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The Innovation Era, Lessons from Leaders to Catalyze Socio-Economic Progress

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Introduction

Countries looking to leapfrog into the future can learn from how the world's leading innovators have leveraged innovation as a driver of economic growth, resilience, creativity, and progress. Until recently, 'innovation' was a term important only to research universities and cities with meaningfully large technology clusters. However, the past two decades have seen a fundamental transition in how the power of innovation at the national and corporate levels can enable broad economic value, equity, social progress, and soft power.

Currently, every industrialized country, and nearly half of all countries tracked by the World Economic Forum have a formal innovation strategy. As these innovation strategies roll out, it is clear they are not narrow thrusts at a few deep-tech sectors of G20 economies. Rather, they represent a basic change in the economic strategy and structure of a country. This change is not limited to governments: the relative performance of companies is directly affected by their ability to incorporate innovation into both their strategy and their daily operations. Finally, an increasing portion of the economic strength that allows governments to address pressing social and policy issues, and the value of better goods and services from the corporate sector, comes from innovation.

This paper seeks to put this change in context and show its universal importance.

Progress, Resilience and Power Dynamics

AN ENGINE OF PROGRESS

Innovation propels the world's economies forward. It is more than just a creative force; it is the cornerstone of modern economic growth and the fountain from which unprecedented productivity has sprung. There exists a linear correlation: each dollar spent on research and development triggers an approximate \$2 return¹, a ratio that is a testament to how crucial innovation is in multiplying economic value.

The symbiotic relationship between innovation and GDP growth is clear in some of the world's largest economies. In the US, for example, innovation has contributed to three-quarters of the GDP growth rate since World War 2 and currently fuels 50% of annual GDP increases². Similarly, countries such as Singapore and Switzerland, which host smaller populations, are consistently ranked among the top 10 global innovators and consequently, boast among the world's highest GDP per capita ratios.

Global leaders in the private sector, including Apple, Amazon, and Alphabet, epitomize this dynamic. Their strategy and commitment to innovation translate into 3x better returns³ through enhanced productivity, setting benchmarks for industries worldwide.

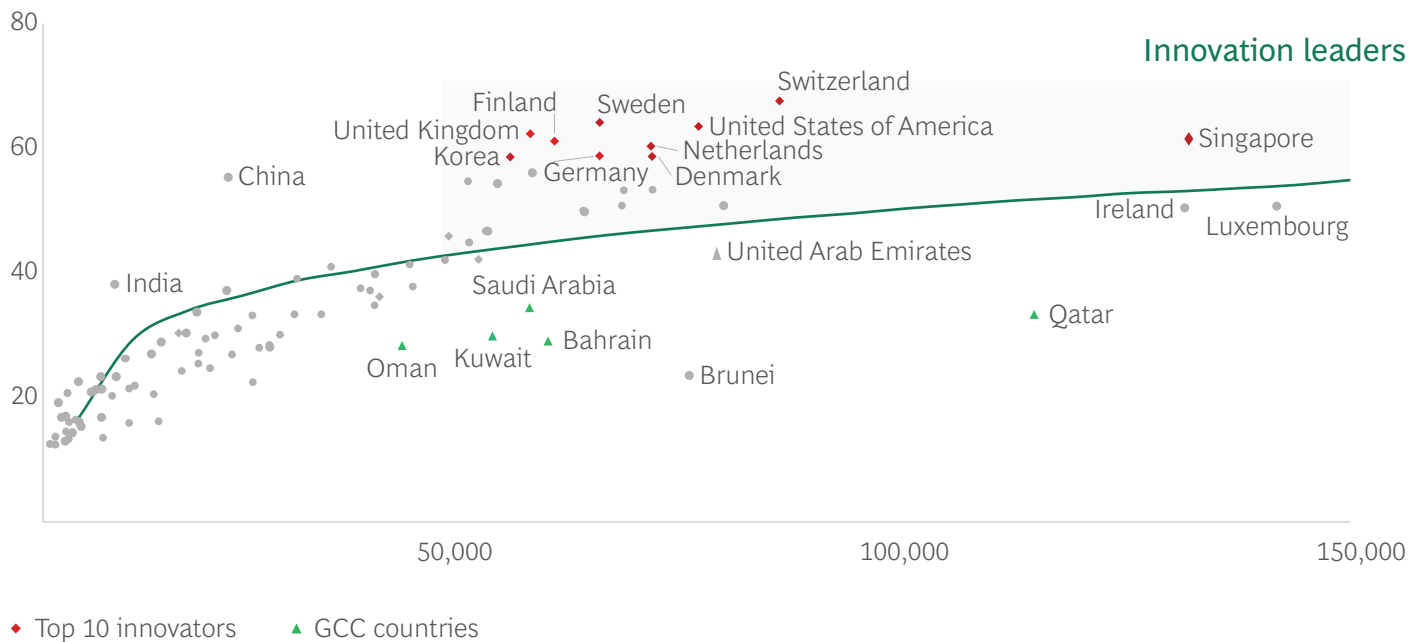
Similarly, for Small and Medium Enterprises (SMEs), which make up over 90% of global businesses⁴, and as essential job creators form the backbone of many economies, innovation is key that 'lets them in' to existing markets. Through products that perform better, or are available at prices lower than what big legacy companies in their sectors offer, they are able to deliver exactly what Professor Clayton Christensen meant when he popularized the term 'disruption'.

1. UNESCO Institute for Statistics
2. US Chamber of Commerce Foundation
3. BCG, The Race for Innovation
4. World Bank statistics

Exhibit 1 - RDI leaders typically exhibit higher GDP/capita compared to laggards

Global Innovation Index scores and GDP per capita

Global Innovation Index (Score, 2023)



GDP per capita (\$, 2022)

Source: Global Innovation Index Report 2023, GDP per capita (current prices, PPP, \$) data based on IMF World Economic Outlook database October 2022, Statistics.

Innovation is also the tool that SMEs use in carving out their niche in emerging sectors, often by providing opportunities for collaboration that can serve as a lifeline for their businesses. An example is lighthouse factories, which foster knowledge transfer and technology adoption, enabling SMEs to adapt and thrive in the Fourth Industrial Revolution. These innovation hubs, called lighthouses, equip SMEs with essential tools, resources, and partnerships, ensuring their continued relevance in a dynamic global marketplace.

A SHIELD IN TIMES OF CRISIS

In addition to economic growth, innovation enhances an economy's resilience during crises. From economic downturns to unforeseen global challenges, innovative solutions provide both immediate relief and long-term stability. At the height of the COVID-19 pandemic in 2020, the top 50 most innovative companies outperformed the market by 17% compared with the MSCI World Index, a global large and mid-cap equity index⁵.

As countries grapple with their national challenges and those shared globally, innovation emerges as the key driver to develop solutions that are unknown today. Innovation, combined with ambition and sustained willpower, is the primary element in setting and moving toward sustainable development targets as nations push the boundaries of what is possible.

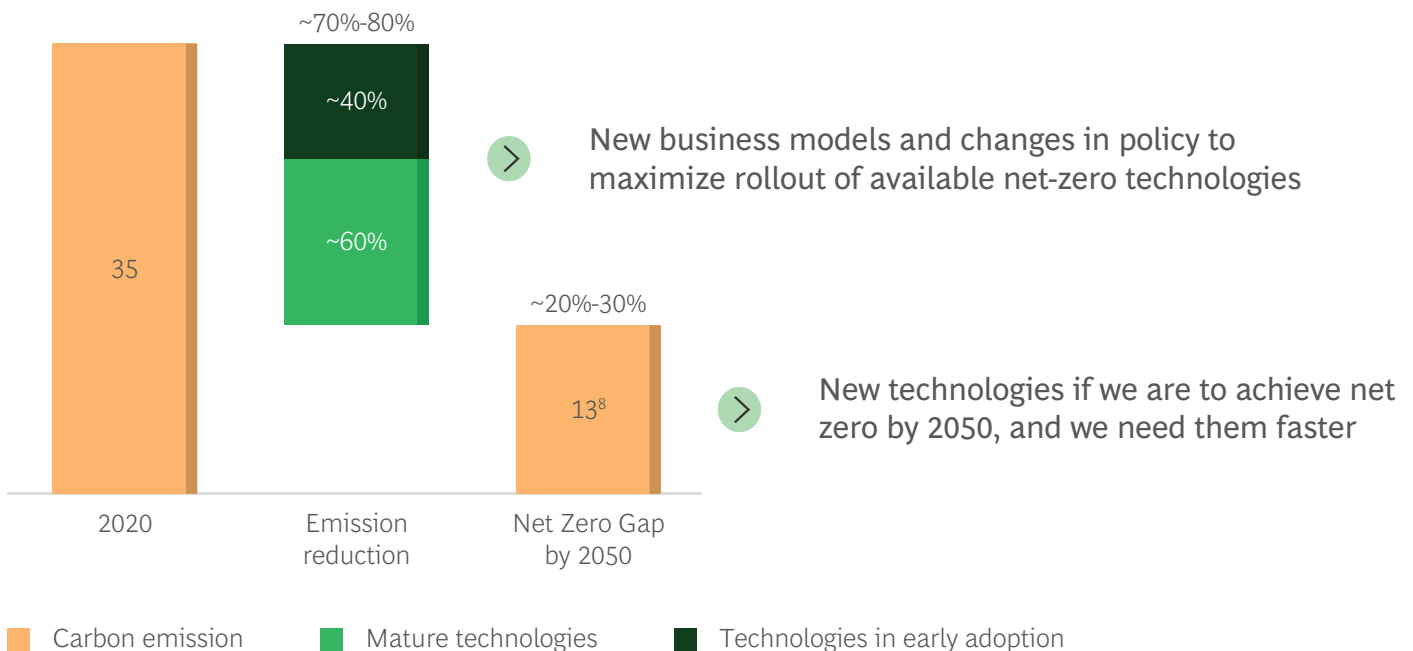
5. BCG, Pandemic Separates Readiest Innovators from the Rest in List of Most Innovative Companies

A prime illustration of this is the global commitment to achieving net-zero carbon emissions. Even as we leverage numerous advanced technologies, estimates suggest that essential technologies required to meet these ambitious targets remain underdeveloped or undiscovered⁶. By 2030, the International Energy Agency estimates that despite ramping up renewables, improving energy efficiency, cutting methane emissions and increasing electrification with technologies available today, the world will only be able to deliver 80% of the emissions reductions needed. Based on its 2021 NZE Scenario, which outlines a pathway for the global energy sector to achieve net-zero emissions, IEA estimates that existing technologies will deliver only 65% of the emissions reductions required. This is an improvement over the organisation's earlier iteration of the scenario, but still means that technologies yet to be introduced to the market hold the keys to delivering 35% of the emissions reductions needed in 2050 to reach net zero.

Some of the biggest contributions to curbing carbon emissions will come from widely electrifying end-use sectors (such as advanced batteries); carbon capture, utilization, and storage (CCUS); hydrogen and hydrogen-related fuels; and bioenergy. These four technology value chains are expected to contribute about half of the cumulative CO₂ savings needed by 2050⁷. It is also likely that another major portion of CO₂ reductions will come from technologies not yet in operation – such is the nature of innovation.

Transitioning these technologies from an idea to laboratory conceptualization to full deployment requires not just scientific brilliance but also a large team of people experienced in moving a technology along in development and getting it to market. They also work best, and achieve the most, in supportive regulatory and policy frameworks. Such frameworks, which prioritize innovation, intellectual property protections, and R&D incentives, are instrumental in ensuring that innovation doesn't just flourish but also addresses globally pressing challenges.

Exhibit 2 - GtCO₂ per year (gap from Net Zero)



6. IEA Sep 2020: Global energy sector CO₂ emissions reductions by current technology maturity category in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2019-2070

7. IEA Sep 2020: Global energy sector CO₂ emissions reductions by current technology maturity category in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2019-2070

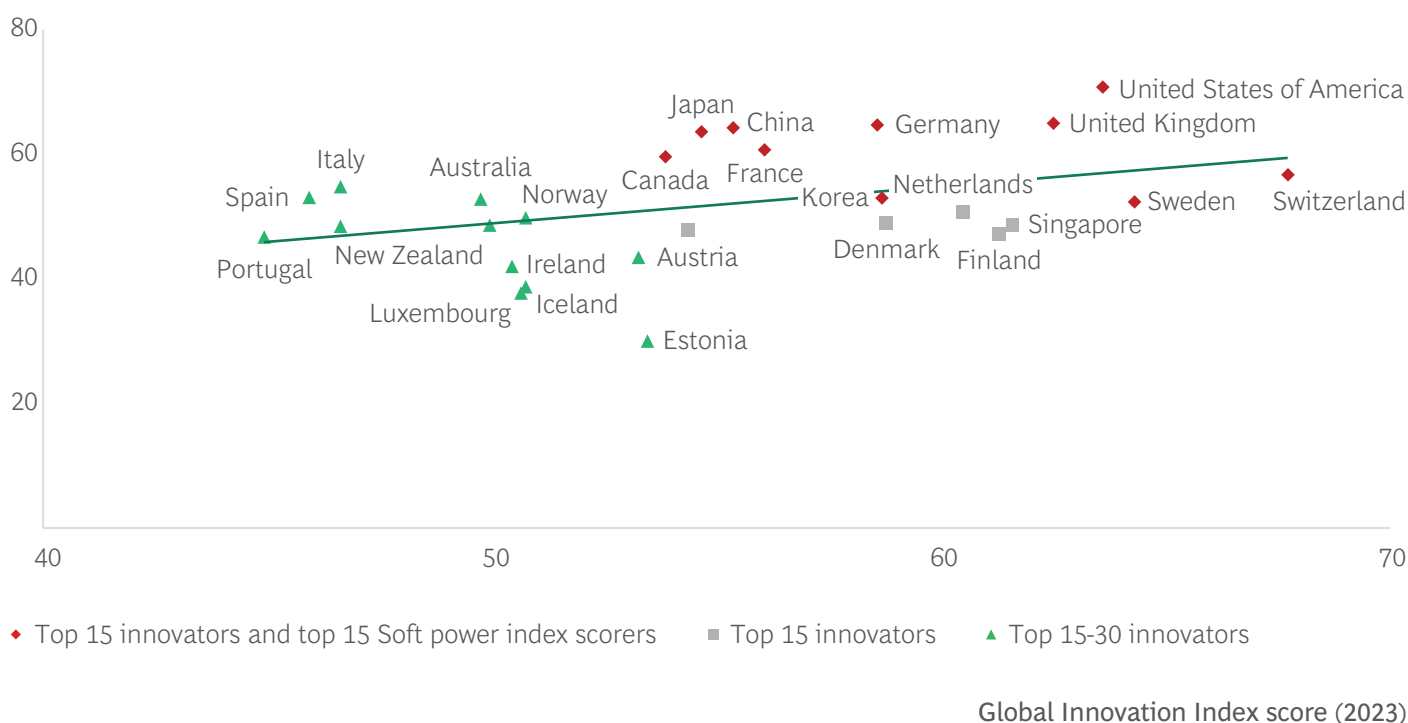
8. 10.2 GtCO₂ of the Net Zero gap in 2050 comes from technologies in demonstration (5.4) or large prototype (4.8). The excess 6.4 is the remaining forecasted gap not filtered by technology at any maturity stage.

Source: Global Innovation Index Report 2023, GDP per capita (current prices, PPP, \$) data based on IMF World Economic Outlook database October 2022, Statistics.

Exhibit 3 - Innovation leaders also occupy the top ranks in the soft power index

Top 30 innovators⁹ Global Innovation Index scores (2023) and Soft Power Index scores (2022)

Soft Power Index score (2022)



9. Excluding Hong Kong, Malta and Cyprus

Source: Global Innovation Index Report 2023, Soft Power Index 2022

POWER DYNAMICS

In the grand geopolitical arena, innovation is no longer just a tool for economic competitiveness but also a conduit for soft power. National governments that have consistently invested in and nurtured innovation find themselves not just reaping economic rewards but also increasingly gaining strategic influence on global platforms. Evidence of this trend is found in more than 20 of the 25 Soft Power Index leaders, which also feature prominently among the top 30 most innovative nations ranked by the Global Innovation Index (refer to Exhibit 4.)¹⁰.

Innovation allows private sector companies to move into areas that were once the sole domain of government monopolies, creating not just new companies, but value for the entire economy. The space economy, for instance, is undergoing a transformative shift, driven primarily by global partnerships that are reshaping the way we explore and utilize this frontier. Once dominated by government agencies and large telecommunication corporations, recent participation from private sector players such as SpaceX has revolutionized the landscape. Advancements in manufacturing and propulsion technologies have significantly reduced the cost of heavy launches, enabling widespread participation with the price to access space having plummeted by approximately 50% in the decade between 2010 and 2020¹¹.

10. Brand Finance, Global Soft Power Index, and Global Innovation Index

11. <https://ntrs.nasa.gov/citations/20200001093>

This surge in space interest has attracted companies from diverse sectors, drawn to the potential for innovation and economic opportunities. Global pharmaceutical firms are exploring zero-gravity research on cell growth, while semiconductor companies seek to enhance their manufacturing processes in space. The emergence of private sector engagement signifies a tipping point, where large-scale activities in space become increasingly feasible. While the vision of space cities may be distant, the momentum has attracted investor interest, resulting in a surge of venture funding for space-related ventures, proving that collaborative partnerships are key to unlocking the full potential of the space economy.

WIDENING CHASM BETWEEN LEADERS AND LAGGARDS

The rush towards innovation isn't without its disparities and has inadvertently created a widening chasm between nations. The discrepancies between developed and developing countries have heightened, with the gap in average GDP per capita increasing by 2.4 times over the past half-century¹². Recent surges in emerging technologies have further polarized this divide.

Such disparities aren't just restricted to nation-states. Within industries, businesses that either fail to recognize the value of innovation or lack the resources to integrate it face existential threats. One projection suggests that nearly 40% of enterprises not actively pursuing innovative strategies may go out of business in the coming decade¹³.

THE PATH FORWARD: DOUBLING DOWN ON INNOVATION

The gravity of these statistics has certainly not been lost on global leaders. A sweeping trend across the globe, particularly among the G20 nations, is a reinvigorated focus on innovation¹⁴. More than 15 of these economic giants have already launched ambitious innovation strategies, committing vast resources to foster a culture of invention, research, and deployment.

For countries, especially those in the developing bracket, the task is twofold: they must balance responsibly accelerating their innovative efforts (i.e., ensuring ethical and safe adoption in areas such as fast-tracking pharma development and autonomous vehicle adoption) while still managing economies that are less robust than those of frontrunners. As they do this, they also need to continuously adapt to the ever-evolving innovation landscape.

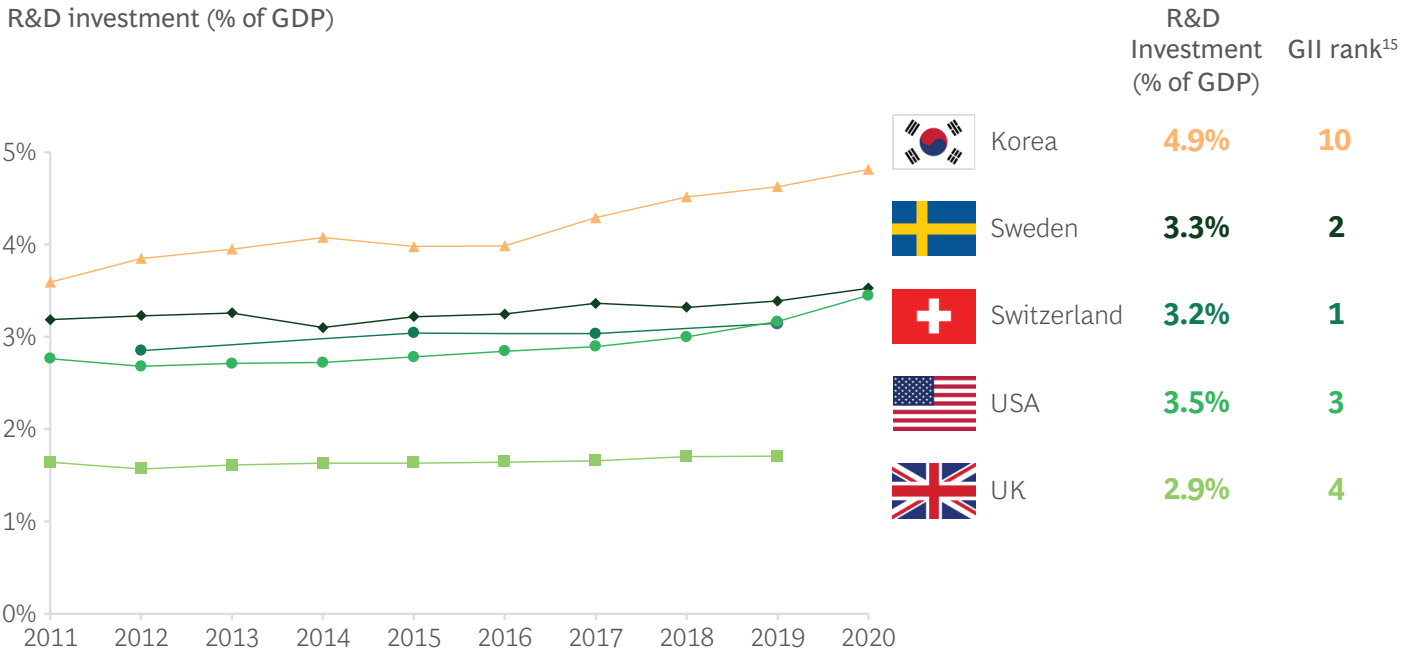
¹². UNCTAD, Technology and Innovation report 2021

¹³. Hult Global webinar: Global Webinar: Innovate or die – Redefining strategy for the innovation economy

¹⁴. G20, Innovation Action Plan

Exhibit 4 - Diagnostics | Innovative countries have maintained stable RDI investments over years

R&D investments of leading innovative countries



Stable & regular funding - RDI programs' success relies on stable & regular outcome-based funding

15. Global Innovation Index ranking, 2023
Source: WIPO and Global Innovation Index Reports

Global Trends in Driving Innovation

PRO-INNOVATION PRINCIPLES: CATALYZING THE RDI ENGINE WITH PROPER POLICIES

Governments worldwide are amplifying their commitment to innovation by adopting principles and rolling out policies specifically designed to cultivate and bolster the critical domain of innovation. A consistent set of core policies and processes allow, support, and in some cases, fuel an innovation economy. Countries looking to foster an innovation economy typically embrace the following six policy approaches, which can be considered causal drivers of initiating and igniting an innovation economy.

- Stable funding.** Top innovating nations consistently deploy funds towards RDI. For example, as shown in Exhibit 5, South Korea and the USA spend approximately 4.8% and 3.5% of their respective GDPs towards research, development, and innovation. These funding commitments are multiyear in nature to mimic the lifespan of RDI projects (e.g., National Science Foundation grants in the US run an average of about three years). Funding stability is critical to drive research outcomes and minimize the sunk cost of incomplete endeavors.

- **Risk appetite and portfolio approach.** While innovation economies overall are resilient, stable, and growing economies, sectors within them can experience fluidity and disruption. This can be unsettling to some in government, but it is inherent – every innovation carries risks. Successful innovators, whether nations or corporations, demonstrate a balanced appetite for risk. A portfolio approach is essential here. By diversifying investments across a range of projects – from ‘safe bets’ to high-risk, high-reward endeavors – leaders can ensure a steady stream of successes while also vying for breakthrough innovations. For instance, in the pharma industry, the cost of drug discovery and development is around USD 1-2 billion with a 10–15-year time horizon. Roughly 60% of investments are written off as costs due to failure and only 0.002% of drugs are approved for human therapy with outsized returns¹⁶. This strategy allows for failures, which are inevitable and often provide valuable lessons, without jeopardizing the entire innovation enterprise.
- **Talent mobility.** Governments recognize the significance of international talent in catalyzing innovation. Surveys of European start-ups in Berlin and London show that about half the CEOs are foreign nationals. Innovation economies have open doors and cultures that welcome all. Ways to proactively drive visionary visa programs can be found in examples such as Singapore’s EntrePass, the UK’s Entrepreneur Visa, and China’s Business Startup Visa, which have been pivotal in attracting entrepreneurial talent, and enhancing Research, Development, and Innovation (RDI) ecosystems.
- **IP protection.** Intellectual property (IP) forms the bedrock of innovation, ensuring that inventors and businesses can reap the rewards of their efforts. Several countries, including Ireland, Singapore, and the UK, have made substantial advancements in their IP frameworks. These reforms not only streamline IP management but also provide robust mechanisms for dispute resolution, safeguarding intellectual property rights.
- **Financial support and incentives.** Leading innovating nations consistently allocate substantial resources to government spending on Research and Development (R&D), particularly basic science. In addition, they support companies directly by offering diverse incentives such as tax credits (Ireland and Australia), low-interest startup loans (UK), and tech adoption credits (China). These measures reduce financial risks associated with R&D investments, thereby fueling innovation, and bolstering global competitiveness.
- **Facilitative policies.** Beyond direct innovation support, countries foster environments conducive to innovation. Australia’s progressive bankruptcy laws, for instance, encourage risk-taking and allow easy shut-down of failed ventures, allowing talent and capital to move on to more productive uses. Open data initiatives in Korea and the UK offer invaluable resources to businesses across industries. Regulatory sandboxes, as exemplified by the Netherlands, enable businesses to experiment and refine innovative financial products and services.

GOVERNMENT REQUIREMENTS AND RESPONSES

Governments often look at spending in terms of the Return on Investment, or ROI, of a given project. However, innovation requires relaxing that spreadsheet constraint and using atypical impact metrics. Adopting a ‘second-order return’ mindset in RDI investments is crucial. Rather than focusing on traditional ROI and IP control, which would stifle innovation, leading nations adopt more comprehensive impact metrics such as GDP impact, job creation and social returns.

The US’ Bayh-Dole Act of 1980, which allowed entities to own IP generated from government funding, exemplifies the second-order return concept. By relinquishing immediate IP ownership, the US multiplied its investment manifold, driving economic growth and transformative technologies. Similarly, UK Research and Innovation (UKRI), a government body that directs research and innovation funding in the country, measures holistic metrics, like spinoff companies and collaborations, to gauge research impact.

16. US Congressional Budget Office, Research and Development in the Pharmaceutical Industry 2020

Looking beyond mere ROI metrics also tends to involve inclusive policymaking. Governments are recognizing the value of co-developing policies with stakeholders from both the public and private sectors. Such collaborative efforts ensure that policies foster and nurture innovation without inadvertently hindering its progress (e.g., through fast-tracked adoption of innovative tech while ensuring public safety).

Finally, this journey leads to a democratization of knowledge. The rise of open innovation is dismantling traditional innovation hierarchies. This move has facilitated the vertical disintegration of established innovation chains, allowing for a more distributed and inclusive approach to ideation and implementation.

EMERGING PATTERNS

As countries and organizations strive to climb the ladder of innovation leadership, some distinct patterns emerge among the frontrunners. Rigorous benchmarking research has shed light on the frameworks, strategies, and ideologies that top innovators embody. It is also noteworthy that many of these trends involve a conscious shift away from more traditional forms of managing an economy. From the wealth of benchmarking information, several global trends emerge as the keystones of successful innovation leadership that provide beneficial outcomes:

- 1. User-centricity.** Moving away from supply-driven R&D, innovation agendas are increasingly becoming demand-driven. Nations such as Germany have exemplified this trend. Their High-Tech Forum, comprising 21 domain experts, steers the country's High-Tech Strategy 2025 by engaging in constant dialogue with a wide spectrum of stakeholders, ensuring that innovations cater to end-user needs while navigating the intricate framework of maintaining profitability, engineering design constraints, manufacturing processes and cost, and respecting industry policies.
- 2. Multidisciplinary approaches.** No longer restricted within isolated knowledge silos, innovations are morphing into multidisciplinary endeavors. Solutions to pressing challenges now involve holistic teams that blend expertise from diverse domains, emphasizing the convergence of skills and perspectives.
- 3. Collaborative synergies.** Co-design and co-creation models are tearing down walls that traditionally isolated research, technology, and innovation. Through dynamic partnerships, bridges are being built across diverse actors, leading to more cohesive and effective solutions. This has also led to the rise of 'innovation districts', physical locations where academic experts, entrepreneurs, talented workers, and suppliers gather to collaborate on rapidly addressing problems and building companies.
- 4. GovTech frameworks for swift adaptation.** With innovation cycles shrinking, there's a pressing need for stable and simpler regulations. Regulatory frameworks need to accommodate emerging sectors and business models, but they also must be clear and stable enough that thousands of newly emerging companies can manage within them. Equally vital is the fluid mobility of capital and talent, ensuring that innovations aren't stifled by bureaucracy or logistical challenges. While in the short run this can highlight that winners and losers in an innovation economy, over the long run, it is an essential feature of any strong innovation system.
- 5. Bottom-Up solutions to top-down directives.** While top-down directives, such as national policies or corporate strategies, can set the general direction for innovation, ground-breaking ideas often emerge at the grassroots level. Encouraging bottom-up solutions ensures that those closest to problems are empowered to devise solutions. This approach can lead to more practical, user-centric innovations. A dual approach, where top-down directions provide the overarching vision and bottom-up solutions fill in the details, can yield robust, holistic, and effective innovations.

6. International play and partnerships. In an interconnected world, no country or company can afford to innovate in isolation. International collaborations provide avenues for sharing knowledge, pooling resources, and accessing new markets. Such partnerships, whether through formal treaties, business collaborations, or research tie-ups, can bolster innovation by merging the strengths of diverse entities. For example, countries might collaborate on large-scale research projects, or businesses might enter joint ventures to develop and market new products. These partnerships, built on mutual trust and shared objectives, amplify the collective potential of the entities involved. At the level of individual researchers and employees, this is mirrored as workforce mobility. The world's most innovative locations and companies have workers from dozens and dozens of countries, all contributing to the local innovation ecosystem.

CONCLUSION

In the modern era, innovation is not just a luxury, but a necessity. From driving economic progress by enhancing GDP growth and productivity to serving as a protective shield during crises, innovation's multifaceted role is undeniable. Yet, innovation's potential benefits extend beyond economic growth. Innovation offers solutions to some of the world's most pressing challenges, including the path towards net-zero emissions, and global resilience to risks as profound as the ones experienced during the COVID-19 pandemic. Governments and industries are waking up to this, with most G20 nations heavily investing in innovation. However, a significant gap still exists between developed and developing countries, highlighting the urgency with which all nations need to embrace innovation.

The landscape of innovation itself is undergoing transformative changes. Traditionally viewed as a top-down directive, there's a growing realization of the power of bottom-up, grassroots solutions. Collaborative models, transcending sectors and geographies, are becoming the norm. We are seeing a shift from supply-driven R&D to a demand-driven one, a testament to the evolving nature of innovation where end-users play a pivotal role. Furthermore, the financial system supporting innovation is evolving as well. Beyond the allocation of funds, the focus is now on designing incentives that genuinely accelerate R&D initiatives. Governments worldwide are introducing pro-innovation policies, from tax incentives to entrepreneur visas, ensuring that the ecosystem is ripe for innovators to thrive.

Successful innovation requires a blend of bold risk-taking and a diversified portfolio approach, understanding that while many attempts may falter, a few will lead to truly groundbreaking results. For this to happen, there is a need to broaden the metrics of success and look beyond expenditure and patents to gauge the actual societal and environmental impacts of innovative endeavors.

As we navigate this 'Innovation Era', a multidimensional, collaborative, and forward-thinking approach is vital. Nations, businesses, and even individuals, embracing these principles will be instrumental in shaping a brighter, more innovative future.

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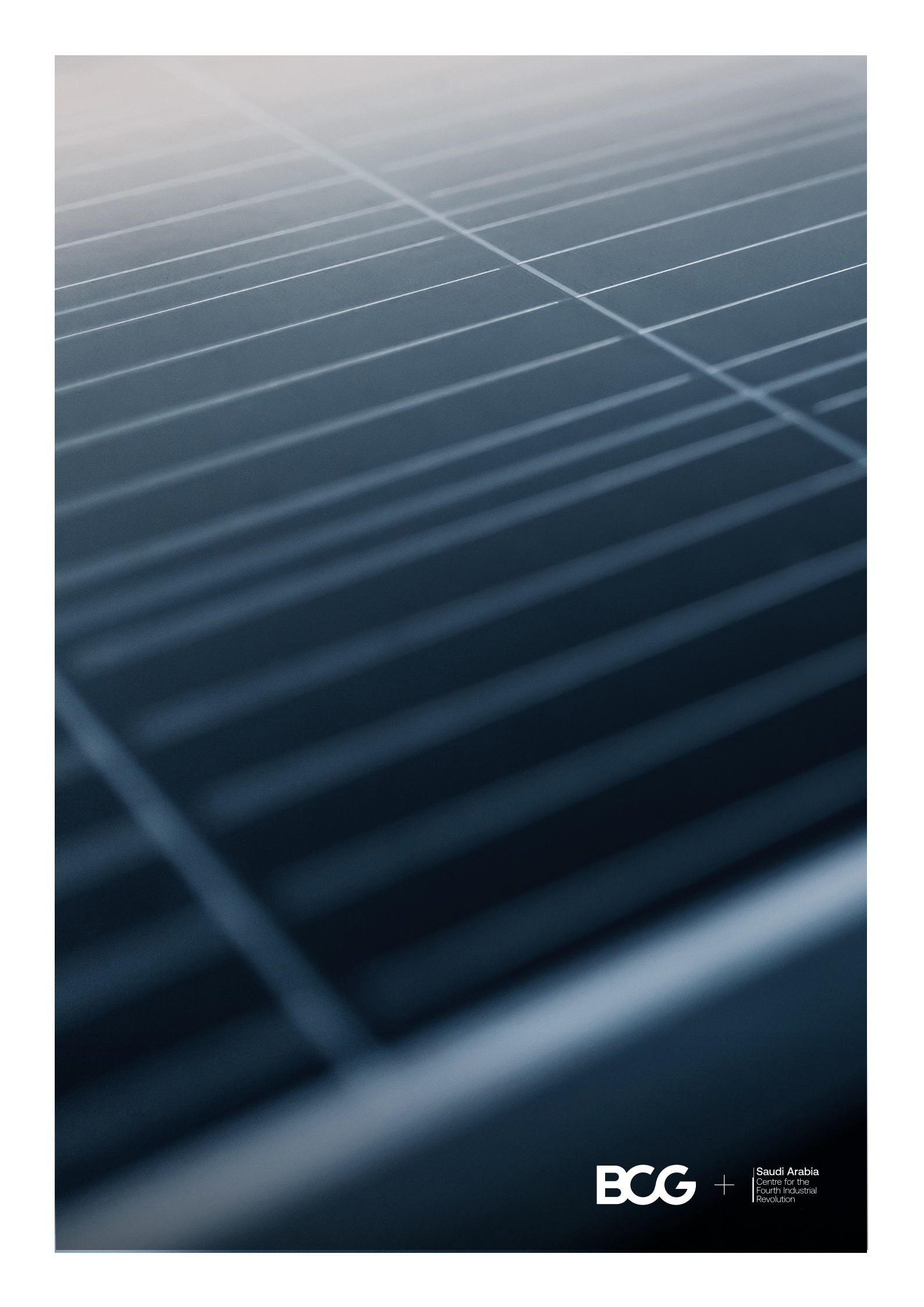
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Through collaboration between the public and private sectors, it pioneers innovative regulatory and adoption approaches for the benefit of society and the environment, whilst ensuring inclusivity and no one is left behind.

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