al. (2023). *Population health impact and economic evaluation of the CARDIO4Cities approach to improve urban hypertension management*. https://journals.plos.org/globalpublichealth/article/authors?id=10.1371/journal.pgph.0001480.

47. United Nations. (2023). (n.d.). *Cantinho Cuidanda de Todos (NCD Screening Corners)*. https://sdgs.un.org/partnerships/cantinho-cuidando-de-todos-l-ncd-screening-corners.

48. Jarrett, C., Y. C. Baxter, J. Boch, C. Carrasco, et al. (2022). Deconstructing design thinking as a tool for the implementation of a population health initiative. *Health Research Policy and Systems*, vol. 20, no. 91. https://health-policy-systems.biomedcentral.com/articles/10.1186/s12961-022-00892-5.

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