In collaboration with Accenture

WORLD ECONOMIC FORUM

Global Economic Futures: Productivity in 2030

WHITE PAPER

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Contents

Foreword

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The global economic backdrop is one of weak growth, complex geoeconomics and deepening policy uncertainty. The question is no longer whether the economic landscape is going to evolve, but how decision-makers can respond to these shifts. Can they harness this wave of change to build more innovative, inclusive, sustainable and resilient economies and businesses?

To help decision-makers understand and anticipate change, the World Economic Forum and Accenture are launching this new series of publications entitled *Global Economic Futures*. The series uses scenario analysis as a tool to understand future trends, vulnerabilities and opportunities, and to identify strategies that can shape better outcomes.

This first edition of the series explores the future of productivity, a critical topic at the root of challenges around boosting economic growth and living standards. The paper sets out four scenarios exploring the interaction of two core drivers of productivity: technology and human capital. It also presents a data-driven assessment of how businesses in different sectors may be affected.

The aim is not to predict where the world will be in 2030. Instead, the series encourages leaders to think critically, creatively and purposefully about the future and to drive action on the key issues. The paper offers a set of actionable strategies to help businesses and governments not only adapt to change, but also shape it.

We hope this paper and series will be a useful resource for decision-makers as they navigate an increasingly complex global landscape.

Executive summary

The future of productivity – central to economic growth and living standards – will be shaped by technology, human capital and adaptive business models.

Productivity has historically been a critical driver of global growth, increasing living standards and economic dynamism. However, productivity growth has come to a virtual standstill in recent decades, and more than half of the deceleration of global growth since 2008 can be attributed to this slowdown.

Key trends shaping future productivity

There is little consensus on the pace of productivity growth in the coming years, but many trends will influence it, including technology, skills, labour markets, demographics, finance, regulation, infrastructure and geoeconomics.

For example, the commercialization of disruptive technologies has the potential to transform productivity, although the rate of adoption and level of impact remain uncertain. In the case of artificial intelligence (AI), business executives in high-income economies rate the productivity-boosting use of the technology nearly 40% higher than their peers in low-income economies. Sectorally, they expect AI to be harnessed the most in information and technology services, financial services and energy technology in the coming years.

Human capital development will also be critical to reversing the productivity slowdown, not least because of its important role in unlocking technological gains. Nearly half of global business executives cite a lack of workforce skills and visionary leadership as the primary obstacles to AI adoption.

Four scenarios for productivity in 2030

Scenario analysis offers a structured process for exploring, understanding and navigating uncertainty. The purpose of this analysis is not to predict where the world will be in 2030, but to encourage decision-makers to think critically, creatively and purposefully about the future.

Looking at the interaction of potential acceleration and slowdown on two key productivity drivers – technology and human capital – results in the following four futures:

1. **Productivity Leap**: A virtuous circle between widespread disruptive innovation and rapid human capital development leads to significant and broad-based productivity gains and a marked improvement in living standards.

2. **Automation Overload**: Technological advancements outpace human capital development, leading to a “winner-takes-all” dynamic and an economy characterized by increased concentration of wealth and power. Productivity gaps widen between leading and lagging firms, sectors and regions.

3. **Human Advantage**: Human capital development outpaces technological advancement, centring economic activity on people. Productivity growth is slow and uneven, driven more by creative use of existing technologies than breakthroughs. Productivity gains hinge on the ability to attract talent that can maximize the potential of technology.

4. **Productivity Drought**: A simultaneous slowdown in technological innovation and human capital development stalls productivity growth. Economies struggle to sustain previous levels of prosperity, leading to stagnation in living standards and socioeconomic progress.

Industry exposure and implications

Each of these futures has the potential to reshape sectors and disrupt individual businesses. Across 12 sectors, four broad clusters are identified based on analysis of the differing headwinds and tailwinds for corporate output and profitability across the scenarios. Five sectors are analysed closely, each characterized by varying levels of exposure to technological and human capital trends: information technology and digital communications; financial, professional, and real estate services; manufacturing; energy and materials; and education.

Strategies for the future

The paper offers a series of high-level strategic recommendations designed to help businesses and governments maximize opportunities and mitigate risks while harnessing the productivity potential of trends in technology and human capital:

- Promote synergies between technology and human capital development
- Strengthen anticipatory and data-driven decision-making
- Future-proof education and training systems
- Anticipate talent needs and develop workforce transition policies
- Accelerate adoption and diffusion of emerging technologies
- Invest in the trustworthiness of emerging technologies
- Strengthen critical infrastructure
- Bridge regional and sectoral gaps to mitigate productivity divergence
- Strengthen resilience to geopolitical disruption

1 Introduction: Understanding productivity

Reviving productivity growth requires tackling structural barriers such as access to capital and talent, infrastructure gaps and diffusion of innovation.

Productivity is more than an abstract economic statistic. For businesses, it determines profitability and market viability. For economies, it is a fundamental measure of economic health and the foundation of long-term growth and improvements in living standards. Differences in productivity are what explains why countries with similar resource endowments can exhibit vastly different economic outcomes. For example, more than half of global disparities in GDP (gross domestic product) per capita can be attributed to countries' differing levels of productivity.[1]

Ultimately, productivity growth reflects the ability to produce more with less, owing to new ideas, innovation and the capacity of human capital to harness technological progress.[2]

Without productivity improvements, economic growth becomes reliant on expanding labour and capital inputs – an approach that is unsustainable in a world constrained by environmental limits, a dwindling workforce and tightening financial buffers.

The remainder of this introduction looks at global productivity patterns, outlining the sluggish dynamics of recent decades and considering the global trends that will shape future productivity. The rest of this paper will then build on this analysis by conceptualizing four scenarios for the future of productivity in 2030 (see Chapter 2), assessing industry exposure to changing productivity dynamics (see Chapter 3) and identifying a series of strategic recommendations for businesses and governments (see Chapter 4).

1.1 The productivity slowdown

> More than half of the deceleration in global economic growth since the 2008-2009 global financial crisis can be attributed to a slowdown in productivity.

Historically, productivity has followed a pattern of booms and slowdowns. For example, in the early- and mid-20th century, industrialization, mass electrification and rapid infrastructure development fuelled a surge in productivity. Similarly, the rapid development of new information technologies and digital infrastructure in the late 20th century spurred significant productivity gains, creating new markets and reshaping industries from retail to finance. These waves of innovation and increasing productivity were key drivers of GDP growth, rising incomes and improved living standards over the last century.

More recently, however, despite the acceleration of technological development, productivity growth has remained sluggish in many economies – what is commonly referred to as the "productivity paradox". New technologies have delivered significant productivity gains to frontier firms, but the wider productivity impact has been meagre.[3] In fact, based on Accenture analysis, nearly 40% of large companies recorded negative productivity growth in recent years.[4]

Country-level trends

The International Monetary Fund (IMF) estimates that more than half of the deceleration in global economic growth since the 2008-2009 global financial crisis (GFC) can be attributed to a slowdown in productivity.[5] Globally, growth in total factor productivity (TFP) – a measure of the effectiveness with which economic inputs are combined, reflecting drivers such as efficiency, innovation and organizational change – has slowed from an annual 1.6% in the early 2000s to just 0.6% for the post-GFC period (see Figure 1). In advanced economies, TFP growth halved to 0.4% over this period, while the slowdown has been steeper for emerging-market and middle- and low-income economies, where average TFP growth dropped from above 2% in the early 2000s to 0.6% after 2008, settling near 0% in low-income economies since 2020.[6]

FIGURE 1 | **Contribution of components of GDP Growth, 1995-2023**

Figure 1.1 World

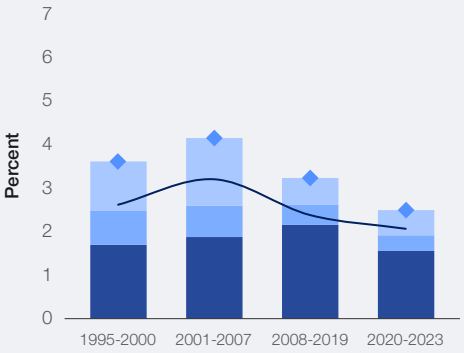


Figure 1.2 Advanced economies

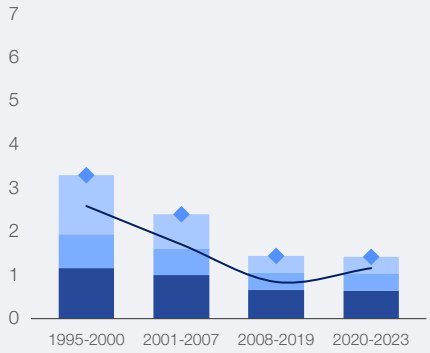
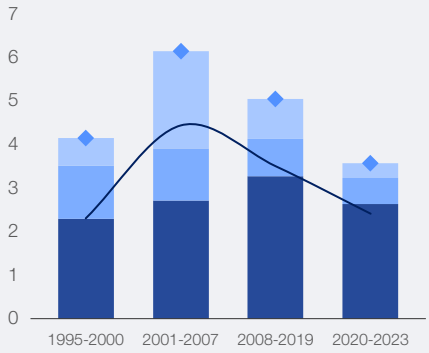


Figure 1.3 EMMIEs and LIDCs



Note: Growth decomposition sample comprises 140 countries. Contributions of capital growth and labour growth reflect output share of respective factor inputs and the growth rates; EMMIEs = emerging market and middle-income economies; LIDCs = low-income developing countries, TFP = total factor productivity.

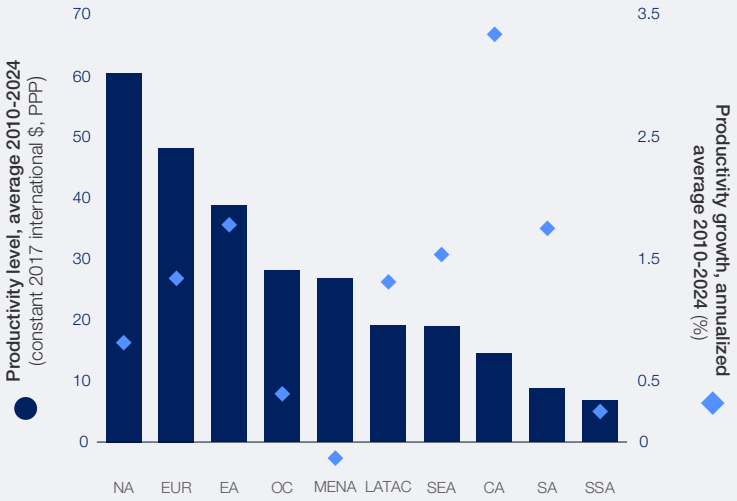
Source: World Economic Forum and Accenture based on International Monetary Fund, April 2024.

There is also a stark divergence in labour productivity according to income levels, with high-income economies on average nearly fifteen times more productive compared to their low-income peers over the 2010-2024 period.[7] A divergence can also be seen in the regional data (see Figure 2.1), where the three most productive regions (North America, Europe and East Asia) are, on average, nearly five times more productive than the three least productive regions (Central Asia, Southern Asia and Sub-Saharan Africa).

However, when looking at productivity growth rates rather than levels, the economies of Asia – in particular Central Asia, East Asia and South Asia – have significantly outpaced the rest of the world since 2010 (see Figure 2.1).

FIGURE 2 | **Productivity trends, by region and by sector**

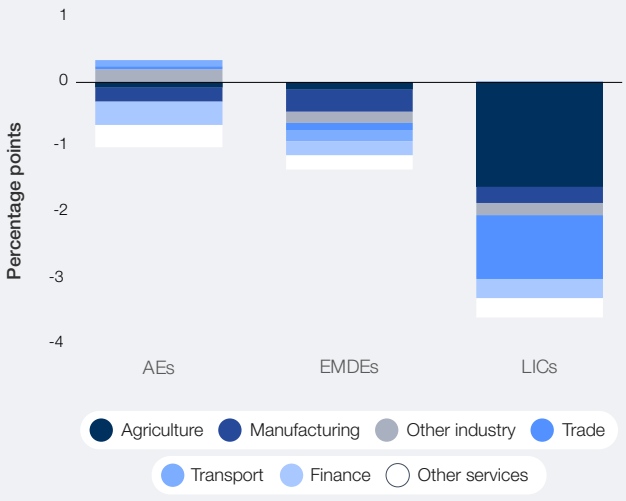
Figure 2.1 Labour productivity 2010-2024 (level and growth), by region



Note: NA = Northern America, EUR = Europe, EA = Eastern Asia, OC = Oceania, MENA = Middle East and Northern Africa, LATAC = Latin America and the Caribbean, SEA = South-eastern Asia, CA = Central Asia, SA = Southern Asia, SSA = Sub-Saharan Africa.

Source: World Economic Forum and Accenture based on International Labour Organization (ILO) modelled estimates, output per hour worked (GDP, constant 2017 international $, purchasing power parity).

Figure 2.2 Sectoral contribution to productivity growth between 2003-2008 and 2013-2017



Note: "Other industry" includes mining, utilities and construction; "Other services" includes government and personal services. All medians.

Source: World Bank, 2020.

Business trends

Sector-specific trends have had a significant impact on overall productivity patterns since the global financial crisis, particularly in agriculture, trade, finance and manufacturing (see Figure 2.2). This has been particularly true for low-income economies, where agriculture and trade have each accounted for more than 1 percentage point of the overall deceleration of productivity growth. The finance and business services sector exerted the strongest drag on productivity growth among advanced economies, while for emerging-market and developing economies, it was manufacturing.

At the level of individual businesses, the gap between frontier firms and laggards has nearly doubled in recent years, increasing from 6.3 percentage points to 11.8 percentage points between 2016 and 2023, according to Accenture estimates.[8] A lag in technology diffusion is a key reason, with many industries and firms yet to deploy and harness new technologies.

1.2 Key drivers of future productivity

There is little consensus on the pace of productivity growth in the coming years, but it is likely to be shaped by trends in a number of key global developments – including technology, demographics, policy and geopolitics – and by the responses of policy-makers and business leaders.

Technology

The commercialization of disruptive emerging technologies has the potential to redefine the future of productivity. The World Bank estimates that a technology shock can raise productivity by 1.5% in advanced and 4.5% in emerging economies over a 10-year period.[9] This is particularly relevant to developments in artificial intelligence (AI), the archetypal current example of a frontier technology shock, which has exploded into the public consciousness since the launch of numerous generative AI tools in 2022. Over time, AI is widely expected to deliver a systemic economic boost, although current estimates of the extent of this boost are subject to significant uncertainty.[10] The long-term impact of AI on global productivity growth will depend heavily on how rapidly and effectively businesses across different sectors and regions can integrate it into their business models.

As of 2024, the use of AI to enhance productivity remains patchy, according to the World Economic Forum's latest annual survey of over 10,000 executives globally (see Figure 3). Respondents in high-income economies rate the adoption of AI to boost productivity nearly 40% higher than those in low-income economies, although it is notable that no countries perform very highly. Regionally, Northern America, Oceania and South-eastern Asia are seen as having the highest use of AI for productivity. At the country level, Norway, the USA and Finland are the main global leaders (see Figure 4.1).

FIGURE 3 **Perception of the business community about the adoption of AI among local businesses to enhance productivity**

Source: World Economic Forum. Executive Opinion Survey 2024.

The same survey reveals that service-related sectors are the ones most expected to use AI to innovate new products and business models in the coming years (see Figure 4.2). Nearly half of respondents expect information and technology services companies to generate AI opportunities, closely followed by companies in the financial services sector. The energy technology and utilities sector is also seen as a leading adopter of AI. Among other industries, more than one-fifth of executives expect companies in advanced manufacturing, engineering and construction to leverage AI in the near term.

FIGURE 4

Top countries and sectors expected to leverage AI opportunities according to business executives

Figure 4.1 Top 10 economies by use of AI among local businesses to enhance productivity

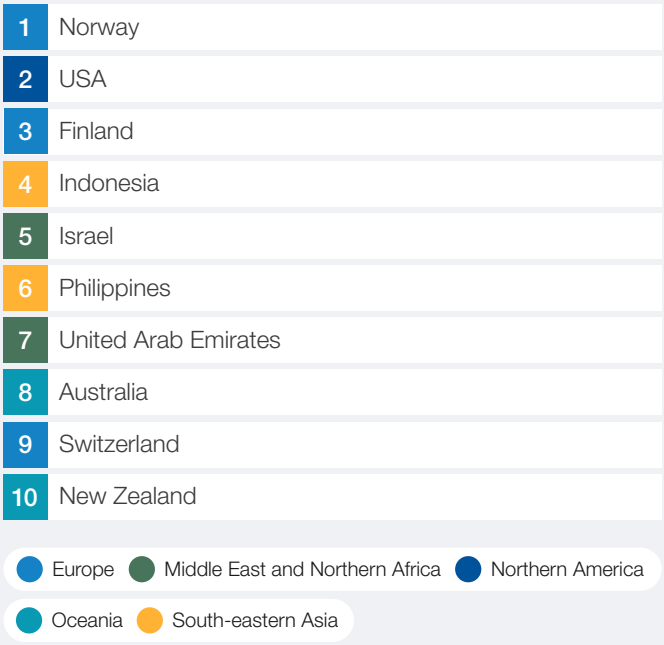


Figure 4.2 Top 10 sectors to generate AI opportunities

Source: World Economic Forum. Executive Opinion Survey 2024.

Realizing the full productivity potential of new technologies requires addressing structural barriers such as access to capital and talent, digital infrastructure gaps and diffusion of innovation. While breakthroughs at the frontier carry significant potential, improved access to simpler and more readily available technologies can unlock wider productivity gains across firms and countries. For example, the diffusion of improvements in energy and irrigation technologies is expected to drive sizeable increases in agricultural productivity,[11] with the use of precision farming boosting crop yields by as much as 15%[12] in some cases.

Human capital

The adoption and diffusion of advanced technologies are inextricably linked to human capital. Recent World Economic Forum interviews with business executives reveal that the successful deployment of AI depends as much or more on people as on the technology itself.[13] This is in line with the finding that firms can boost productivity gains from 4% to 11% if they leverage complementarities between data, technology and talent, rather than focusing solely on data and technology.[14] Yet despite the clear importance of human capital in maximizing productivity gains from technology, both public and private spending on workforce training has declined in recent years, with spending in OECD (Organisation for Economic Co-operation and Development) countries falling from 0.2% to 0.1% of GDP since 2008.[15]

Human capital is also seen as the main obstacle to AI adoption by business leaders. Nearly half of respondents cite a lack of skills as the primary bottleneck, while 43% point to a lack of vision among managers and leaders.[16] By contrast, fewer than one-third of executives highlight the cost of AI products and services, and only one-fifth see regulatory constraints as key barriers.[17]

Ongoing digitization is accelerating a shift towards a high-skill-intensive workforce, where both technical expertise and non-cognitive skills – such as leadership and communication – are increasingly critical. The level of skills and their complementarity

Global economic fragmentation and financial constraints also pose a challenge to sustained productivity gains.

are particularly strong among firms at the productivity frontier. On average, frontier firms have twice the share of high-skilled workers compared to laggard firms.[18] However, their differentiation rests not only on workforce composition but on the depth and deployment of specific skills. For example, frontier firms exhibit almost twice the level of management and communication skills compared to laggards and more than double in ICT skills.[19] Closing the skills gaps and enhancing the quality of education and job training could unlock significant productivity gains.[20]

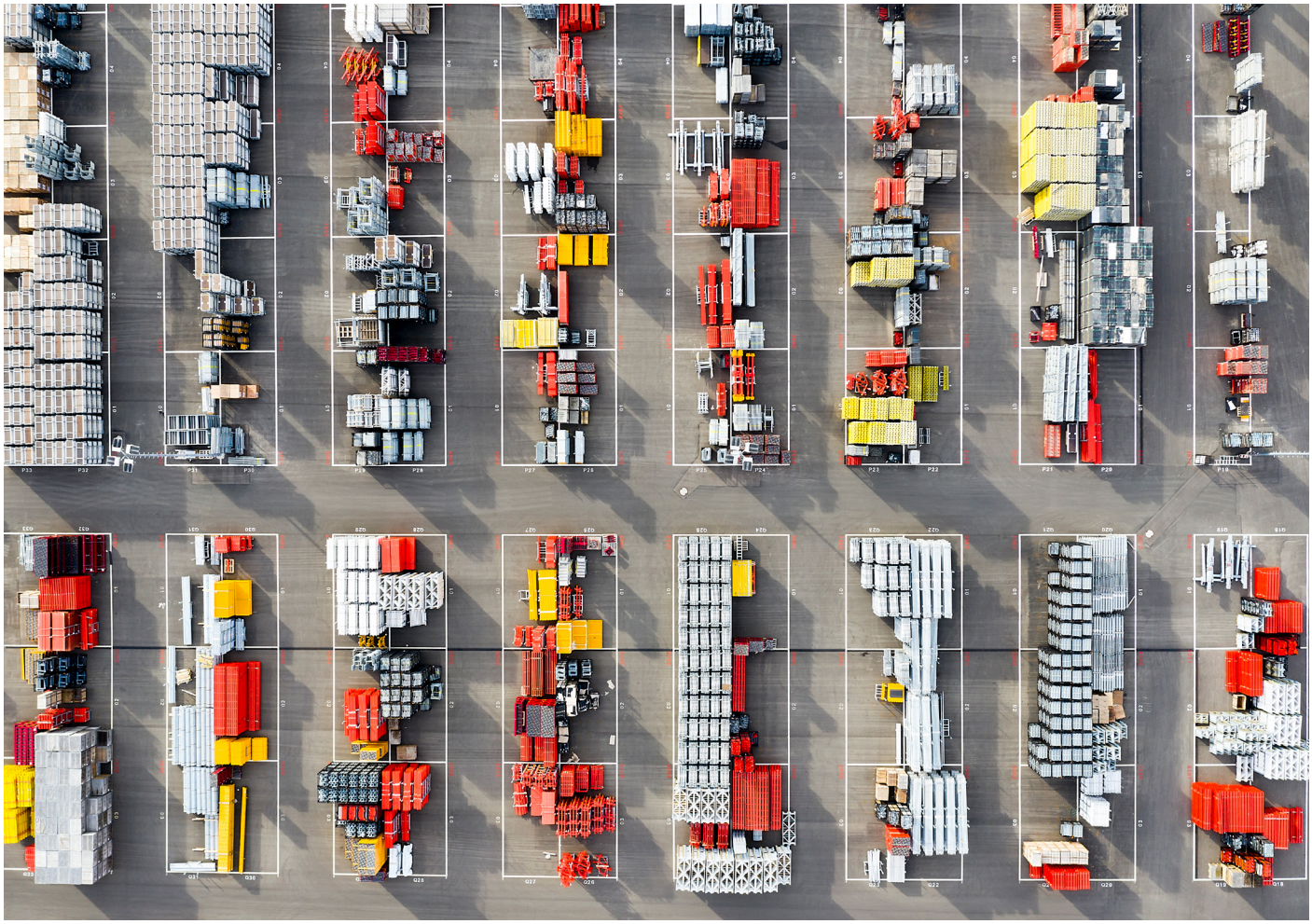
Demographic trends are also reshaping productivity prospects, with the ratio of working-age individuals to those aged above 65 projected to shrink from 6.4 in 2024 to 3.9 by 2050.[21] Migration is likely to play a pivotal role in mitigating these headwinds. Beyond addressing labour shortages, migration also drives knowledge diffusion and facilitates cross-border productivity spillovers. However, tightening labour markets and increasingly selective migration policies are likely to reshape the global talent landscape in the years ahead.

Business environment

The evolving business environment presents both opportunities and risks for productivity growth in the coming years.

Industrial policies are increasingly being used to stimulate domestic industries, promote technological leadership and secure supply chains. However, their long-term implications for allocative efficiency, market dynamics, firm size and productivity are uncertain. At the start of 2024, the World Economic Forum's *Chief Economists Outlook* flagged concerns about domestic market distortions and global supply chain redundancies arising from such interventions.[22] For example, past misallocations of capital and labour have already caused a 0.6 percentage point drag on annual productivity growth, and it is estimated that TFP growth could have been 50% higher in recent years without these inefficiencies.[23]

Global economic fragmentation and financial constraints also pose a challenge to sustained productivity gains. By 2021, business investment in OECD countries had fallen by 40% from pre-GFC levels.[24] This decline limits the ability of firms to adopt new technologies and scale productivity-enhancing innovations. The global fiscal environment, shaped by high levels of public and private debt, risks exacerbating this squeeze on productivity-enhancing investments, including public spending on critical areas such as workforce training, infrastructure and research and development. The geopolitically-driven reconfiguration of supply chains also risks reducing the economies of scale and cost advantages that underpin productivity growth.



2 Scenarios

The purpose of these scenarios is not to predict the future, but to understand how technology and human capital dynamics may affect economies and sectors.

2.1 Framework

The narratives presented in this chapter allow decision-makers to analyse how the possible futures and the assumptions underpinning them play out across economies and sectors.

Technological breakthroughs, shifting regulatory landscapes and global disruptions create an environment in which traditional forecasting methods can struggle to accommodate the complexity and unpredictability of these dynamics. By contrast, scenario analysis is designed to offer a structured process for exploring, understanding and navigating uncertainty. It encourages decision-makers to think critically, creatively and purposefully about the future.

The scenarios presented in this paper should be considered in this light: as a tool to help decision-makers understand trends, vulnerabilities and opportunities and to identify strategies that can shape better future outcomes. The narratives presented in this chapter allow decision-makers to analyse how the possible futures and the assumptions underpinning them play out across economies and sectors. This is a crucial step in understanding how businesses are likely to be affected by – and can adapt to – changes.

The framework used to develop these exploratory scenarios starts with identifying key trends and drivers shaping the future of productivity (see Chapter 1) before narrowing things down to explore the interaction of two particularly high-uncertainty and high-impact drivers – to capture the most strategically meaningful futures. In the case of productivity between now and 2030, those are technology and human capital and their potential trajectories of acceleration and slowdown. The scenarios consider these dynamics throughout the technology and human capital ecosystems, meaning that acceleration or slowdown can be achieved through faster and broader improvement at different levels, not just at the frontier.

Technological development: Technology has historically been a powerful driver of productivity growth. It is currently in a prolonged acceleration phase, but its trajectory and impact on global productivity remain uncertain. Key questions that will shape future technological development include:

- Will AI and other cutting-edge innovations deliver real productivity gains, or will the "productivity paradox" persist?
- Will investment flows and policy choices enable or stifle productivity-enhancing innovation?
- Will rapid technological change lead to lower costs for adoption and diffusion?
- Will geopolitical tensions and natural resource constraints inhibit technological development and diffusion?

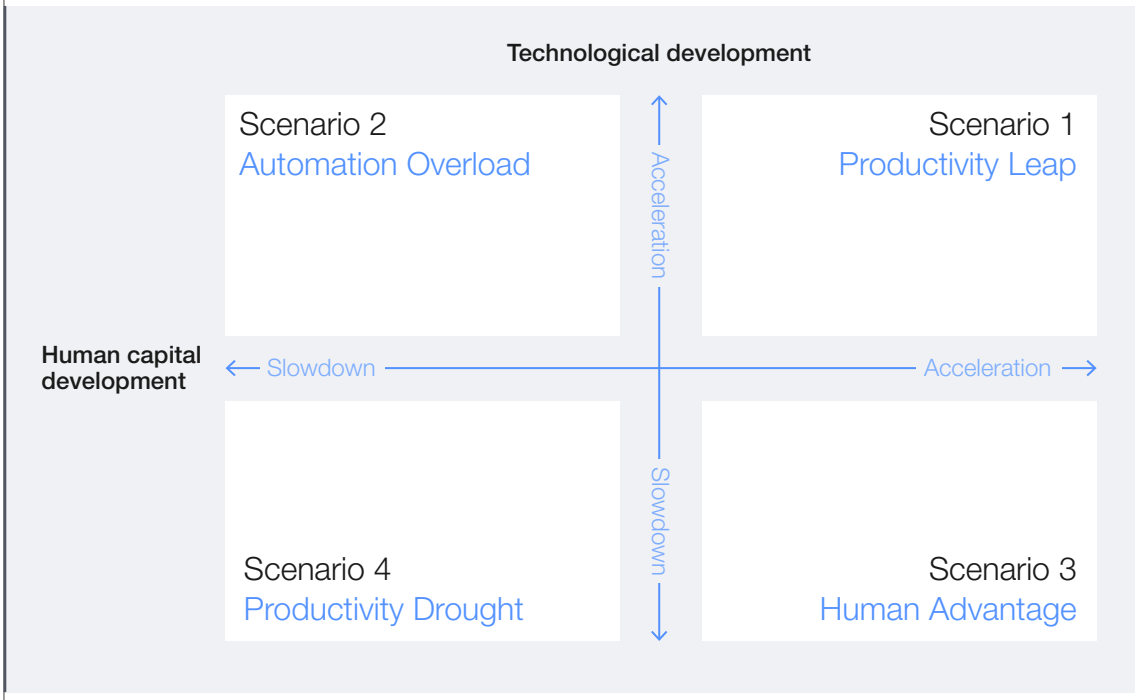
Human capital development: People are another critical driver of productivity. A highly skilled workforce is essential to drive and adopt innovation, as are leaders and managers capable of identifying new opportunities and reorienting their organizations to exploit them.[25] Yet, labour markets are subject to deep uncertainty and dramatic disruptions: almost two-thirds of today's workforce is employed in occupations that did not exist in the mid-20th century,[26] and nearly a quarter of current jobs globally face disruption over the next five years.[27] Key questions that will shape the future of human capital development include:

- How quickly will education and training systems adapt to emerging needs?
- How will demographic trends (ageing, migration, etc) affect the global distribution of human capital?
- Will there be sufficient skills in all areas of the global labour force (workers, leaders, entrepreneurs, etc) to drive productivity growth?
- How resilient will the labour force be in the face of future disruptions (of skills, occupations, etc)?

Combining these two drivers generates the following four scenarios for the future of productivity by 2030 (see Figure 5).

- **Scenario 1. Productivity Leap**: A virtuous circle between widespread disruptive innovation and rapid human capital development leads to significant and broad-based productivity gains and a marked improvement in living standards.
- **Scenario 2. Automation Overload**: Technological advancements outpace human capital development, leading to a "winner-takes-all" dynamic and an economy characterized by increased concentration of wealth and power. Productivity gaps widen between leading and lagging firms, sectors and regions.
- **Scenario 3. Human Advantage**: Human capital development outpaces technological advancement, centring economic activity on people. Productivity growth is slow and uneven, driven more by the creative use of existing technologies than breakthroughs. Productivity gains hinge on the ability to attract talent that can maximize the potential of technology.
- **Scenario 4. Productivity Drought**: A simultaneous slowdown in technological innovation and human capital development stalls productivity growth. Economies struggle to sustain previous levels of prosperity, leading to stagnation in living standards and socioeconomic progress.

FIGURE 5 **Four scenarios for the future of productivity in 2030**



Source: World Economic Forum and Accenture.

2.2 Four futures for productivity in 2030

Scenario 1: Productivity Leap

Acceleration of technological and human capital development

A virtuous circle between widespread disruptive innovation and rapid human capital development leads to significant and broad-based productivity gains and a marked improvement in living standards.

Note: The arrows denote a directional change in a given scenario characteristic. The analysis is based on scenario narratives and extrapolations from similar existing research. The directionality is illustrative and for scenario-building purposes only.

In this scenario, the world has embraced the role of human-technology complementarity as a key driver of productivity growth. Economies have been reshaped by new patterns of human-technology interaction and the emergence of new industries, business models and occupations. Managers, entrepreneurs and workers who creatively apply new technologies are key enablers of faster productivity growth.

The twin acceleration of technology and human capital development has succeeded in breaking the tepid growth dynamics of the preceding decades. Optimistic projections of global GDP growth reaching 4% before the end of the decade[28] have materialized, outperforming mid-decade forecasts.[29]

The major industrial policy initiatives of the early 2020s – including the CHIPS and Science Act, Society 5.0 and others – have spurred productivity-enhancing innovation while fears about disruption to market dynamics have not come to pass.

There is a shared global awareness of the benefits of knowledge and technology sharing. However, these exchanges remain constrained by geopolitical fault lines. Competition between geopolitical "blocs" has driven technological acceleration at the frontier, while stronger knowledge and talent flows within those blocs have led to broad-based progress.

Global technology spending has surged, and corporate R&D spending has accelerated from an annual average growth of 10% in 2017-2023.[30] These investments have driven innovation, increased adoption of advanced technologies and shortened timelines for the commercialization of vanguard technologies such as quantum computing. Sustainability concerns are ever more acute as technological advances drive demand for critical resources.

Lower costs of technology adoption have enabled a broader diffusion of less cutting-edge innovation, unlocking additional productivity gains.

With nearly 22% of tasks already performed by technology,[31] the demand for workers with social, emotional and digital skills has increased.[32] Learning ecosystems have been transformed to keep up with evolving needs, with governments and businesses increasing education spending and partnering with educational institutions.

The skilled workforce has expanded, and skills transferability and augmentation have increased. However, the relentless pace of technological development means that some workers still face high risks of automation, displacement and income stagnation.

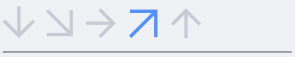
Although broad-based, productivity benefits are not equally distributed in this scenario, with initial gains being strongest in businesses close to the technological frontier or with capital to integrate technological advances with human ingenuity.[33]

Advanced economies have been the main early beneficiaries due to higher technology adoption, attractiveness to talent and capital availability. Many emerging economies have gained from access to technology, younger talent and dynamic industries. However, less agile economies risk falling behind as the twin acceleration increases fiscal pressures and the economic and social costs of inaction.

Scenario 2: Automation Overload

Acceleration of technological development, slowdown of human capital development

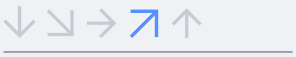
Technological advancements outpace human capital development, leading to a "winner-takes-all" dynamic and an economy characterized by increased concentration of wealth and power. Productivity gaps widen between leading and lagging firms, sectors and regions.



GDP growth, % annual
Baseline: 2.7%
(IMF, 2019-2024 average)

Labour productivity growth (GDP per worker), % annual
Baseline: 1.2%
(ILO, 2019-2024 average)

Total factor productivity growth, % annual
Baseline: 0.7%
(The Conference Board, 2024)



Advanced technology adoption rate, %
Baseline: 15% (based on WIPO 2022-2023, Accenture 2023, Acemoglu et al. 2022)

Total R&D spending (public and private), % of GDP
Baseline: 2.6%
(World Bank, 2021)

Share of business tasks performed by technology, %
Baseline: 22%
(World Economic Forum, 2025)

Public spending on workforce training, % of GDP
Baseline: 0.11%
(OECD, 2021)

Skills mismatch, % of over and underqualified employment
Baseline: 46%
(OECD, ILO, 2021)

Note: The arrows denote a directional change in a given scenario characteristic. The analysis is based on scenario narratives and extrapolations from similar existing research. The directionality is illustrative and for scenario-building purposes only.

In this scenario, a growing mismatch between new technological capabilities and workforce readiness has emerged. Automation dominates key sectors, businesses invest heavily in cutting-edge technologies to mitigate talent shortages, cut costs and stay competitive. While automation has led to significant economic gains, this has not translated into improved living standards, instead contributing to new social and economic frictions.

The global economy is more productive overall, driven by technology hubs and sectors that attract a shrinking pool of highly skilled workers. However, this has led to widening global divergences, with many countries grappling with outdated skills, underemployment and inequality. Sustainability concerns are also mounting as automation creates new demand for energy and critical technology components.

This future reflects an intensification of winner-takes-all dynamics, which have been strengthening since the turn of the century. The global economic and geopolitical fractures of the mid-2020s accelerated this trend, leading to antagonistic industrial policies and slower diffusion of technology. Inputs such as capital and critical materials have become increasingly concentrated in frontier firms and innovation hubs, with private finance pouring into advanced technologies at historic rates. This has accelerated technological breakthroughs and enabled industries to transition to fully autonomous operations, such as "lights-off" factories.[34] The ICT sector now accounts for a significantly greater share of economic activity, while the value of trade in digitally delivered services has surged from the $3.8 trillion recorded in 2022.[35] Meanwhile, services and industries that rely on manual labour risk being marginalized.

These advances have primarily replaced rather than augmented human labour, with displacement due to automation significantly surpassing the earlier estimates.[36]

Despite significant investment in education and training programmes through the 2020s, the global educational ecosystem has not been able to adapt to meet the rapidly changing needs of a transformed technological landscape. More than half of the global population lacks relevant skills. With automation eliminating most repetitive and routine tasks, a large share of the workforce has either been relegated to low-wage, low-skill, low-quality jobs or else displaced entirely. Although AI and automation have filled many gaps in the labour market, a lack of creative, agile and entrepreneurial talent hampers innovation and growth.

Demographic trends exacerbate human capital challenges. In most advanced economies, ageing has contributed to talent shortages, driving further automation.[37] The growth of the cross-border digital workforce has been limited by global skills gaps and restrictive migration and labour market policies aimed at protecting domestic jobs.

The benefits of technology-enabled productivity have not been broadly shared, and inequality has grown. Governments face mounting social and economic costs as automation disrupts competition, squeezes out businesses and threatens entire communities and regions. Many developing economies, in particular, risk falling further behind as they struggle to attract financial and human capital for technological leapfrogging or wider deployment of the available technologies.

Scenario 3: Human Advantage

Slowdown of technological development, acceleration of human capital development

Human capital development outpaces technological advancement, centring economic activity on people. Productivity growth is slow and uneven, driven more by the creative use of existing technologies than breakthroughs. Productivity gains hinge on the ability to attract talent that can maximize the potential of technology.

GDP growth, % annual
Baseline: 2.7%
(IMF, 2019-2024 average)

Labour productivity growth (GDP per worker), % annual
Baseline: 1.2%
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Total factor productivity growth, % annual
Baseline: 0.7%
(The Conference Board, 2024)

Advanced technology adoption rate, %
Baseline: 15% (based on WIPO 2022-2023, Accenture 2023, Acemoglu et al. 2022)

Total R&D spending (public and private), % of GDP
Baseline: 2.6%
(World Bank, 2021)

Share of business tasks performed by technology, %
Baseline: 22%
(World Economic Forum, 2025)

Public spending on workforce training, % of GDP
Baseline: 0.11%
(OECD, 2021)

Skills mismatch, % of over and underqualified employment
Baseline: 46%
(OECD, ILO, 2021)

Note: The arrows denote a directional change in a given scenario characteristic. The analysis is based on scenario narratives and extrapolations from similar existing research. The directionality is illustrative and for scenario-building purposes only.

In this scenario, a slowdown in technological development has put human capabilities at the centre of productivity growth. Businesses now compete on their ability to harness human talent at all organizational levels. A strong consensus has emerged around the need for a human-centric economy, with governments and businesses focusing on using technology to augment rather than replace workers.

Productivity growth is uneven. While some firms and economies have harnessed improved human capital to build stronger growth foundations, global GDP[38] and labour productivity growth[39] rates have stabilized not far above their mid-2020s levels.

Concerns over societal and national-security risks from unrestrained technological development have led to more stringent regulation, slowing frontier innovation. Automation has slowed, high-return technology opportunities have dried up, and AI investment has yet to reach the $200 billion mark that had been projected for the mid-2020s.[40] Nevertheless, the absorption of earlier technological breakthroughs continues to generate benefits. The acceleration of human capital development has enabled a wider and more productive use of existing technologies. The improved affordability and accessibility of existing technologies have become a critical driver of progress for many economies, even as geopolitical tensions constrain the diffusion of new innovations.

Governments have become increasingly focused on maximizing human capital potential. By 2030, education systems and policies in most major economies have been overhauled to support more human-centric economies. The education sector has seen significant growth as public-private cooperation has sought to align curricula with business needs to drive human-driven competitiveness.

Global competition for talent has intensified, with highly skilled workers gaining increased negotiating power. Hybrid and remote working have surged, and job quality has become a focal point. While top global talent enjoys wage premia and improved working conditions, labour market polarization persists and many routine jobs in sectors such as manufacturing, retail and services remain vulnerable to automation and wage stagnation.

Inequality patterns show potential signs of narrowing as human capital improvements unlock wider prosperity benefits. Countries that invested heavily in reskilling and upskilling have positioned themselves as global hubs for high-skill outsourcing. Advanced economies that combined strong education, lifelong learning and labour policies have partially mitigated productivity slowdowns linked to ageing populations.[41] Many developing economies with untapped human capital have also benefited from the increased mobility of skilled workers and global demand for expertise.

Despite many attempts, global efforts to establish a common framework for human capital development have fallen short. Divergent approaches to labour and talent regulations have increased the risks of localized unemployment and wage polarization. Many economies have prioritized domestic job and talent protection, amplifying regional disparities.

Scenario 4: Productivity Drought

Slowdown of technological and human capital development

A simultaneous slowdown in technological innovation and human capital development stalls productivity growth. Economies struggle to sustain previous levels of prosperity, leading to stagnation in living standards and socioeconomic progress.

GDP growth, % annual
Baseline: 2.7%
(IMF, 2019-2024 average)

Labour productivity growth (GDP per worker), % annual
Baseline: 1.2%
(ILO, 2019-2024 average)

Total factor productivity growth, % annual
Baseline: 0.7%
(The Conference Board, 2024)

Advanced technology adoption rate, %
Baseline: 15% (based on WIPO 2022-2023, Accenture 2023, Acemoglu et al. 2022)

Total R&D spending (public and private), % of GDP
Baseline: 2.6%
(World Bank, 2021)

Share of business tasks performed by technology, %
Baseline: 22%
(World Economic Forum, 2025)

Public spending on workforce training, % of GDP
Baseline: 0.11%
(OECD, 2021)

Skills mismatch, % of over and underqualified employment
Baseline: 46%
(OECD, ILO, 2021)

Note: The arrows denote a directional change in a given scenario characteristic. The analysis is based on scenario narratives and extrapolations from similar existing research. The directionality is illustrative and for scenario-building purposes only.

Hopes for a global productivity breakthrough have faltered in this scenario, with the twin slowdown of technological and human capital development undermining economic dynamism. While the complementarity between humans and technology is recognized as a key driver of productivity, businesses and governments have failed to unlock its potential.

Technological advancements and incremental human capital improvements have occurred in isolated pockets, but global productivity growth and prosperity remain uneven. By 2030, global GDP growth has settled below early-decade projections of around 3%.[42]

Geopolitical rivalries and economic pressures during the 2020s have given rise to inward-looking policies with increased government intervention and protectionism in critical technologies. Public resistance to frontier technologies and automation has grown, slowing the commercialization of promising technological developments, such as AI, and prompting many businesses to cut back on potentially transformative technological projects.

Global cooperation has fragmented, leading to duplicated innovation and supply-chain inefficiencies. Major economies have prioritized protecting key technologies and developing national champions, leading to distortions in competition and global trade. By 2030, cutting-edge innovations remain confined to global technology hubs and select industries. Prohibitive costs, diverging regulations and stronger barriers to knowledge and technology sharing have limited the wider diffusion and scaling of technologies.

Even strong innovation ecosystems face reduced dynamism due to talent shortages, trade wars and shrinking supplies of critical materials.

Rising fiscal and geopolitical pressures have undermined stimulus packages aimed at reviving technological and human capital development, with many governments diverting resources towards shorter-term priorities. By 2030, global R&D expenditure had stayed close to the mid-2020s level, failing to restore economic dynamism. Businesses, meanwhile, have shifted focus to short-term cost-optimization strategies over innovation.

Spending on education has stalled too.[43] Global literacy rates have improved only marginally, while lifelong learning and labour policy reforms have faltered, leaving reskilling and skill-matching opportunities inaccessible to large segments of the population. Skills gaps have widened in most economies, with the share of employers reporting difficulty in recruiting people with the right skills spiking above 75% recorded in the mid-2020s.[44]

Labour market polarization persists, with high-skill knowledge workers thriving while many others remain stuck in low-skill, low-wage, low-quality jobs. Weak human capital development has led to rising inequality, hollowing out the middle class and exacerbating social tensions. Globally, prosperity and living standards continue to diverge, while progress on the Sustainable Development Goals has stalled at mid-2020s levels.[45]

Global productivity growth has declined further from already weak levels. Isolated pockets of progress exist, particularly for businesses that integrated earlier technological advances. However, the slow diffusion of innovation and the growing competition for talent have dampened the competitiveness of laggard firms and sectors.

3 Industry exposure and implications

Exploring sectoral exposure to technology and human capital dynamics highlights headwinds and tailwinds that will shape the business landscape.

3.1 Mapping industry exposure

The scenarios outlined in Chapter 2 highlight four stylized pathways for the future of technology, human capital and productivity. Each of these futures has the potential to reshape sectors and disrupt individual businesses. The purpose of the scenario analysis is not to predict where the world will be in 2030 but to help understand and navigate the trends, dynamics and uncertainties that will confront businesses, policy-makers and other actors in the years ahead.

This chapter builds on the analysis underpinning the scenarios by considering how different sectors may be affected. Table 1 contains a high-level snapshot of potential exposure across 12 sectors.

The idea is not to suggest which scenario is more likely or desirable in each sector but to explore how a range of enabling and constraining factors may combine across the scenarios to generate differing headwinds and tailwinds for corporate output and profitability. This allows for an assessment of the opportunities and risks associated with different futures that businesses can use to inform their strategies.

The analysis relies on quantitative assessment and consultations with subject matter experts. Further details on data and methodology are available in Appendix A1.

TABLE 1 | **Industry exposure, by scenario**

Headwinds Tailwinds

	Scenario 1 Productivity Leap	Scenario 2 Automation Overload	Scenario 3 Human Advantage	Scenario 4 Productivity Drought
Agriculture, forestry and fishing				
Education				
Energy and materials				
Engineering, construction and utilities				
Financial, professional, real estate services				
Information technology and digital communications				
Leisure and travel				
Manufacturing				
Medical, healthcare and care services				
Mining (excluding fossil fuels)				
Retail and wholesale of consumer goods				
Supply chain and transport services				

Note: Considerations in the analysis include indicators of industries' **1.** potential for automation or augmentation, **2.** reliance on skilled workers, **3.** skills development efforts, **4.** R&D intensity, **5.** vulnerability to cross-border technology restrictions, **6.** potential revenue uplift from AI adoption, **7.** investment capital shortage; Orange = higher potential headwinds for sectors' output and profitability; Green = higher potential tailwinds for sector's output and profitability; Yellow = uncertain or inconclusive impact. See Appendix A1 for further details on methodology and data.

Sources: World Economic Forum and Accenture analysis based on data from World Economic Forum, ILO, S&P Capital IQ, Information Technology and Innovation Foundation, McKinsey & Company.

From this analysis, four broad clusters of sectors emerge, each characterized by varying levels of exposure to technological and human capital trends:

- **Sectors that combine highly skilled labour with a strong potential for technology adoption** – including manufacturing and financial, professional and real estate services – appear well positioned to harness both technological advancements and human capital development.
- **Sectors with a high share of human-centric occupations** – including education and medical, healthcare and care services – appear well-positioned to benefit from any acceleration of the technological augmentation of roles, and from shifts towards more human-centric economies, as in the Human Advantage scenario.
- **Sectors with lower reliance on technology and highly skilled labour** – such as agriculture, forestry and fishing – appear resilient to disruption across the scenarios, but also exhibit limited upside potential.
- **Sectors reliant on high levels of manual labour and niche occupation-specific skills** – such as mining, engineering and construction – appear more exposed to slowdowns in human capital development and shortages of the talent needed to fully realize the potential benefits of technological acceleration.

The remainder of this chapter looks more closely at the implications across five selected business sectors, analysing how the trends and factors discussed interact in diverse contexts.

3.2 Implications across selected industries

Information technology and digital communications

The sector's dual role as an enabler and beneficiary of technological innovation positions it for substantial growth, particularly in scenarios marked by rapid technological acceleration. Building trust in emerging technologies, addressing data privacy concerns and establishing responsible AI standards will be pivotal for unlocking long-term opportunities. However, its proximity to the innovation frontier and reliance on a rapidly advancing talent pool also make it vulnerable in the scenario of a twin slowdown.

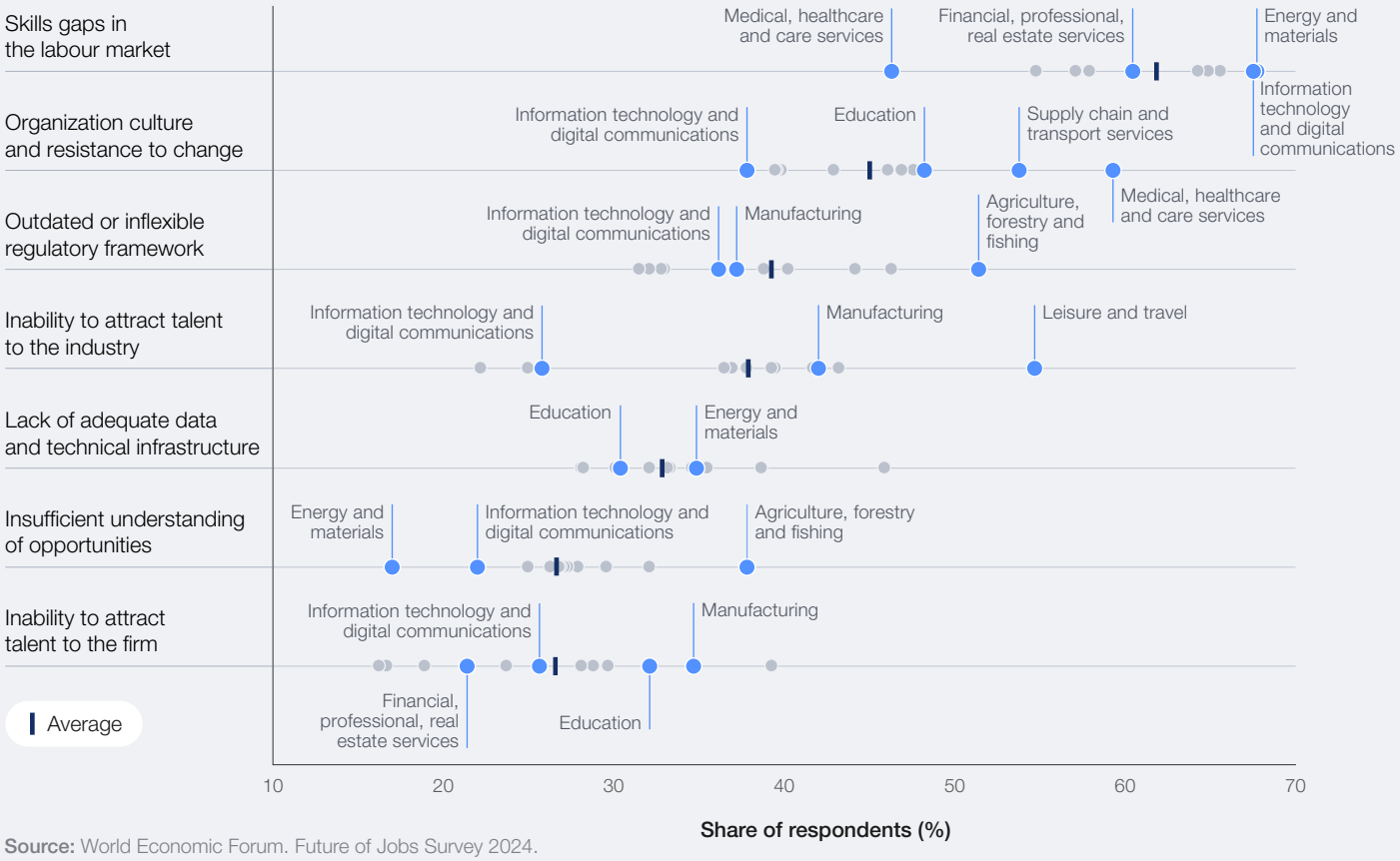
The sector's heavy reliance on cross-border data flows exposes it to geopolitical and regulatory challenges. The number of countries implementing data localization requirements nearly doubled between 2017 and 2021.[46] Such restrictions present significant barriers to cloud computing, data processing and internet publishing, which are among the industry's fastest-growing segments. Navigating these complexities will require substantial investments in compliance frameworks and strategic localization, such as adapting supply chains or building local infrastructure to meet regional regulations.

According to the World Economic Forum's Future of Jobs Survey 2024, the sector is relatively less hindered by resistance to change, a lack of awareness of opportunities or difficulties in attracting talent (see Figure 6). However, nearly two-thirds of industry employers cite skills gaps as a major barrier to transformation.

This shortage of digital talent coupled with R&D intensity nearly three times higher than in other sectors[47] means that talent development can be a critical lever for unlocking productivity gains. Research collaboration with external ecosystems – such as academia, research institutes and start-ups – can accelerate the development and commercialization of emerging technologies. These partnerships provide access to foundational research and a pipeline of highly skilled talent, enabling companies to stay at the forefront of innovation.

Firms in the sector can increase their resilience and growth opportunities by shifting from a short-term mindset of adopting the latest technology to longer-term strategies focused on durable value creation. While more than three-quarters of software-as-a-service companies have launched or are developing generative AI offerings, only 15% have successfully monetized these initiatives.[48]

FIGURE 6 **Barriers to transformation in the next five years**



Source: World Economic Forum. Future of Jobs Survey 2024.

> Nearly half of employers in the sector see resistance to change as the main barrier to transformation in the next five years.

Financial, professional, real estate services

This sector's heavy reliance on skilled labour and advanced technologies should position it to capitalize on emerging opportunities for productivity growth. Banking, for instance, could see a 30% productivity improvement from AI adoption in the next three years.[49] In real estate, technologies such as digital twins and internet of things (IoT) integration are also driving efficiency and innovation.

However, while the sector's high capacity for technological and skills absorption could amplify productivity, this reliance also exposes the sector to risks, such as under the twin slowdown that characterizes the Productivity Drought scenario. Moreover, the sector has historically lagged in productivity growth and it contributed significantly to the post-financial crisis slowdown in advanced economies.[50] Despite significant investments in digitalization over the years – above $1 trillion according to Accenture estimates[51] – productivity improvements have been patchy, and many core operations in the financial sector, such as foreign-exchange transactions, can still rely on legacy processes and algorithms.

The sector's automation potential, at over 53% of work time, suggests opportunities to mitigate talent shortages and reduce repetitive tasks. In financial services alone, generative AI could save up to $158 billion in work hours annually in the US.[52] However, legacy systems, complex decision-making structures and the need for analytical and creative skills will still require human-centric improvements, particularly in consumer-facing functions.

Regional dynamics in the sector vary. Advanced economies, with established infrastructure and greater capital availability, are better positioned for technological adoption while developing economies could see higher relative gains from lower baselines. Urbanization and shifting investment flows could boost real estate services in all scenarios, particularly those favouring productivity growth.

To capture these gains, businesses must align technology and talent strategies with agile business models. Significant challenges remain. According to the World Economic Forum's Future of Jobs Survey 2024, nearly half of employers in the sector see resistance to change as the main barrier to transformation in the next five years, closely followed by outdated or inflexible regulatory frameworks (see Figure 6). Industry actors have also highlighted skills gaps and a lack of adequate data and technical infrastructure as barriers.

Manufacturing

The manufacturing sector's patterns of productivity growth are poised to create divergence between innovation-intensive industries – such as aerospace, automotive, electronics and pharmaceuticals – and other segments. Advanced industries are growing three times faster than the broader manufacturing sector, driven by their ability to attract global talent and develop and integrate cutting-edge technologies.[53] For instance, the automotive industry is using AI to develop autonomous vehicles and expand into service offerings like software subscriptions, with a projected increase in operating margins from 7% to 12%.[54] Similarly, technological acceleration is likely to boost demand for electronics, semiconductors, specialized manufacturing equipment and supply chain innovations. Hardware spending is projected to account for 24% of total AI investments,[55] underscoring the opportunity for manufacturers ready to scale.

> Targeted investments in high-potential technologies and talent development are essential to unlock sustainable productivity gains in the manufacturing sector.

However, innovation-intensive sectors face risks in the scenarios defined by talent shortages, fragmentation and winner-takes-all dynamics. With only 45% of the workforce engaged in upskilling,[56] manufacturers may face significant challenges in building a qualified talent pool. According to the World Economic Forum's Future of Jobs Survey 2024, skills gaps and difficulties in attracting talent are identified as the top barriers to transformation in the next five years (see Figure 6).

Industries further from the innovation frontier, while less affected by technological breakthroughs, can achieve substantial gains through human-centric improvements and the adoption of technologies throughout their value chains. Predictive maintenance, for example, can increase equipment effectiveness and reduce unexpected breakdowns by 60%.[57] With assembly line costs comprising 16% of manufacturing sector revenues, such advancements offer significant cost savings and productivity gains,[58] even in the absence of broad-based technological acceleration.

Regional dynamics are affecting the pace of adoption across the sector. Advanced economies with high labour costs and demographic pressures are rapidly automating. This is exemplified by a leading Japanese manufacturer achieving a 35% cost reduction through robotics.[59]

Manufacturers in many developing economies may face risks if automation leads to reshoring or shortens global supply chains. Technological acceleration can also create opportunities for faster industrialization and technological leapfrogging for many developing economies, albeit infrastructure, investment and talent gaps can create substantial obstacles to productivity growth.

Targeted investments in high-potential technologies and talent development are essential to unlock sustainable productivity gains in the sector. This includes involving workers in digitization and automation processes, supporting job transitions and promoting a culture that embraces change. However, more than one-third of manufacturing employers highlight resistance to change and outdated or inflexible regulatory frameworks as significant barriers to transformation (see Figure 6).

Energy and materials

The energy and materials sector is shaped by the competing dynamics of more capital-intensive segments, such as oil and gas, and more innovation-driven green energy. Both sub-industries are poised to benefit from advances in technology and talent development. Wider benefits can also be unlocked through digitalization of value chains, automated fault detection systems, improved grid management, predictive maintenance in resource extraction and improved access to highly specialized talent. Nearly half of industry executives expect AI investments to improve organizational effectiveness,[60] while more than one-third plan to use AI to improve operational resilience and efficiency.[61]

In high-productivity scenarios, there is likely to be an acceleration of green innovation and a scaling up of green energy technologies, such as wind, solar and hydrogen. This would contribute significantly to a broader increase in electricity demand across the economy, with AI alone projected to increase data centres' power consumption by 160% globally by 2030.[62] This may contribute to the continued growth of renewables in the long term, but in the short to medium term, the energy mix is likely to require both renewable and non-renewable sources. The supply of critical materials, if constrained by geopolitical tensions, poses a significant challenge.[63]

Strategic partnerships between governments, businesses and education providers will be essential to meeting evolving skills demand in both technology- and talent-driven scenarios.

The sector's reliance on highly specialized skills, coupled with low transferability, presents risks in scenarios of talent shortages. While automation can increase efficiency in extraction and processing, widening skills gaps threaten grid security and could stall productivity across the value chain. To address these challenges, the sector will need to attract top talent while prioritizing upskilling and reskilling to retain industry-specific expertise.[64] Human capital improvements can unlock efficiency gains, especially in more labour-intensive activities, but the impact may be limited without the integration of technologies.

In scenarios of twin slowdowns in technological and human capital development, the resulting higher energy costs could ripple across industries. Limited progress on green technologies risks increasing reliance on fossil fuels and exacerbating global energy insecurity. Skills gaps, talent acquisition difficulties and regulatory hurdles remain key barriers to transformation by 2030 (see Figure 6). These challenges are particularly acute for energy technology firms, with 81% identifying skills gaps as a critical obstacle, compared to 54% in oil and gas.[65]

Energy companies must balance investments between maintaining existing infrastructure and advancing energy transition technologies. Innovations such as battery storage, hydrogen and carbon capture, while capital-intensive, can offer long-term productivity gains by reducing reliance on volatile energy prices. Given the capital intensity and extended payback periods of energy projects, focusing on modular and scalable projects that enable incremental investments aligned with growing demand can help build agility and optimize costs.

Education

The education sector's critical role in driving technological and talent development positions it as a key enabler of productivity and growth across most scenarios. In futures of accelerating human capital development, the sector stands to benefit from increasing investment by governments and businesses. Similarly, scenarios of technological acceleration are likely to drive growth opportunities for education providers as demand for training and specialized skills increases. Broader technology integration across the sector could amplify productivity, open new markets and improve profitability. For instance, AI adoption alone is projected to bring $200 billion in value by 2025.[66]

While automation can enhance productivity and education outcomes,[67] the sector's reliance on highly skilled educators and training providers is likely to ensure that human-delivered services will remain essential. Futures shaped by technological slowdowns, such as the Human Advantage scenario, may unlock growth opportunities tied to increased demand for skilled labour and human-centric occupations.

Strategic partnerships between governments, businesses and education providers will be essential to meeting evolving skills demand in both technology- and talent-driven scenarios. For example, initiatives to enhance workforce employability and develop skills for AI and other emerging technologies can create opportunities for growth in corporate microlearning services, a market valued at approximately $1.9 billion in 2021.[68]

Operational improvements, such as cloud-based systems, can increase the scalability and agility of education services, enabling providers to deliver "just-in-time" or on-demand learning tailored to industry needs. This operational flexibility positions adaptable and innovative education providers for growth in a competitive and dynamic environment.

Digital education ecosystems have the potential to boost accessibility, inclusion and individualized learning pathways in many advanced economies. However, the greatest gains in the sector may be achieved in developing markets with weaker educational infrastructure and structural talent gaps. Subsidized digital classrooms, hybrid learning models and targeted educator training can help address regional disparities and expand access to quality education. However, these efforts face significant hurdles, as nearly two-thirds of the global population still lacks internet access, limiting the potential for broad-based gains.[69]

4 Strategies for the future

Informed and creative decision-making can help businesses and governments not only adapt to change, but shape it too.

Whether the dynamics discussed above drive innovation, stagnation or disruption depends on the informed, creative and long-term thinking and actions of decision-makers. The following considerations have been selected to help governments and businesses prepare for a wide range of potential productivity futures. Each of them responds to how the critical interplay between technological advancements and human capital development can shape patterns of productivity, profitability, prosperity and well-being.

Whether technology accelerates or slows and whether human capital surges or lags behind, the strategies below aim to maximize opportunities, mitigate risks and harness the potential of these two powerful drivers of change.

TABLE 2 | **Strategy considerations for businesses and governments**

Promote synergies between technology and human capital development	**For businesses**: Align strategies on education, workforce development and innovation to ensure technology and human capital evolve in tandem. **For governments**: Strengthen integration of innovation, knowledge and learning ecosystems and policies through partnerships with educators, technologists and industry leaders.
Strengthen anticipatory and data-driven decision-making	**For businesses**: Use foresight tools, big data analytics and real-time feedback loops to inform operational and strategic decision-making. Invest in leadership development and create agile governance structures to break silos and encourage innovation and dynamic decision-making. **For governments**: Institutionalize foresight practices and anticipatory policy design. Develop decentralized decision-making mechanisms and national data frameworks that balance privacy with the need for robust, actionable insights into economic trends. Invest in developing public sector talent to strengthen innovation and change management.
Future-proof education and training systems	**For businesses**: Establish dynamic partnerships with educational institutions to co-develop industry-relevant curricula and invest in robust in-house reskilling and upskilling programmes. Invest in talent development and ensure equitable access to training opportunities. **For governments**: Strengthen the education and training ecosystem to meet evolving labour market needs, increase skills transferability, ensure equitable access to learning and encourage lifelong learning, technological literacy, adaptability and creativity.
Anticipate talent needs and develop workforce transition policies	**For businesses**: Establish talent mobility frameworks to enable transition across occupations and to tap into global talent pools as business needs evolve. Invest in augmentation and involve workers in digitalization and automation processes. **For governments**: Develop workforce transition policies and strengthen safety nets for workers at risk of displacement. Engage businesses to co-create sector-specific training pipelines and incentivize investment in human capital development and retention. Strengthen workforce inclusion and develop talent mobility policies to attract top global talent, e.g. through fast-track visas.
Accelerate adoption and diffusion of emerging technologies	**For businesses**: Collaborate with governments, technology leaders and industry peers on initiatives to scale and disseminate productivity-enhancing technologies throughout the value chain. Invest in developing technological leadership and align technology and operational strategies to maximize return on investments. **For governments**: Reduce barriers to technology access for smaller firms and underserved regions through subsidies, infrastructure investments, regulatory sandboxes and public-private innovation hubs. Incentivize innovation and entrepreneurship culture and ensure broad-based participation across the economy (e.g. small and medium business, rural and urban areas).
Invest in the trustworthiness of emerging technologies	**For businesses**: Implement ethical frameworks and guardrails to ensure transparency in technology design, development and deployment and to build accountability and stakeholder trust. Engage stakeholders through open communication. **For governments**: Develop ethical frameworks and transparent regulations for AI and automation to address societal concerns and build public trust in new technologies. Engage society and industry stakeholders to develop policies that address biases and balance innovation with accountability.
Strengthen critical infrastructure	**For businesses**: Integrate digital infrastructure upgrades into core strategy and invest in supply chain infrastructure to build resilience, improve efficiency and maximize market access. **For governments**: Invest in infrastructure development to close digital gaps, increase resilience and boost efficiency in critical areas such as transportation and energy.
Bridge regional and sectoral gaps to mitigate productivity divergence	**For businesses**: Develop localized strategies to secure supply chains, market access and efficiency in peripheral areas of operation. Partner with governments, educational institutions and other stakeholders to facilitate adoption of emerging technologies and the development of human capital across underserved regions, sectors and value chain components. **For governments**: Invest in regional innovation hubs, reduce informality and implement targeted policies to support lagging regions and industries, including targeted investments, tax incentives and workforce relocation and development programmes.
Strengthen resilience to geopolitical disruption	**For businesses**: Strengthen technology supply chains through diversification and safeguard access to human capital by investing in flexible workforce strategies, such as cross-border talent mobility and expanded remote working. **For governments**: Pursue bilateral and multilateral agreements to safeguard knowledge exchange, movement of people and supply-chain continuity, while diversifying to reduce reliance on any single region or market.

Appendices

A1 Methodology

The industry implications analysis in Chapter 3 evaluates the exposure of 12 sectors to the human capital, technology and productivity trends outlined in the four scenarios in Chapter 2. This evaluation results in an "industry impact matrix" visualized as a heat map that provides a high-level snapshot of potential headwinds and tailwinds for sectoral output and profitability for each scenario. The analysis also incorporated qualitative consultations with subject-matter experts to validate and contextualise the findings.

The industry impact matrix was constructed using a three-step process:

1

Dimension and indicator selection

Seven dimensions, reflecting enabling and constraining factors within the scenarios, were chosen to capture key aspects of industry performance influenced by technological and human capital dynamics. These dimensions, along with their rationale and the indicators used to measure them across the 12 sectors, are summarized in Table 4. Range-based normalization was applied to convert all indicator values into a unitless score between 0 and 1.

2

Dimension-scenario coefficients

Each dimension was assigned a multiplier coefficient ranging from -1 to 1 for each of the scenarios, reflecting the expected direction and intensity of correlation between the dimension and business performance in that scenario (see Table 3). For example, the multiplier coefficient of "1" for the "Skills development efforts" dimension in the Human Advantage scenario represents strong positive correlation between industries' skills development efforts and their performance in the future shaped by human-centric business models and high competition for talent.

3

Aggregation

Normalized indicator values for each sector were multiplied by the dimension-scenario coefficients. The summed results for each sector were then categorized according to the following thresholds to produce the heat map presented in Table 1 in Chapter 3.

>1	Higher potential tailwinds
0.25 to 1	Potential tailwinds
-0.25 to 0.25	Uncertain or inconclusive impact
-1 to -0.25	Potential headwinds
<-1	Higher potential headwinds

TABLE 3 **Direction and degree of indicator correlation with industry performance across scenarios**

Dimension	Productivity Leap	Automation Overload	Human Advantage	Productivity Drought
Potential for automation and augmentation	1	1	0.5	0.5
Reliance on skilled workers	1	-0.5	0.5	-1
Skills development efforts	1	0.5	1	0.5
Corporate R&D intensity	1	0.5	0.5	-0.5
Vulnerability to cross-border technology restrictions	0.5	-0.5	-1	-1
Revenue uplift from AI adoption	1	0.5	0	-0.5
Shortage of investment capital	-1	-1	0	-0.5

Source: World Economic Forum and Accenture.

TABLE 4 | **Indicator descriptions and sources**

Dimension	Indicator	Rationale	Source
Potential for automation and augmentation	Proportion of worktime with potential for automation or augmentation (%)	Reflects industries' capacity to automate or augment processes, with high potential for automation or augmentation often linked to substantial productivity improvements.	World Economic Forum. (2023). *Jobs of Tomorrow: Large Language Models and Jobs*
Reliance on skilled workers	Share of high-skilled workers in industry workforce (%)	Reflects industries' dependence on skilled labour. Sectors with a higher share of skilled workers are better positioned to leverage technological change but face risks from talent gaps and shortages.	International Labour Organization (ILO). (2023, or latest available)
Skills development efforts	Share of the workforce that has completed training which bridged skills gaps (%)	Measures industries' action to reskill and upskill workers. Industries with higher average training efforts are likely to be more agile and resilient in the evolving talent and technology landscape.	World Economic Forum. (2024). Future of Jobs Survey.
Corporate R&D intensity	R&D spending as a share of revenue (%)	Serves as a proxy for industries' focus on innovation. Industries with higher R&D intensity are generally better positioned to drive and absorb innovation and technological advancements.	S&P Capital IQ. (2019-2023 average)
Vulnerability to cross-border technological restrictions	Data intensity (non-capitalized software expenditure per worker) (%)	Captures the impact of fragmentation on industry operations and access to technology. Industries with higher data intensity are likely to be more exposed to fragmentation trends within the scenarios.	Information Technology and Innovation Foundation. (2021).
Revenue uplift from AI adoption	Uplift to annual revenue due to AI (%)	Estimates the contribution of AI to revenue growth, offering a proxy for potential output gains from adopting advanced technologies.	McKinsey & Company. (2023). *The economic potential of generative AI: The next productivity frontier*.
Shortage of investment capital	Share of respondents reporting "shortage of investment capital" as the main barrier to transformation in the organization in the next five years (%)	Accounts for structural financial constraints limiting industries' ability to invest in technology or human capital, and reducing their capacity to respond to shocks.	World Economic Forum. (2024). Future of Jobs Survey.

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1. Feenstra, R. C., Inklaar, R., & Timmer, M. P. (2015). The Next Generation of the Penn World Table. *American Economic Review 2015*, 105(10): 3150-3182. http://dx.doi.org/10.1257/aer.20130954; and Caselli, F. (2005). Accounting for cross-Country Income Differences, in Philippe Aghion and Stephen Durlauf (eds.), *Handbook of Economic Growth*, Volume 1A, 679-741, Elsevier.
2. Organisation for Economic Co-operation and Development. (2021), *OECD Compendium of Productivity Indicators 2021*. https://www.oecd-ilibrary.org/industry-and-services/oecd-compendium-of-productivity-indicators_f25cdb25-en.
3. Qureshi. Z. (2020). Technology, Change, and a New Growth Agenda, in Kim, H.-W., & Qureshi, Z. (Eds.), *Growth in a Time of Change: Global and Country Perspectives on a New Agenda*. Brookings Institution Press.
4. Accenture. (2024). *The productivity payoff: Unlock competitiveness with gen AI*. https://www.accenture.com/us-en/insights/strategy/productivity-payoff?c=acn_glb_costproductivileader_14213552&n=smc_1024.
5. International Monetary Fund. (2024). *World Economic Outlook: Steady but slow: Resilience amid divergence*. https://www.imf.org/en/Publications/WEO/Issues/2024/04/16/world-economic-outlook-april-2024.
6. Ibid.
7. Based on International Labour Organization, *Statistics on labour productivity*, Output per hour worked (2005-2024 average).
8. Accenture. (2024). *The productivity payoff: Unlock competitiveness with gen AI*. https://www.accenture.com/us-en/insights/strategy/productivity-payoff?c=acn_glb_costproductivileader_14213552&n=smc_1024.
9. World Bank. (2020). *Global Productivity: Trends, Drivers, and Policies*. https://www.worldbank.org/en/research/publication/global-productivity.
10. Filippucci, F., et al. (2024), The impact of Artificial Intelligence on productivity, distribution and growth, *OECD Artificial Intelligence Papers*, No. 15, OECD Publishing. https://www.oecd-ilibrary.org/science-and-technology/the-impact-of-artificial-intelligence-on-productivity-distribution-and-growth_8d900037-en
11. Mashnik, D., Jacobus, H., Barghouth, A., Wang, E. J., Blanchard, J., & Shelby, R. (2017). Increasing productivity through irrigation: Problems and solutions implemented in Africa and Asia. *Sustainable Energy Technologies and Assessments,* Volume 22. https://doi.org/10.1016/j.seta.2017.02.005.
12. Padhiary, M., Saha, D., Kumar, E., Sethi, L. N., & Kumar, A. (2024). Enhancing precision agriculture: A comprehensive review of machine learning and AI vision applications in all-terrain vehicle for farm automation, *Smart Agricultural Technology*, Volume 8. https://doi.org/10.1016/j.atech.2024.100483.
13. World Economic Forum. (2024). *Leveraging Generative AI for Job Augmentation and Workforce Productivity: Scenarios, Case Studies, and a Framework for Action*. https://www.weforum.org/publications/leveraging-generative-ai-for-job-augmentation-and-workforce-productivity/.
14. Accenture. (2023). *The CHRO as a growth executive*. https://www.accenture.com/us-en/insights/consulting/chro-growth-executive.
15. Based on Organisation for Economic Co-operation and Development. *Going Digital Toolkit*.
16. World Economic Forum. *Executive Opinion Survey 2024*.
17. Ibid.
18. Criscuolo, C. et al. (2021). The human side of productivity: Uncovering the role of skills and diversity for firm productivity. *OECD Productivity Working Papers*, No. 29. OECD Publishing. https://www.oecd-ilibrary.org/economics/the-human-side-of-productivity_5f391ba9-en.
19. Ibid.
20. World Bank. (2020). *Global Productivity: Trends, Drivers, and Policies*. https://www.worldbank.org/en/research/publication/global-productivity.
21. United Nations. (2024). *World Population Prospects 2024*. https://www.un.org/development/desa/pd/world-population-prospects-2024.
22. World Economic Forum. (2024). *Chief Economists Outlook: January 2024*. https://www.weforum.org/publications/chief-economists-outlook-january-2024/.
23. International Monetary Fund. (2024). *World Economic Outlook: Steady but slow: Resilience amid divergence*. https://www.imf.org/en/Publications/WEO/Issues/2024/04/16/world-economic-outlook-april-2024.
24. Ibid.
25. Criscuolo, C. et al. (2021). The human side of productivity: Uncovering the role of skills and diversity for firm productivity. *OECD Productivity Working Papers*, No. 29. OECD Publishing. https://www.oecd-ilibrary.org/economics/the-human-side-of-productivity_5f391ba9-en.
26. Autor, D., Chin, C., Salomons, A., & Seegmiller, B. (2024). New Frontiers: The Origins and Content of New Work, 1940–2018, *The Quarterly Journal of Economics*, Volume 139, Issue 3. https://doi.org/10.1093/qje/qjae008

27. World Economic Forum. (2025). *The Future of Jobs Report 2025*. https://www.weforum.org/publications/the-future-of-jobs-report-2025.
28. World Economic Forum. (2024). *Chief Economists Outlook: May 2024*. https://www.weforum.org/publications/chief-economists-outlook-may-2024/.
29. International Monetary Fund. (2024). *World Economic Outlook: Steady but slow: Resilience amid divergence*. https://www.imf.org/en/Publications/WEO/Issues/2024/04/16/world-economic-outlook-april-2024.
30. World Intellectual Property Organization. (2024). *Global Innovation Index 2024. Unlocking the Promise of Social Entrepreneurship.* https://www.wipo.int/web-publications/global-innovation-index-2024/en/.
31. World Economic Forum. (2025). *The Future of Jobs Report 2025*. https://www.weforum.org/publications/the-future-of-jobs-report-2025.
32. Ibid.
33. Calvino, F. & Fontanelli, L. (2023). A portrait of AI adopters across countries: Firm characteristics, assets' complementarities and productivity. *OECD Science, Technology and Industry Working Papers*, No. 2023/02. OECD Publishing. https://www.oecd-ilibrary.org/science-and-technology/a-portrait-of-ai-adopters-across-countries_0fb79bb9-en.
34. GSMA. *Foxconn Lights-off Factory*. https://www.gsma.com/solutions-and-impact/technologies/internet-of-things/digital-industries-20/benefits-use-case/foxconn-lights-off-factory/.
35. International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations Conference on Trade and Development, World Bank & World Trade Organization. (2023). *Digital Trade for Development*. https://www.wto.org/english/res_e/publications_e/dtd2023_e.htm.
36. World Economic Forum. (2025). *The Future of Jobs Report 2025*. https://www.weforum.org/publications/the-future-of-jobs-report-2025.
37. Acemoglu, D., Restrepo, P. & Krueger, D. (2022). Demographics and Automation. *The Review of Economic Studies*, vol 89(1). https://doi.org/10.1093/restud/rdab031.
38. International Monetary Fund. (2024). *World Economic Outlook: Steady but slow: Resilience amid divergence*. https://www.imf.org/en/Publications/WEO/Issues/2024/04/16/world-economic-outlook-april-2024.
39. The Conference Board. (2023). *Global Productivity Brief 2023*. https://www.conference-board.org/publications/global-productivity-brief-2023.
40. Goldman Sachs. (2023). *AI investment forecast to approach $200 billion globally by 2025*. https://www.goldmansachs.com/insights/articles/ai-investment-forecast-to-approach-200-billion-globally-by-2025.
41. André, C., Gal, P. & Schief, M. (2024). Enhancing productivity and growth in an ageing society: Key mechanisms and policy options. *OECD Economics Department Working Papers*, No. 1807, OECD Publishing. https://www.oecd.org/en/publications/enhancing-productivity-and-growth-in-an-ageing-society_605b0787-en.html.
42. International Monetary Fund. (2024). *World Economic Outlook: Steady but slow: Resilience amid divergence*. https://www.imf.org/en/Publications/WEO/Issues/2024/04/16/world-economic-outlook-april-2024.
43. Based on UNESCO Institute for Statistics. Government expenditure on education as % of GDP.
44. ManpowerGroup. (2024). *Global Talent Shortage 2024*. https://go.manpowergroup.com/talent-shortage.
45. Sachs, J. D., Lafortune, G. & Fuller, G. (2024). *Sustainable Development Report 2024. The SDGs and the UN Summit of the Future*. https://dashboards.sdgindex.org/.
46. Information Technology & Innovation Foundation. (2021). *How Barriers to Cross-Border Data Flows Are Spreading Globally, What They Cost, and How to Address Them*. https://itif.org/publications/2021/07/19/how-barriers-cross-border-data-flows-are-spreading-globally-what-they-cost/.
47. Based on S&P Capital IQ.
48. OpenView. (2023). *OpenView 2023 Saas Benchmarks Report.* https://openviewpartners.com/2023-saas-benchmarks-report/#-key-takeaways.
49. Accenture. (2024). *Banking in the age of generative AI*. https://www.accenture.com/us-en/insights/banking/generative-ai-banking.
50. World Bank. (2020). *Global Productivity: Trends, Drivers, and Policies*. https://www.worldbank.org/en/research/publication/global-productivity.
51. Accenture. (2019). *Caterpillars, Butterflies, and Unicorns. Does digital leadership in banking really matter?* https://bankingblog.accenture.com/wp-content/uploads/2019/12/1910_BR_Accenture-Banking-Does-Digital-Leadership-Matter_DE_Final-2.pdf.
52. Accenture. (2023). *Productivity: The next competitive edge. A breakthrough in managing costs.* https://www.accenture.com/us-en/insights/strategy/reinvent-productivity.
53. United Nationals Industrial Development Organization. (2023). *International Yearbook of Industrial Statistics 2023*. https://www.unido.org/sites/default/files/unido-publications/2023-12/UNIDO_IndustrialStatistics_Yearbook_2023.pdf.
54. Goldman Sachs. (2022). *Software Is Taking Over the Auto Industry*. https://www.goldmansachs.com/insights/articles/software-is-taking-over-the-auto-industry.

55. International Data Corporation. (2024). *A Deep Dive Into IDC's Global AI and Generative AI Spending*. https://blogs.idc.com/2024/08/16/a-deep-dive-into-idcs-global-ai-and-generative-ai-spending/.
56. World Economic Forum. Future of Jobs Survey 2024.
57. World Economic Forum. (2019). *Fourth Industrial Revolution Beacons of Technology and Innovation in Manufacturing*. https://www.weforum.org/publications/fourth-industrial-revolution-beacons-of-technology-and-innovation-in-manufacturing/.
58. Based on Accenture analysis.
59. International Federation of Robotics. (2024). *35% cost reduction while maintaining work safety and high-quality output*. Case Studies - Robots addressing the UN SDGs. https://ifr.org/case-studies/35-cost-reduction-while-maintaining-work-safety-and-high-quality-output.
60. Accenture. *Energy*. https://www.accenture.com/us-en/industries/energy.
61. Ibid.
62. Goldman Sachs. (2024). *AI is poised to drive 160% increase in data center power demand.* https://www.goldmansachs.com/insights/articles/AI-poised-to-drive-160-increase-in-power-demand.
63. International Renewable Energy Agency. (2023). *Geopolitics of the Energy Transition: Critical Materials*. https://www.irena.org/Publications/2023/Jul/Geopolitics-of-the-Energy-Transition-Critical-Materials.
64. World Economic Forum. (2024). *Accelerating an Equitable Transition: A data-driven approach*. https://www.weforum.org/publications/accelerating-an-equitable-transition-a-data-driven-approach/.
65. World Economic Forum. Future of Jobs Survey 2024.
66. Morgan Stanley. (2023). *Generative AI Is Set to Shake Up Education*. https://www.morganstanley.com/ideas/generative-ai-education-outlook.
67. World Economic Forum. (2024). *Shaping the Future of Learning: The Role of AI in Education 4.0*. https://www.weforum.org/publications/shaping-the-future-of-learning-the-role-of-ai-in-education-4-0/.
68. Sifted. (2023). *B2B edtech. The early-stage report card*. https://sifted.eu/pro/briefings/b2b-edtech.
69. International Telecommunication Union. (2023). *Facts and Figures 2023. Measuring digital development*. https://www.itu.int/itu-d/reports/statistics/facts-figures-2023/.

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