

Aligning with SDG 9: Policy Whitepaper

Evidence-based strategies for Industry, Innovation & Infrastructure designed for organizational leadership and impact. This whitepaper provides actionable insights for businesses, governments, and NGOs seeking to align their operations with Sustainable Development Goal 9 while driving sustainable economic growth and social prosperity.



Understanding SDG 9

Sustainable Development Goal 9 represents one of the most transformative components of the United Nations' 2030 Agenda, aiming to "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" (UNOOSA, 2018). This goal recognizes that industrialization, innovation, and infrastructure development are fundamental drivers of economic growth and development.

SDG 9 serves as a critical enabler for numerous other SDGs, including poverty reduction (SDG 1), zero hunger (SDG 2), good health and well-being (SDG 3), and climate action (SDG 13). By strengthening technological capabilities, creating robust infrastructure networks, and promoting inclusive industrialization, SDG 9 creates the foundation upon which sustainable societies can thrive.



The importance of SDG 9 has been magnified in recent years as global challenges like climate change, pandemics, and geopolitical tensions have highlighted the need for resilient, adaptive, and sustainable systems. Organizations that align with SDG 9 principles position themselves not only as responsible global citizens but also as forward-thinking entities prepared for the challenges and opportunities of the 21st century economy.

Core Pillars of SDG 9



Infrastructure

Reliable, sustainable, and resilient infrastructure forms the backbone of economic development and human well-being. This includes transportation networks, energy systems, water management, and ICT infrastructure that enable connectivity and access to essential services.

- Quality infrastructure reduces inequality by providing access to markets, jobs, and services
- Resilient infrastructure withstands natural disasters and climate change impacts
- Modern infrastructure incorporates digital technologies for efficiency and sustainability



Industrialization

Sustainable and inclusive industrialization drives economic growth, creates jobs, and reduces poverty. Modern industrial development focuses on clean technologies, resource efficiency, and inclusive business models that benefit wider segments of society.

- Manufacturing value added per capita serves as a critical indicator of industrial development
- Clean manufacturing technologies reduce environmental impact
- Small and medium-sized enterprises need integration into value chains



Innovation

Scientific research, technological development, and innovation fuel productivity growth and enable solutions to pressing global challenges. Innovation encompasses not only technological advances but also new business models, processes, and institutional arrangements (Iberdrola, 2025).

- R&D investment as percentage of GDP indicates innovation capacity
- Digital technologies create new opportunities for inclusive development
- Skills development and knowledge diffusion support innovation ecosystems

The Business Case for SDG 9



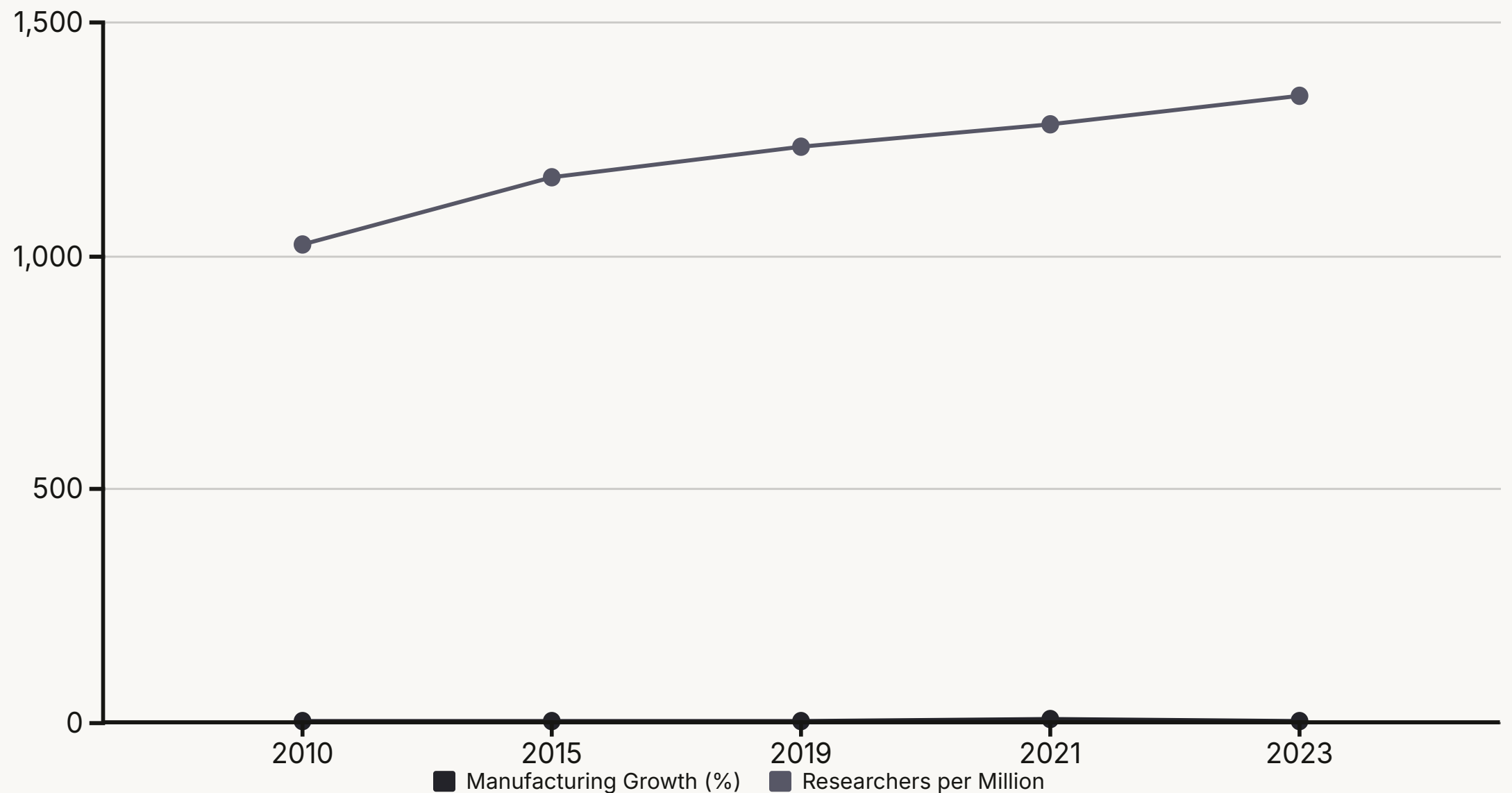
Beyond its societal benefits, SDG 9 offers compelling economic advantages for organizations. According to analysis by Iberdrola (2025), manufacturing continues to serve as a critical multiplier for economic development, with each manufacturing job supporting approximately 2.2 additional jobs in related sectors. This multiplier effect demonstrates how investments in industrial capacity generate broader economic prosperity.

Robust infrastructure provides businesses with essential competitive advantages:

- Reduced logistics costs and improved supply chain reliability
- Enhanced access to markets, suppliers, and talent
- Improved energy security and reduced operational disruptions
- Accelerated innovation through better connectivity and knowledge sharing

Organizations that invest in innovation capabilities experience higher productivity growth, better market positioning, and improved resilience to disruption. Research indicates that innovative companies typically outperform industry peers in terms of revenue growth, profitability, and shareholder returns.

Global Progress to Date



Global progress toward SDG 9 has been uneven but shows positive momentum in several key areas. After a significant manufacturing rebound following the COVID-19 pandemic (7.4% growth in 2021), growth moderated to 3.3% in 2023 (Iberdrola, 2025). This reflects both normalization after the rebound and ongoing challenges in the global economy, including supply chain disruptions, inflationary pressures, and geopolitical tensions.

The number of researchers engaged in R&D activities has shown steady growth, increasing from 1022 per million people in 2010 to 1342 per million in 2023. This positive trend reflects increasing prioritization of innovation across regions, though significant disparities remain between developed and developing nations. Research intensity correlates strongly with higher levels of economic development and industrial sophistication.

Infrastructure development has accelerated in many regions, particularly in digital connectivity, where mobile broadband subscriptions have grown substantially. However, quality, reliability, and affordability of infrastructure services remain challenges, especially in least developed countries (LDCs) and rural areas.

Persistent Regional Gaps



Despite global progress, substantial disparities persist between regions in their advancement toward SDG 9 targets. These gaps threaten to entrench existing inequalities and limit the potential for inclusive growth. The stark contrast in R&D investment—0.27% of GDP in LDCs versus 2.62% in developed regions—reflects fundamental differences in innovation capacity and future economic competitiveness (Iberdrola, 2025).

Infrastructure gaps remain particularly pronounced in:

- **Transportation:** Many developing regions lack adequate road networks, ports, and airports
- **Energy:** Nearly 760 million people still lack access to electricity
- **Digital connectivity:** Device ownership and broadband affordability limit inclusion

Addressing these persistent regional disparities requires coordinated policy interventions, increased financing, and capacity building initiatives that target the specific needs of underserved regions and populations.

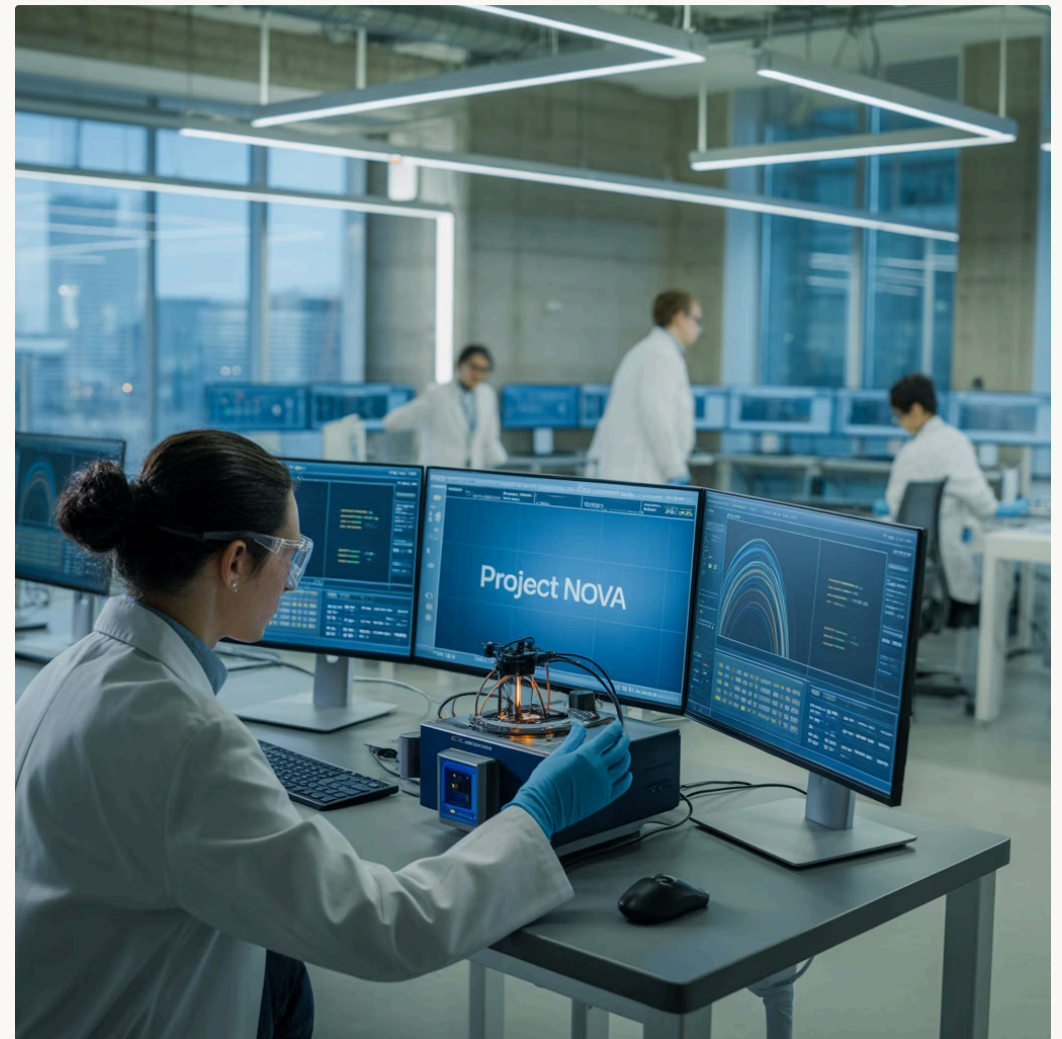
Innovation Infrastructure in the US: A Snapshot

The United States maintains one of the world's most robust innovation ecosystems, investing approximately \$650 billion annually in research and development across public and private sectors (GC Insights, 2025). This substantial investment—representing approximately 3.1% of GDP—funds a diverse portfolio of basic research, applied sciences, and commercialization activities.

State governments play an increasingly important role in regional innovation systems, contributing \$2.4 billion to R&D activities in 2019. Notably, 45% of this funding was directed toward health-related projects, reflecting both public priorities and state-level specialization strategies.

The U.S. innovation infrastructure is characterized by:

- Strong university-industry collaboration frameworks
- Robust intellectual property protections
- Well-developed venture capital and early-stage financing
- National laboratory networks addressing long-term challenges



Recent federal initiatives, including the CHIPS and Science Act and the Infrastructure Investment and Jobs Act, represent significant new investments in America's innovation foundation. These programs aim to strengthen domestic manufacturing capabilities, address supply chain vulnerabilities, and accelerate the development and deployment of critical technologies.

Despite these strengths, challenges remain in ensuring equitable access to innovation opportunities across demographic groups and geographic regions, with persistent disparities in STEM education, entrepreneurship support, and technology access.

Infrastructure's Role in Sustainable Growth



Infrastructure represents the fundamental physical and organizational structures needed for society to function and flourish. As emphasized by UNOOSA (2018), quality infrastructure underpins virtually all economic activities while enabling social mobility and opportunity. The design, construction, and operation of infrastructure systems have profound implications for sustainability outcomes across economic, social, and environmental dimensions.

Renewable energy infrastructure plays a particularly crucial role in sustainable development by:

- Reducing greenhouse gas emissions and air pollution
- Enhancing energy security and resilience
- Creating jobs in growing clean energy sectors
- Providing reliable energy access to underserved communities

Modern transportation systems—including public transit, electric vehicle charging networks, and non-motorized infrastructure—similarly contribute to sustainability by reducing congestion, improving air quality, and enhancing mobility options for all population segments.

Digital infrastructure has emerged as an essential component of sustainable development, enabling remote work, telemedicine, distance learning, and e-government services that reduce resource consumption while expanding access to opportunities.

Policy Levers: R&D and Industrial Policy



National Innovation Strategy

Comprehensive national innovation strategies coordinate policies, funding, and institutional arrangements to enhance innovation capabilities. These strategies identify priority sectors, technology areas, and cross-cutting research themes aligned with national development goals.



Public R&D Funding

Direct government funding for basic and applied research addresses market failures in knowledge production. Competitive grant programs, research institutions, and public-private partnerships mobilize resources for innovation while building human capital.



Intellectual Property Frameworks

Well-designed intellectual property systems balance incentives for innovation with knowledge diffusion. Patent systems, technology transfer offices, and open innovation initiatives facilitate the commercialization of research outputs.



Education and Skills Development

Human capital development through STEM education, technical training, and lifelong learning programs builds innovation capacity. Workforce development initiatives align skills with emerging industry needs and technological change.



Effective innovation and industrial policies provide the frameworks, incentives, and support mechanisms needed to accelerate technological advancement and industrial transformation. These policies must balance market-driven innovation with strategic public interventions that address societal challenges and long-term competitiveness.

Successful policy approaches typically combine horizontal measures that improve the overall business environment with targeted vertical interventions that address specific sectors or technologies. The most effective innovation ecosystems feature policy coherence across education, research, finance, competition, and trade domains.

Technology Spotlight: Satellite & GNSS



Global Navigation Satellite Systems (GNSS) and satellite technologies represent transformative tools for accelerating progress toward SDG 9 objectives. According to UNOOSA (2018), GNSS-enabled automation in construction increases speed by approximately 50% while reducing material consumption by 9%, delivering both economic and environmental benefits.

Satellite technologies enhance infrastructure development through:

- Precise positioning and survey capabilities that improve construction accuracy
- Remote sensing for infrastructure planning and environmental impact assessment
- Earth observation for monitoring infrastructure conditions and detecting maintenance needs
- Communications capabilities that extend connectivity to remote regions

In urban planning applications, satellite-derived data enables more efficient land use, better disaster risk management, and improved climate resilience. Transportation and logistics operations benefit from GNSS through route optimization, fleet management, and synchronization capabilities that reduce fuel consumption and emissions.

Gender and Diversity Gap in Innovation

1

Female Researchers

Women represent less than one-third of researchers globally, indicating significant gender disparity in scientific fields (Iberdrola, 2025).

2

Patent Holders

Percentage of patents with at least one female inventor, highlighting the gender innovation gap in commercial technology development.

3

STEM Graduates

Proportion of female graduates in science, technology, engineering, and mathematics fields globally, showing persistent educational disparities.

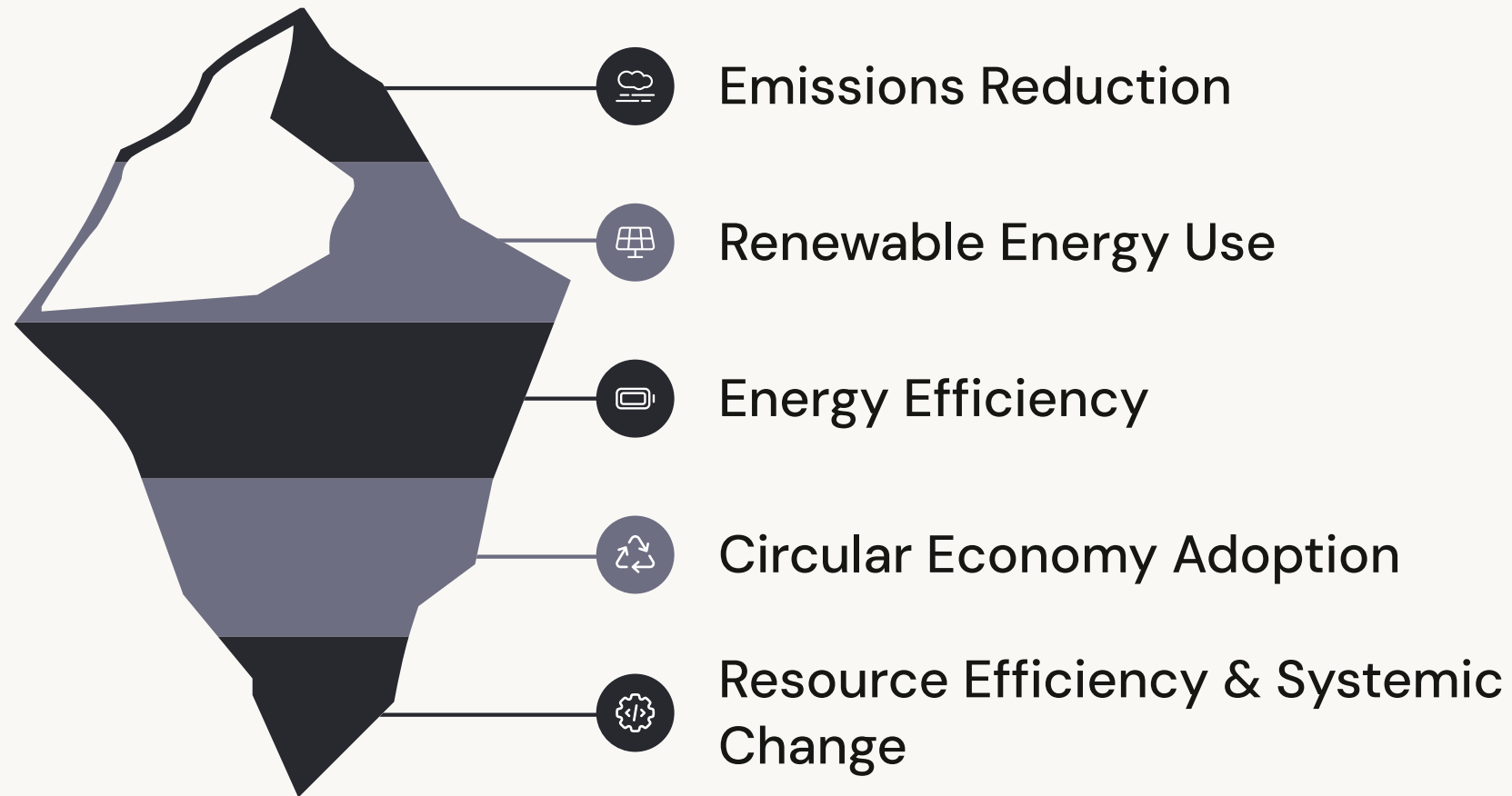
Gender and diversity gaps persist throughout innovation ecosystems, limiting both participation and outcomes. Women represent only 31.2% of researchers worldwide (Iberdrola, 2025), with even lower representation in fields like engineering and computer science. This underrepresentation reflects persistent barriers in education, career advancement, and research funding access.

Research consistently demonstrates that diverse teams produce more innovative and impactful solutions. Organizations with above-average diversity in leadership tend to report higher innovation revenue and better financial performance. Inclusive innovation approaches that incorporate diverse perspectives lead to products and services that better address the needs of all market segments.

Addressing gender and diversity gaps requires comprehensive interventions throughout the innovation pipeline, including:

- Early STEM education initiatives targeting underrepresented groups
- Mentorship and sponsorship programs to support career advancement
- Inclusive workplace policies that accommodate diverse needs
- Gender-responsive research funding mechanisms
- Targeted support for women and minority entrepreneurs

Climate Change and Green Industrialization



Climate change presents both challenges and opportunities for industrial development and infrastructure systems. Traditional carbon-intensive industrial processes contribute significantly to greenhouse gas emissions, while climate impacts threaten existing infrastructure through extreme weather events, sea level rise, and changing environmental conditions.

Green industrialization strategies address these challenges by:

- Deploying clean energy technologies throughout industrial processes
- Implementing circular economy principles that minimize waste and maximize resource efficiency
- Developing climate-resilient infrastructure designed for changing conditions
- Creating markets for low-carbon products and services

The transition to green industrialization creates substantial economic opportunities in growing sectors like renewable energy, energy efficiency, advanced manufacturing, and environmental services. Countries and organizations that lead this transition gain competitive advantages through reduced resource costs, improved productivity, and access to expanding green markets.

Policy frameworks that integrate climate considerations into industrial and infrastructure planning—including carbon pricing, green procurement, and performance standards—accelerate this transition while ensuring economic competitiveness.

Digital Divide: Barriers to Universal ICT

Despite remarkable progress in digital connectivity, significant disparities persist in access to information and communication technologies (ICTs). Only approximately 56% of the global population has reliable internet access (ITU, 2024), with pronounced gaps between urban and rural areas, income groups, age cohorts, and genders.

The digital divide manifests through multiple dimensions:

- Infrastructure access: Lack of broadband networks in rural and remote areas
- Affordability: High costs of devices and data relative to income
- Digital skills: Insufficient capabilities to utilize digital technologies effectively
- Relevant content: Limited availability of local language and culturally appropriate digital resources

These gaps in digital connectivity undermine innovation potential in emerging markets by limiting access to information, educational resources, financial services, and market opportunities.

Entrepreneurs and innovators in digitally excluded communities face significant disadvantages in developing and scaling new ideas.



Addressing the digital divide requires coordinated approaches that combine infrastructure investment, policy reforms, capacity building, and business model innovation. Universal service funds, community networks, public access facilities, and targeted subsidies represent proven mechanisms for expanding connectivity to underserved populations.

Organizations can contribute to bridging the digital divide through inclusive product design, affordable service models, digital skills initiatives, and infrastructure partnerships that extend connectivity to new markets and communities.

Case Study: Infrastructure for All

Africa50 Initiative

The Africa50 infrastructure investment platform has mobilized over \$1.6 billion to accelerate infrastructure development across the African continent. By bringing together institutional investors, development finance institutions, and African governments, Africa50 creates bankable projects that attract private capital while addressing critical infrastructure gaps.

Project Impact

- Developed 114 MW solar power plant in Egypt, reducing CO2 emissions by 180,000 tons annually
- Expanded broadband connectivity to 640,000 homes and businesses in Rwanda
- Improved transportation infrastructure connecting agricultural regions to urban markets

Success Factors

- Public-private partnership models that share risks and responsibilities
- Project preparation facilities that develop bankable investment opportunities
- Standardized documentation and processes that reduce transaction costs
- Blended finance approaches that leverage development funding

The Africa50 initiative demonstrates how innovative financing and partnership models can accelerate infrastructure development in emerging markets. By focusing on commercially viable projects with strong development impacts, Africa50 bridges the gap between public sector infrastructure needs and private sector investment requirements.

Public-private partnerships (PPPs) play a central role in this approach by allocating risks to the parties best positioned to manage them. Well-structured PPPs accelerate project delivery, improve operational efficiency, and ensure sustainable maintenance through performance-based agreements. The model enables governments to leverage limited public resources while accessing private sector expertise and capital.

Policy Insight: Universal Access to Finance

Digital Financial Inclusion

Mobile banking and fintech innovations have dramatically expanded financial inclusion in developing economies. Countries like Kenya have achieved over 80% financial inclusion rates through mobile money platforms that enable transactions, savings, credit, and insurance services without traditional banking infrastructure.

SME Financing Mechanisms

Innovative financing mechanisms address the "missing middle" funding gap for SMEs that are too large for microfinance but too small for traditional corporate finance. Credit guarantees, mezzanine financing, and specialized SME investment funds reduce risk perception and mobilize capital for growing enterprises (GC Insights, 2025).

Green Finance Instruments

Sustainable finance tools—including green bonds, sustainability-linked loans, and impact investing vehicles—direct capital toward environmentally beneficial infrastructure and industrial projects. These instruments grew from \$5.2 trillion in 2018 to over \$35.3 trillion in 2023.

Access to affordable financial services represents a critical enabler for innovation and entrepreneurship, particularly for small and medium enterprises (SMEs) that drive job creation and economic diversification. As highlighted by GC Insights (2025), limited access to credit constrains SME growth potential while hindering investments in productivity-enhancing technologies and business model innovation.

Effective financial inclusion policies combine regulatory reforms that enable innovation while protecting consumers, public investments in financial infrastructure, and targeted interventions that address market failures in specific segments. Digital public infrastructure—including digital ID systems, interoperable payment platforms, and data exchange frameworks—creates the foundation for inclusive digital financial services that reach previously excluded populations.

Smart Cities and Urban Innovation



Urban areas serve as critical innovation hubs where density, diversity, and connectivity accelerate knowledge exchange and creativity. Smart city initiatives leverage digital technologies, data analytics, and participatory approaches to enhance urban infrastructure performance while improving quality of life for residents.

Leading examples of urban innovation include:

- Singapore's Smart Nation initiative, which integrates sensors, networks, and analytics across urban systems
- Barcelona's urban innovation district, which combines technology deployment with inclusive governance models
- Copenhagen's climate-resilient infrastructure systems, which address flood management while creating recreational spaces

Smart transportation solutions—including integrated mobility platforms, intelligent traffic management, and electric vehicle infrastructure—demonstrate how technology can enhance sustainability and accessibility simultaneously. These systems reduce congestion, lower emissions, and improve mobility options for all residents.

Urban data platforms that integrate information from multiple sources enable evidence-based decision-making while empowering citizens to participate in urban planning and management processes. Open data approaches that make non-sensitive information publicly available stimulate innovation in urban services and applications.

Recommendations for Organizations

1

Invest in Research & Development

Organizations should establish ambitious R&D investment targets of at least 2% of gross revenues to drive innovation and maintain competitiveness. This investment should balance near-term product improvements with longer-term exploratory research that may yield breakthrough innovations.

- Develop formal innovation management processes with clear governance
- Establish metrics to track innovation performance and outcomes
- Create mechanisms to capture and implement employee ideas

2

Prioritize Digital Equity

Organizations should implement digital equity initiatives that expand access to technology, enhance digital skills, and ensure products and services are accessible to diverse users. STEM training programs targeting underrepresented groups build future talent pipelines while addressing systemic barriers.

- Develop inclusive design practices for digital products and services
- Support community technology centers in underserved areas
- Provide internships and apprenticeships for diverse candidates

3

Foster Strategic Partnerships

International and cross-sector partnerships accelerate innovation by combining complementary capabilities, sharing risks, and leveraging diverse perspectives. Collaborative approaches are particularly valuable for addressing complex sustainability challenges that exceed the capacity of individual organizations.

- Participate in industry consortia and pre-competitive research initiatives
- Engage with academic institutions through sponsored research and talent development
- Explore partnerships with organizations in emerging markets

Evidence-Based Policy Pillars

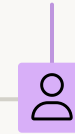
Disclosure Requirements

Mandating disclosure on innovation investment, infrastructure maintenance, and sustainability metrics in annual reporting creates transparency and accountability. Standardized reporting frameworks enable benchmarking and performance comparison across organizations and sectors.



Gender Diversity in STEM

Targeted hiring goals, mentorship programs, and inclusive workplace policies address systemic barriers to women's participation in STEM fields. Supporting girls' STEM education creates a pipeline of future talent while challenging gender stereotypes about technical careers.



Green Infrastructure Incentives

Tax benefits, credits, and accelerated depreciation for green infrastructure investments improve project economics while advancing sustainability objectives. Performance-based incentives that reward measurable environmental outcomes drive continuous improvement and innovation.

Evidence-based policy development requires rigorous analysis of intervention effectiveness, robust stakeholder engagement, and systematic monitoring of outcomes. Policies that successfully advance SDG 9 objectives typically address both supply-side factors (e.g., research capacity, infrastructure availability) and demand-side dynamics (e.g., market demand, user adoption).

Effective policy frameworks balance regulatory requirements, economic incentives, and capacity building initiatives to shape behavior while empowering implementation. Policy coherence across domains—including education, research, industrial development, infrastructure, and finance—enhances effectiveness by addressing interdependencies and avoiding conflicting incentives.

Policy experimentation through pilot programs, regulatory sandboxes, and iterative implementation enables learning and adaptation in complex environments. Evidence from these experiments should inform ongoing policy refinement and scaling of successful approaches.

Measuring Impact

1

Key Performance Indicators

Robust measurement frameworks enable organizations to track progress, identify challenges, and demonstrate impact. Effective KPIs for SDG 9 alignment include:

- Infrastructure uptime and reliability metrics
- R&D investment as percentage of revenue
- Innovation output measures (patents, new products, etc.)
- Diversity in innovation teams and leadership
- Resource productivity improvements

2

UN SDG Indicators

The UN SDG framework provides standardized indicators for measuring progress toward SDG 9 targets, enabling transparent benchmarking and reporting:

- 9.1.1: Population proportion with access to all-season roads
- 9.2.1: Manufacturing value added as proportion of GDP
- 9.5.1: Research and development expenditure as proportion of GDP
- 9.5.2: Researchers per million inhabitants
- 9.c.1: Population proportion covered by mobile networks

3

Impact Assessment Methods

Comprehensive impact assessment approaches capture the full value of investments in industry, innovation, and infrastructure:

- Economic impact analysis (direct, indirect, and induced effects)
- Social return on investment calculations
- Life-cycle assessment of environmental impacts
- Contribution analysis for complex multi-stakeholder initiatives
- Participatory evaluation involving affected communities

Measuring progress toward SDG 9 objectives requires a comprehensive approach that captures economic, social, and environmental dimensions of impact. Organizations should combine quantitative metrics with qualitative assessments that capture contextual factors and stakeholder perspectives. Regular reporting on these metrics enhances accountability while informing strategy refinement and resource allocation decisions.

Conclusion: Leading Through SDG 9

Sustainable Development Goal 9—focused on industry, innovation, and infrastructure—provides a powerful framework for organizations seeking to drive sustainable growth while addressing global challenges. As this whitepaper has demonstrated, investments in these areas yield multiple dividends across economic, social, and environmental dimensions.

Organizations that align their policies and investments with SDG 9 principles position themselves for future success by:

- Building resilience to disruption through robust infrastructure and diverse capabilities
- Enhancing competitiveness through innovation and productivity improvements
- Accessing growing markets for sustainable products and services
- Attracting and retaining talent committed to purposeful work
- Contributing to systemic solutions for pressing global challenges

As noted by UNOOSA (2018), progress toward SDG 9 targets creates positive spillover effects for multiple other sustainable development goals, magnifying impact and accelerating transformation toward more sustainable systems.



The path forward requires collaborative action across sectors, disciplines, and geographies. By working together—sharing knowledge, resources, and responsibilities—we can accelerate progress toward resilient infrastructure, inclusive industrialization, and sustainable innovation that benefits all.

This whitepaper calls on organizations to take concrete action: invest in innovation capabilities, implement inclusive approaches, measure and report on progress, and engage in partnerships that amplify impact. Through these efforts, we can build more resilient economies, more inclusive societies, and more sustainable systems for generations to come.