Microsoft

Closing the Sustainability Skills Gap: Helping businesses move from pledges to progress

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Foreword

Brad Smith, Vice Chair
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It's hard to ignore the effects of climate change. In recent weeks, a heavy blanket of smoke from nearby wildfires has enveloped the region I call home, an eerie phenomenon that has become an unfortunate seasonal event in the Pacific Northwest of the United States. At the same time, the American West and parts of Europe are experiencing historic drought. And halfway around the world, Pakistan is recovering from catastrophic summer floods that killed 1,500 people, displaced 33 million more, and caused $40 billion in ruin. All devastating events. And all believed to be fueled by climate change.

The gravity of the problem has led more than 3,900 companies, including Microsoft, to announce climate pledges. As we work internally and with a large majority of these companies, it's clear that the coming business changes will be massive. They will impact a wide variety of processes and operations, in part based on new applications for digital technology, including cloud services, AI, and dedicated services like our Cloud for Sustainability. But as we've learned, this will also require an equally vital effort to equip companies and employees with a broad range of new skills needed for climate adaptation and sustainability transformation.

The historical importance and current breadth of the sustainability skilling challenge are difficult to overstate. A clear analogy has emerged from our study of the issue. Humanity's initial quest to reach the moon required the spread of physics into a broadly accessible academic discipline across the United States. The world's entry into the digital age then required that computer science move into every school. In a similar way, the creation of a net-zero planet will require that sustainability science spreads into every sector of the economy.

That's the focus of this report.

During the past year, Microsoft and the Boston Consulting Group (BCG) studied the work of 15 companies at the forefront of sustainability innovation and change. Including across Microsoft itself. Our teams interviewed or surveyed nearly 250 employees whose jobs have sustainability commitments. We identified new jobs that have emerged. We studied the impact on the many jobs that existed before. And we considered what our data says about in-demand knowledge and skills.

The impact on jobs across companies falls into two broad categories. The first is specialized sustainability positions emerging quickly across the global economy. For example, a company like Microsoft now employs individuals who pursue full time the purchase of long-term, high-quality carbon removal. The second is much broader, as existing jobs expand to encompass sustainability subject matter. A good example involves engineers and materials scientists who design hardware devices. They now have to assess not only the capabilities of materials that go into a new device but also the sustainability implications of those materials.

As companies move to create and fill these jobs, they are confronting a huge sustainability skills gap. This gap encompasses three categories. First, some employees need deep and specialized sustainability knowledge and skills in areas like carbon accounting, carbon removal, and ecosystem services valuation. This includes the skills needed to address these issues through new climate-specific digital tools. Second, broader business teams need readier access to more limited but sometimes deep knowledge in specific sustainability subject areas, such as climate-related issues that have become important for procurement and supply chain management. Third, a great many employees need basic and broader fluency in sustainability issues and climate science fields that impact a wide variety of business operations and processes.

Ultimately, it's important to recognize that the sustainability transformation will need people who can combine specialized sustainability knowledge and skills with varying degrees of other multidisciplinary skill sets. These will need to combine knowledge from STEM and other fields in the liberal arts and encompass skills that span across business, the use of data, and digital technology. This combination currently is hard to find and often doesn't exist naturally.

Perhaps not surprisingly, we've also learned that the sustainability skills gap is creating an increasing sense of anxiety for business leaders. This reflects not only the enormity of the climate crisis but two other factors as well.

First, there are growing public expectations that companies will turn their climate pledges into progress. In the next 24 months, regulators in multiple countries likely will require that public companies report their carbon emissions. A great many businesses are not yet equipped with the skilled personnel, business processes, and data systems needed for this step. Business leaders understandably fear that if their reports are incomplete or show a lack of progress, they will confront growing public criticism.

Second, this pressure for performance is growing while economic concerns are rising. Economic turbulence is putting added pressure on companies to find new ways to do more with less. In some instances, companies may even be tempted to postpone or forego new business initiatives, including pursuing their climate pledges.

Yet ongoing scientific observations and data show that the world cannot afford to wait. In late October, new reports underscored the need for accelerated action. In particular, the United Nations Environment Programme made clear in its annual Emissions Gap report that current national climate plans fall short of what will be needed to meet the world's climate targets.

Clearly the business community will need to do more. Other institutions must as well. Climate pledges and performance are equally important for every organization on the planet, including nonprofits and even government institutions themselves. In short, we're all in this together, and we need to come together to chart a successful path forward, including by investing in sustainability skills.

Yet today the gap between sustainability workforce needs and the number of qualified people available is growing. According to the LinkedIn Green Jobs report, green jobs grew at an annual rate of 8 percent between 2015 and 2021, while the talent pool grew at only 6 percent.

As these figures reflect, progress is underway, but it's not moving fast enough. To date, most companies at the forefront of sustainability transformation have been scrappy, growing the "home-grown" talent they need. Our research found that employers so far have tapped 68 percent of their sustainability leaders by hiring from within their own company. Sixty percent of sustainability team members joined without expertise in the field. Employers mostly have tapped talented insiders with the core transformational and functional skill sets needed to create change in a company, even though they lacked formal training in sustainability. They then upskilled those individuals to accomplish critical sustainability work.

The biggest problem with this approach is that it will not scale to meet either the business community's or the planet's needs. As we look at the roughly 3,900 companies that have made climate pledges, it's readily apparent that the work to turn these pledges into progress will require far more talent with sustainability skills and fluency than currently is being trained within these companies' businesses.

How do we move farther and faster?

This is a fundamental question, and we offer in this report both some suggestions and a commitment as a company to do more. Progress will be needed in three areas.

First, we all need to work together to develop a shared understanding, based on better data, regarding evolving jobs and the sustainability knowledge and skills needed for them. Currently, data remains spotty. We need a better and common taxonomy and framework that builds on recent sustainability work by international organizations, national governments, and private companies. As described in our report, we believe sustainability skilling can borrow from recent advances to address cybersecurity skilling to help create a better roadmap linking specific sustainability skills, training, jobs, and career paths.

Work will be needed from a broad array of stakeholders. To develop a shared understanding of sustainability workforce needs, Microsoft and LinkedIn will support efforts to define skills and competencies and enable the mapping of

sustainability skills and jobs as they evolve. We will achieve this in part through partnerships with organizations like the International Labour Organization and our work with the Development Data Partnership, which includes the Organisation for Economic Co-operation and Development (OECD), World Bank, Inter-American Development Bank (IADB), United Nations Development Programme (UNDP), International Monetary Fund (IMF), and other multilateral organizations.

Second, employers must move quickly to upskill their workforce through learning initiatives focused on sustainability knowledge and skills. This will require support from a variety of learning partners, including educational institutions, vocational education providers, apprenticeship programs, and online training providers. This work must start with the development of new learning materials that can be used both in person and online. This must be supported by expanded learning initiatives to reach employees in companies and more broadly across the workforce. There is an opportunity for government policy and funding to help scale these efforts.

To support this work, Microsoft will work with partners to develop and share new sustainability learning materials. These will include LinkedIn Learning paths for sustainability as well as business-focused sustainability materials provided through Microsoft's Sustainability Learning Center and our Cloud Solution Center. Additionally, we are forming new partnerships with NGOs to help workers, including those in impacted and transitioning communities, to complete sustainability learning pathways. This will include a partnership with INCO Academy to launch a Green Digital Skills course to support up to 10,000 learners, including in the Global South.

We will also work with our customers to create a network and advanced forum to share new learning and best practices to transform sustainability practices and reduce carbon emissions. This will include a new and focused forum for chief sustainability officers.

Third, the world must prepare the next generation of workers for the sustainability jobs of the future. Just as governments, NGOs, and companies have worked to bring digital skilling and computer science into schools, we will need similar partnerships to bring sustainability fluency and science into primary and secondary schools. And higher education institutions will need to strengthen and expand their undergraduate and graduate sustainability programs. All these efforts can move faster if governments and public-private partnerships develop stronger sustainability programs through country-level networks and centers of excellence, foster international professional forums and communities of practice, and create real-world interdisciplinary learning opportunities for students.

To support these efforts, Microsoft is committed to creating and providing new curricular and training materials that can be used by primary and secondary students. This will include our new Minecraft Frozen Planet II worlds, which we will present in partnership with BBC Earth at COP-27. This adds to the Climate and Sustainability Subject Kit and Sustainability City learning map, available through Minecraft Education. In addition, Microsoft FarmBeats for Students will provide students with a hands-on experience to explore how big data, AI, and machine learning apply to real-world sustainability challenges. Finally, we will join UNESCO's Greening Education Partnership to deliver strong, coordinated action that will empower learners with the skills required for inclusive and sustainable economic development.

Microsoft will also invest in global capacity-building for post-secondary education. This will include a new partnership with the international research collaboration MECCE (Monitoring and Evaluating Climate Communication and Education Project) to support the implementation, monitoring, and reporting of sustainability education worldwide. Additionally, we will partner with the Association for the Advancement of Sustainability in Higher Education, providing support to its Centers for Sustainability Across the Curriculum program.

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The start of this decade has seen more than its share of crises, including the COVID pandemic, a war in Europe, and growing economic uncertainty. Although we can't predict when these current challenges will fade, it seems certain that the climate crisis will outlast all of them.

For almost three centuries since the dawn of the industrial revolution, human ingenuity has produced remarkable inventions and unprecedented prosperity for much of the world. But this has come from the use of fossil fuels that have produced carbon emissions at an unsustainable level. Now we must move to a Net-Zero World in which we both seek to eliminate net carbon emissions and expand global economic opportunity. This will require sweeping changes in every sector of the economy in every country in the world. And we must achieve all this in only three decades.

In the history of civilization, few generations have needed to do as much in as little time as we must do now. At its most fundamental level, this is the single greatest challenge and opportunity of our time.

Like the space age and digital era, the world's sustainability transformation calls not only for a new generation of technology but a new generation of knowledge and skills. Clearly no single entity can meet this challenge alone. The key will be to partner broadly and effectively with others to move the world's workforce into the future. We know the proposals in this report don't have all the answers, but we believe the world must commit to a Global Sustainability Skilling Strategy based on a concerted and coordinated effort from companies, industry organizations, learning providers, and governments. And we are committed to doing our part.

Brad Smith
Vice Chair and President, Microsoft

Part I · An unsustainable talent shortage

Our planet is in crisis. The Earth has warmed 1.1°C since the late 1800s under a shroud of the highest levels of greenhouse gases (GHGs) in human history.[1] For some, this temperature rise sounds slight, but the impact on the world is not. If our carbon emissions continue unabated, the resulting shifts in temperature and weather patterns will only accelerate and worsen, meaning more frequent and catastrophic droughts, wildfires, floods, and storms, as well as the expanding loss of polar ice and biodiversity.

But there is good news: this human-generated crisis is not beyond our control. Although it stems from our use of fossil fuels like coal, oil, and natural gas—the very organic compounds that have powered our economies and societies for centuries—most of the world agrees we can take steps to mitigate the impact. We must take immediate action to stop the warming by reducing our reliance on fossil fuels and by developing new technology to capture and store carbon dioxide while ensuring developing countries can advance their own economies. We aren't moving fast enough, though, to meet the deadline set by scientists—to get to net zero by 2050 to avoid an increase of 1.5°C [2] —and prevent the worst effects of climate change. Meaningful progress requires a global infusion of money, technology, and most of all, people equipped with the know-how and skills to tackle this vital work.

Although we are faced with a daunting challenge, there is also cause for optimism. The industrial revolution, the agricultural revolution, and the digital revolution each proved the transformative power of human ingenuity. Each of these eras ushered in dramatic scientific, economic, and social advancements, driving generations of people to acquire new skills and expertise to meet the opportunities they unleashed.

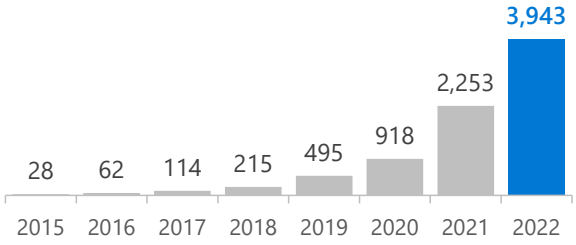
Today, we are at the dawn of a new revolution, the sustainability revolution. It will be a global transition that will beget new discoveries, innovations, and industries to address the world's changing climate. But unlike other eras that evolved organically at their own pace, we are working under an urgent deadline constrained by the laws of nature: the most recent Intergovernmental Panel on Climate Change (IPCC) report makes clear that to have a 50 percent likelihood of avoiding a 1.5°C rise in global average temperatures, humanity can only emit another 420Gt CO2 into the atmosphere—*ever*. At the world's current rate of carbon emissions, the remaining global carbon budget will run out in 11 years. Successfully stalling the clock will require action from everyone, from vanguard companies to the world's most vulnerable communities.

The challenge: A workforce built for sustainability

We cannot address climate change at the scale and speed required without developing sustainability capacity and fluency in the global workforce. Current gaps in skills, organizational structure, and talent pipeline present some of the biggest obstacles to overcome. We simply will not achieve our goals without a ready workforce that is equipped to act.

Today, more than 3,900 companies have announced actions to lower their GHG emissions. And more than a third of the world's largest public companies have net-zero targets.[3]

Companies with science-based targets or commitments to reduce GHG emissions

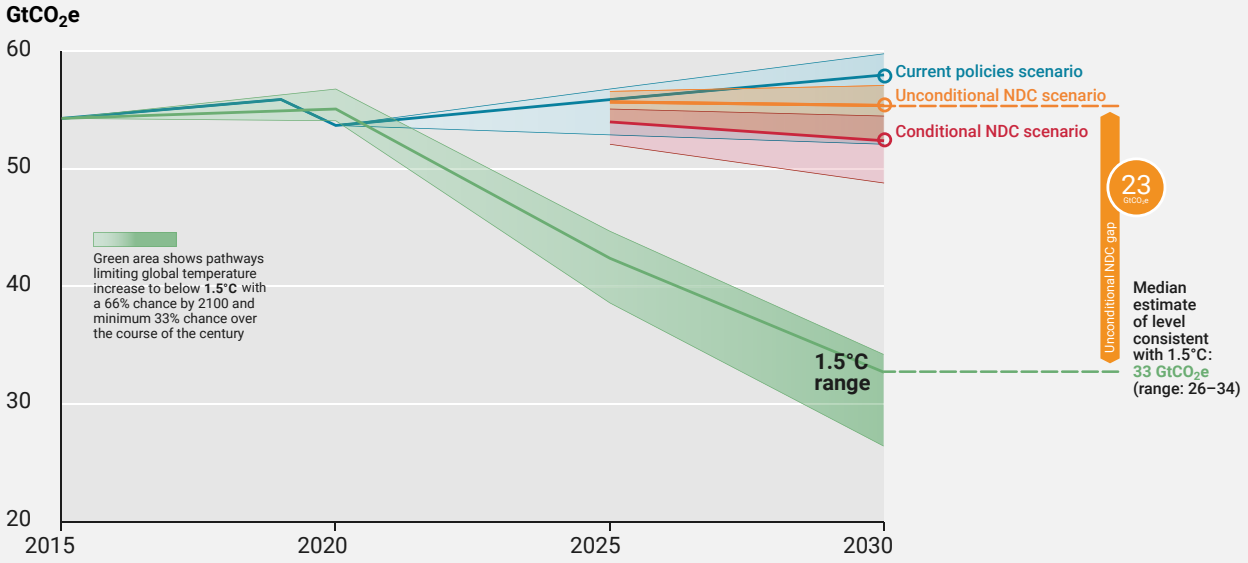


Source: SBTi (data as of October 29, 2022)

These corporate commitments and national pledges are critical to drive progress. But progress is not being made quickly enough and much more is needed beyond current commitments. The world must overcome a large carbon emissions gap to achieve net-zero emissions.

Compounding the issue, companies and organizations are struggling to meet their goals. They consistently identify the lack of a trained workforce and inadequate strategies to develop sustainability skills and expertise as major barriers toward progress.[4]

2030 Emissions gap under different scenarios



Under various scenarios reported in the UNEP Emissions Gap Report 2022, the emissions gap is between 20Gt CO_2e to 25Gt CO2e (with a 23 Gt CO_2e gap under the scenario where outcomes are not conditioned on financing or other external assistance).

Source: Derived from UNEP Emissions Gap Report 2022

Millions of workers will be needed to meet the world's climate and sustainability goals

To meet global sustainability goals, organizations must make their operations and business models more sustainable across multiple workstreams. Every organization and company will need to fundamentally transform to significantly reduce GHG emissions and address other environmental concerns including water, waste, and ecosystems.

At the heart of that transformation will be workers who design, drive, and track progress toward sustainability goals—not only within specialized roles but also in positions that incorporate a holistic view of business strategy and operations to adapt accordingly.

Such a transition will inevitably create myriad opportunities for employees in emerging and evolving fields, whose roles are dedicated to carbon accounting, lifecycle analysis, ecosystem evaluation and management, transformational systems design, renewable resource procurement, and supply chain sustainability expertise. These workers will be at the forefront of helping organizations reduce their environmental footprints as well as build new industries and business models to transform the global economy.

As significant and urgent as the need for sustainability-focused organizational shifts is, there is a corresponding demand for a sizeable pool of reskilled workers trained and equipped to address that need. The International Labour Organization (ILO) estimates 18 million net-new jobs will be created by 2030 as a result of meeting the goals of the Paris Agreement.[5] Yet according to the **LinkedIn Global Green Skills Report**, green jobs grew at an annual rate of 8 percent between 2015 and 2022, while the talent pool grew at only 6 percent.[6]

Of the nearly 200 UN member states that are party to the Paris Agreement, the ILO found that "less than 40 per cent … include any plans for skills training to support their implementation, and over 20 per cent do not plan any

human capital related activities at all."[8] Some countries and regions are developing skilling plans, for example the **European Skills Agenda**, a five-year plan that includes the development of a core green skills set and the monitoring and statistical analysis of green skills in European Union (EU) Member States. A similar example is the **ASEAN Declaration on Promoting Green Jobs for Equity and Inclusive Growth of ASEAN Community**. It is encouraging to see some countries and regions take such steps, but development and adoption of skilling plans needs to be done worldwide.

Achieving the requisite scale of transformation will require a global workforce—one that spans economic sectors and geographies—trained in the right skills, knowledge, and capabilities to develop, implement, scale, and evaluate the new tools, technologies, and processes needed for the world to make this transition. Our collective climate goals are ambitious and necessary, making a skilled sustainability workforce a top priority. But forming such a workforce will require the private sector to be fully engaged in accelerating reskilling efforts while also calling on countries around the world to build capacity to tackle this enormous challenge.

Microsoft's sustainability journey

Microsoft's sustainability journey began with our first carbon emissions reduction goal in 2009 and the development of our internal carbon fee in 2012. (Throughout this report we use "carbon emissions" to be synonymous with GHG emissions.) It continued with the launch of the AI for Earth Program in 2017 and continues to evolve as we assess and learn from our progress. In 2020 we committed to be carbon negative, water positive, and zero waste, and protect more land than we use by 2030, and to remove from the atmosphere all our historic carbon emissions by 2050.[7] What's more, we have also committed to empower our customers and partners to reach their sustainability goals through digital transformation grounded in sustainability science. Digital tools like the Cloud for Sustainability provide sustainability management solutions to enable major enterprises to measure, monitor, and report on their progress toward sustainability commitments and pledges. Sustainability is now a core pillar of our business because it is core to all business.

Microsoft is organized in part around a central sustainability team led by a chief environmental officer. The team includes specialized subject-matter experts in carbon, water, waste, and ecosystems instrumental in setting ambitious sustainability commitments grounded in science. Once these commitments were set, Microsoft embedded sustainability roles across the company dedicated to the work that drives our progress toward achieving our commitments. We currently have more than 250 sustainability roles distributed across our business groups. As we move toward integrating broader sustainability fluency across all aspects of our business and in all roles, our workforce around the world is becoming upskilled on sustainability fundamentals. Having a workforce with sustainability skills and knowledge becomes increasingly important as we look beyond our own sustainability journey to work with our partners and customers on theirs, as well.

Part II · Insights from the corporate sustainability workforce landscape

To better understand sustainability workforce needs, Microsoft and the Boston Consulting Group (BCG) researched 15 large corporations from a variety of sectors. We conducted extensive interviews and surveys across nine of those companies: AT&T, BCG, HSBC, John Deere, JSW Steel, Microsoft, Owens Corning, Sysco, and Unilever. These companies are leaders in setting and pursuing ambitious climate goals, meaning that they are already confronting workforce challenges that most organizations worldwide, whether corporate, governmental, or nonprofit, will face as they adopt and work toward sustainability goals.

Each of the surveyed companies were in different stages of their sustainability planning and operations, with each stage reflected in the company's respective workforce approach. While sustainability teams look different at each organization, they face common challenges as they progress in their sustainability journeys. The results of this survey, combined with international research and Microsoft's own sustainability journey, yield key insights about the sustainability workforce challenge.

1. Talent development drives the sustainability journey

Organizational capacity and talent development are mutually reinforcing: talent development is critical to organizational progress, and organizational changes drive workforce adaptations.

This interplay is clearly seen as corporations move through their sustainability journeys. During the initial mobilization stage, companies set their goals, often publicly, and quickly realize they need to identify sustainability talent from within their existing workforce. Typically, companies at this stage are in reactive mode: considering stakeholder concerns, fulfilling regulatory requirements, and addressing shareholder demands. Training is therefore geared toward compliance and responding to immediate inquiries, rather than building the core transformation and functional skill sets needed to foster change within the company.

Companies then generally shift to optimizing business processes to meet evolving corporate-wide goals. They focus on scaling functional and digital abilities so business units can carry out sustainability initiatives independently, coordinated by central teams. Companies in this phase tend to embed workers with sustainability skills into key business units. And they typically develop a more forward-looking and customized approach to worker training, with mechanisms to upskill talent according to individualized and tailored learning pathways to meet proactive rather than reactive needs.

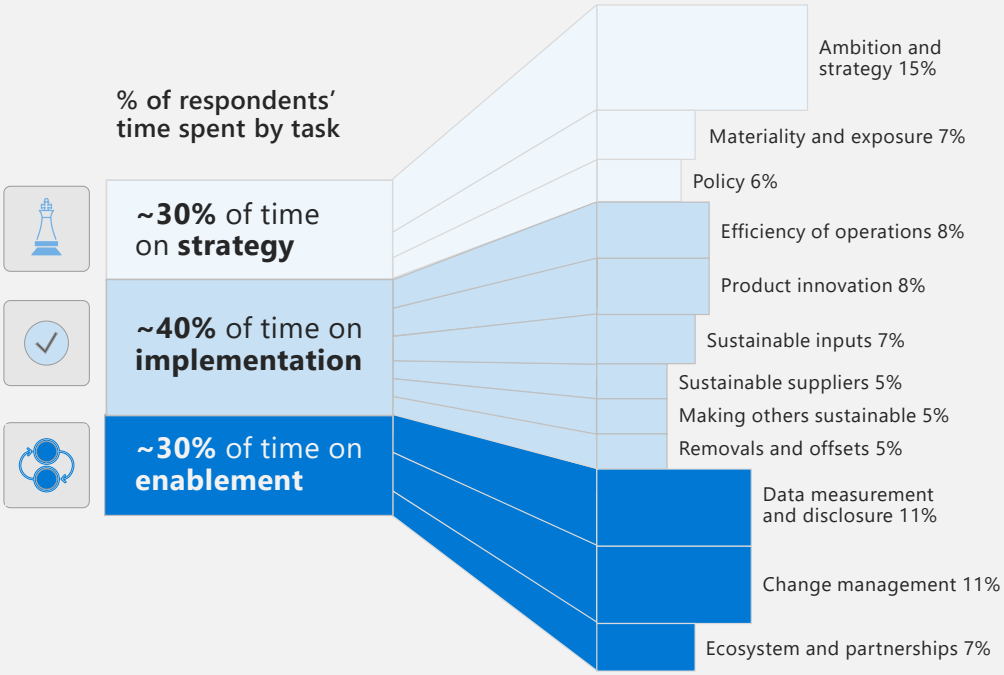
Finally, companies that have made the most progress in their journeys have integrated sustainability across all aspects of the business, including helping their customers address sustainability challenges. These organizations are investing in individuals with specialized skills and equipping many workers with broader sustainability knowledge; they've typically set goals to upskill their broader workforce on sustainability fundamentals to achieve widespread fluency. Employers in this phase have also moved beyond staggered, reactive approaches to cultivate talent and create roles and career paths that provide attractive opportunities for specialized sustainability workers.

2. Businesses need multidisciplinary workers with specialized sustainability skills

Achieving sustainability goals requires reimagining "business as usual." Efforts to reduce GHG emissions, improve energy and water efficiency, reinvent more sustainable packaging, and address other supply chain issues will be implemented by employees who have acquired specialized sustainability skills to incorporate with their understanding of business operations or systems thinking.

Among organizations we examined, core sustainability workforces are focused on three primary areas of activity: setting and managing sustainability strategy, driving sustainability implementation, and activities that enable both of the above. Each area requires expertise in specific sustainability skills and covers a range of sustainability business activities, such as procuring clean energy and other sustainable inputs for business operations; carbon accounting; implementing processes for carbon removal (which throughout this report we use to mean carbon dioxide removal); ecosystem services valuation; assessing climate risks; and working on product design to make products zero waste. Companies emphasized that while they need sustainability expertise, even more critical is

Company sustainability professionals focus on three main areas of work: strategy, implementation, and enablement



Source: 2022 BCG/Microsoft Sustainability Talent and Skills Survey

deep knowledge of business processes, so in many cases sustainability know-how is being acquired on the job.

For example, a company like Microsoft now employs individuals who pursue full time life cycle assessment, climate risk assessment, and the purchase of long-term, high-quality carbon removal.

Another example can be found at a major US-based global product company. In response to customer demand for end-of-life solutions for their products, the company built a team focused on the full product life cycle and invested in circular economy solutions. This team includes individuals with specialized skills in analytics and reporting, manufacturing, and material decarbonization. Although this team is currently centered within their sustainability center of excellence, the company plans to embed end-of-life solutions and associated roles in all parts of its business. This trajectory—incubating sustainable business processes in a central part of the company and then scaling and embedding that talent across the business—was a way to leverage scarce sustainability expertise to transform processes while also developing the talent required.

3. Organizations need to embed sustainability science into their day-to-day operations

To make significant progress on their operational goals and build more sustainable businesses, companies will need to collaborate with scientists experienced in this field. Despite tangible, trackable environmental and social trends, complex and dynamic climate challenges will affect organizations and industries differently, requiring solutions that apply to unique business needs.

Sustainability science is an emerging field that draws from earth, ecological, and social science, as well as other disciplines to understand evolving sustainability challenges and develop solutions. For example, climate, ecological science, and chemistry expertise is needed to evaluate alternative nature-based carbon removal strategies, assess interconnections and feedback of climate risks, and overcome bottlenecks to decarbonization models. Environmental science is critical to assess progress toward goals, model and interpret the physical risks associated with investments, and develop adaptive strategies to respond to uncertain and volatile environmental

conditions. Expanding access to and even embedding sustainability scientists into their workforce will provide companies with the know-how to set and assess their goals and meet their commitments.

And underlying all these is the central role of data science for analysis. At Microsoft, we have found that integrating data science with AI and machine learning can accelerate our understanding and development of solutions. For example, we are advancing research and deploying solutions that combine AI and biophysical observations and modeling to improve environmental forecasts, resource management, and GHG emissions.[9]

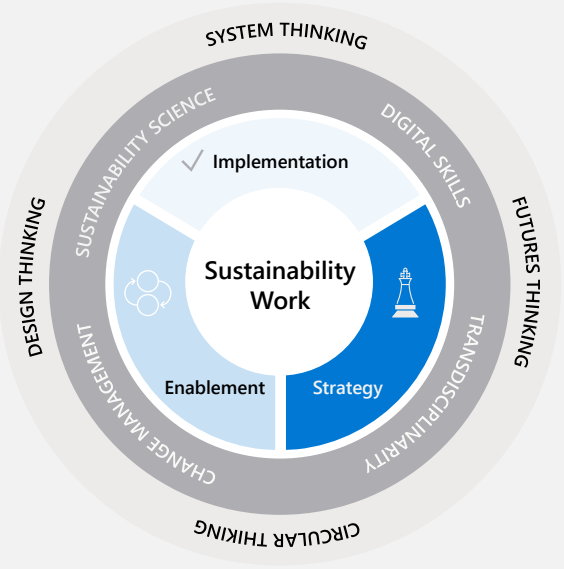
4. Virtually all workers will need basic sustainability fluency

In addition to incorporating highly specialized, scientific knowledge into strategic planning and operations, the implementation of these changes will require a broader sustainability mindset. Workers will need to rethink not only how particular tasks are accomplished but also ways to approach and solve problems from the start. For example, reassessing costs and benefits from a systems perspective or tracking current and future implications of business decisions in terms of emissions, water, and ecosystem impacts.

Growing research highlights the need for what academic literature calls "sustainability competencies." This interlinked set of knowledge, skills, attitudes, and values enables effective response to real-world sustainability problems, challenges, and opportunities.[10] There are numerous definitions, but many of them include fluency in thinking in systems rather than silos, future thinking (thinking about the possibilities of the future rather than the routines of the past), normative or values-thinking, and circular thinking (thinking in terms of circular production rather than purely linear processes).[11] Moreover, foundational knowledge for these roles typically includes some measure of sustainability science, change management, transdisciplinary skills, and digital skills. We believe the broader corporate workforce will need such foundational sustainability competencies and knowledge—essentially a "sustainability fluency."

As one supply chain sustainability leader said, "Sustainability also has a behavioral shift in thinking. We are asking people to change from how they used to function. It's not just technical, it's behavioral. For

Empowering a workforce to support the transformation to sustainability



System thinking
The ability to approach any problem or opportunity as part of a larger whole, which is more than the sum of its parts. Systems thinkers recognize that understanding interconnections, stocks and flows, and positive and negative feedbacks are critical for managing and finding opportunities in complexity.

Futures thinking
The ability to view the future as not being fixed, and while it cannot be perfectly predicted it can be shaped. Envisioning the possible and the unimaginable and charting the path to where you want to be.

Circular thinking
A mindset to eliminate waste and pollution, circulate products and materials, and regenerate nature.

Design thinking
The ability to use creativity to foster collaboration and solve problems in human-centered ways. Design thinkers remain open and curious, assume nothing, and see ambiguity as an opportunity.

Sustainability science
The field of science that focuses on understanding earth, biophysical and social systems as they relate to achieving sustainable development. This includes earth systems science, carbon management, environment and equity, behavioral change, climate vulnerability and resilience, hydrology, environmental forecasting, ecosystem accounting and evaluation.

Digital skills
The skills needed to use digital devices, communication applications, and networks to access and manage information. These including skills such as data management, computer programming, data science, and digital literacy.

Transdisciplinarity
The ability to work across disciplines, sectors, and stakeholders to collaboratively design and implement solutions.

Change management
The collection of skills needed to guide organizational change to a successful resolution. This includes skills such as: preparation, strategic visions, removing barriers, building short-term wins, and building coalitions.

Source: 2022 BCG/Microsoft Sustainability Talent and Skills Survey

procurement, some of it is about cost-savings, but we're also asking them to think about the value creation piece. We're asking them to think outside of the box. We're asking a sourcing leader to think about product redesign: instead of just asking them to source something differently, it's thinking through whether we can approach it [the design process] totally differently."[12]

HSBC is a good example of a company that has invested in sustainability fluency across its broader workforce. Customer-facing employees needed to be able to advise their clients on their sustainability journeys and provide the right financing solutions. Toward that end, HSBC created an internal sustainability academy and by the end of 2022 thousands of frontline staff will have commenced their upskilling journey. It has further developed sustainability boot camps to "train the trainers" to rapidly scale this curriculum. It also supports internal rotations to enable employees to get firsthand experience with sustainability-related work and projects.

The foundational changes needed across organizations will require sustainability fluency beyond individuals in sustainability-specialized roles. These basic competencies should broadly undergird any role-specific skills, even those jobs without sustainability in their title and without a primary sustainability focus.

5. Current sustainability skilling models do not scale.

Sustainability is a rapidly evolving field. It is therefore not surprising to find that companies reported most of their sustainability team members did not join their company with sustainability training but instead have learned on the job. Among sustainability leaders interviewed, 68 percent were hired internally, and among sustainability professionals we surveyed, over 40 percent had three or fewer years of previous sustainability experience. Among sustainability managers and professionals surveyed, nearly 60 percent did not have a degree in a sustainability-related field. These major companies have relied upon talented insiders with the core transformational and functional skill sets needed to evolve their roles and create change, despite a general lack of formal sustainability training.

Microsoft's own sustainability team reflects this trend. One team member's career path—built over 30 years at the company—began in customer service and support, went on to business management and reporting, then continued to procurement, before being promoted to a leadership position on our Sustainability Reporting and Governance team. A career intersecting business and sustainability started with seeing an opportunity to assist with building a proof-of-concept data solution, led

Many sustainability leaders were hired internally, and majority of sustainability professionals did not have a sustainability-related degree

Source: 2022 BCG/Microsoft Sustainability Talent and Skills Survey

to learning sustainability accounting to meet evolving business needs, then leveraging their in-depth knowledge and experience at Microsoft to apply a whole company lens to their responsibilities. Not only has this individual's career path advanced Microsoft's sustainability reporting and governance efforts, but it has also elevated this individual as an expert in driving sustainability insights and change around the globe—all from learning and embracing sustainability on the job.

Similar stories are easy to find across corporate sustainability teams. This is promising because it indicates that many critical skills can be acquired within the structure of today's workforce—a must if we are to act with a shared sense of urgency. However, it also is problematic because tailored in-house talent strategies cannot scale to the global change needed. There simply isn't time to build workforce sustainability capacities piecemeal. We need a focused, data-driven, and adaptive approach.

Part III · Recommendations for building a workforce empowered to drive transformation to sustainability

The only way to meet this pressing workforce challenge is for business, government, nonprofit, science, and education communities to come together to define their workforce needs and gaps and to set ambitious goals to meet them. Achieving the scale and speed of change needed to address climate change requires an all-of-the-above approach to building sustainability capacity in the workforce.

Based on our findings and experiences, we've outlined several steps that public and private organizations can take now—independently and together—to build the global workforce we need.

Action 1 Map needed skills and knowledge for sustainability jobs

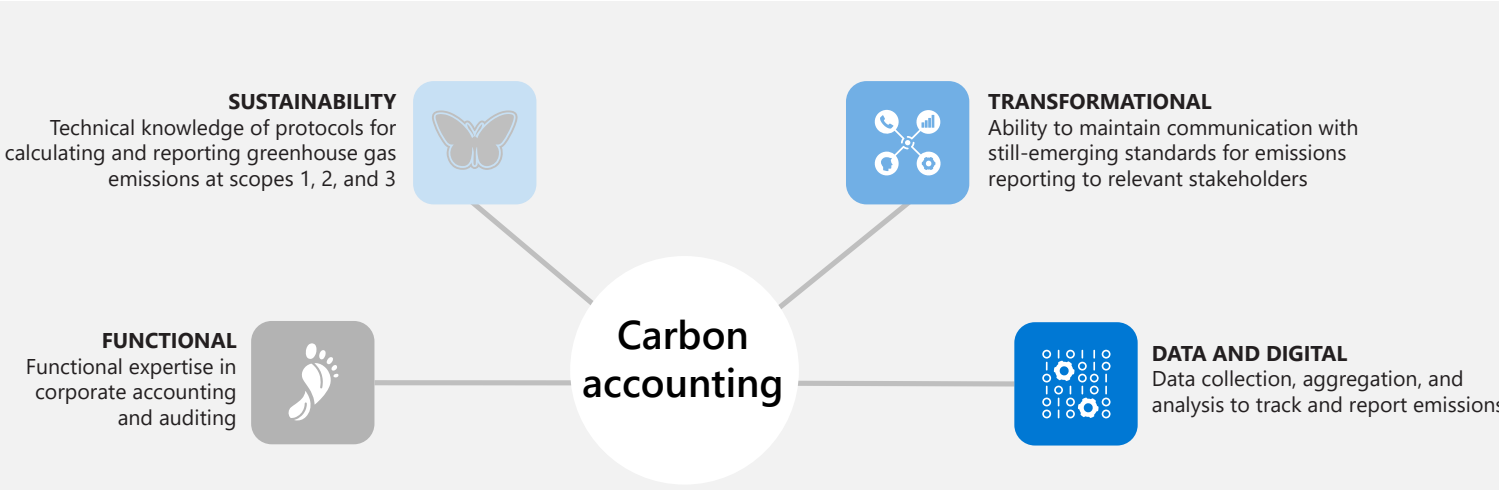
Although we know millions more workers are needed, there is spotty information linking immediate workforce needs with required skills and training. Synthesizing reports from 32 countries, the ILO report "Skills for a greener future" observes: "Most countries lack comprehensive information on gaps and shortages in skills for green jobs .... And systematic mechanisms for anticipating what skills are needed in which the private sector is directly involved exist only in a few countries."[13]

Without better data it is hard for organizations to recruit talent, for workers to understand what skills they should pursue, and for governments to make policy decisions.

Employers are keenly feeling the pain: 76 percent of respondents in the Microsoft-BCG survey identified the nascency and rapid evolution of required skills as the biggest pain points in training their workforce.

Take one example, carbon or GHG accounting, that will be a required role at every organization with carbon emissions reduction goals: the job's requirements illustrate the cross-cutting and transdisciplinary nature of new specialized sustainability roles. A carbon accountant will need technical knowledge of scopes for reporting greenhouse gases across scopes 1-3; functional expertise in accounting and auditing; experience with data collection and reporting; and the ability to adapt to still-emerging standards.

Where each of these skill areas might traditionally be learned through different academic programs and are principally applied in distinct professional roles, the emerging carbon accounting practice meshes them together in novel ways while also requiring change management capabilities and an ability to take a future-thinking approach. Therefore, seeking to fill the role by focusing narrowly upon traditional accounting skills may not necessarily be effective. For example, a leading multi-national manufacturer found that when it hired financial accountants for carbon accounting roles, those individuals' traditional accounting training made it difficult for them to work with still-emerging standards. Instead, the company had more success hiring process engineers and training them in technical knowledge of GHG emissions. HSBC found that in sustainability-related work it needed individuals who, more than anything, are



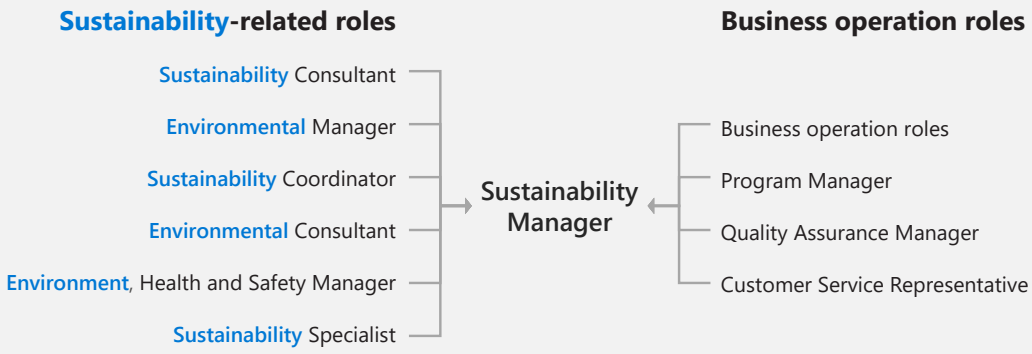
comfortable with uncertainty. As one leader described it, in this space "the uncertainty and volatility are key features that people need to deal with."[14]

A look at the skills and career history for one of the most common sustainability-focused jobs at corporations, sustainability manager, is instructive. Sustainability managers are responsible for analyzing numerous aspects of a business to identify sustainability issues and must work with others—internally and externally—to help a business reach its environmental sustainability goals. Responsibilities can differ by industry and sector, but the job frequently entails monitoring and enforcing environmental controls; making sure work activities comply with applicable laws regarding waste, water, and emissions; studying the impacts of various work activities on different environment and energy measures; and planning for ways to reduce environmental impacts.

When we examine the careers of current sustainability managers, among their top 10 most common immediately prior positions, roughly half are not sustainability roles but instead relate to customer engagement, project management, and other leadership and development functions.

Relatedly, the multidisciplinary skillsets most seen among sustainability managers do not all occur together in previous roles; a prior job may cover only half of the top 10 skills needed. Moreover, when we map such skills over time, we see that the top skills for sustainability managers have changed significantly over the past seven years and that digital skills have become increasingly important. Employers unaware of this may be unnecessarily limiting their search for sustainability talent or failing to provide the full range of multidisciplinary training that will nurture a sustainability manager's success.

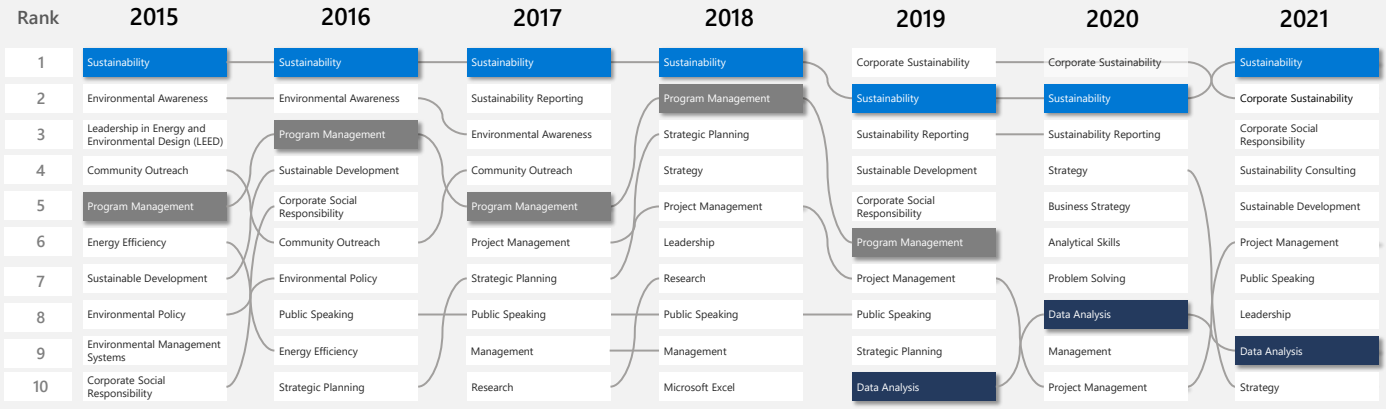
Four out of the top ten prior jobs most often held by sustainability managers were not sustainability focused*



Source: LinkedIn

** Roles listed are titles for the top ten jobs held immediately prior by individuals who moved into a sustainability manager role.*

Top 10 skills ranked for sustainability managers from 2015 to 2021



Source: LinkedIn

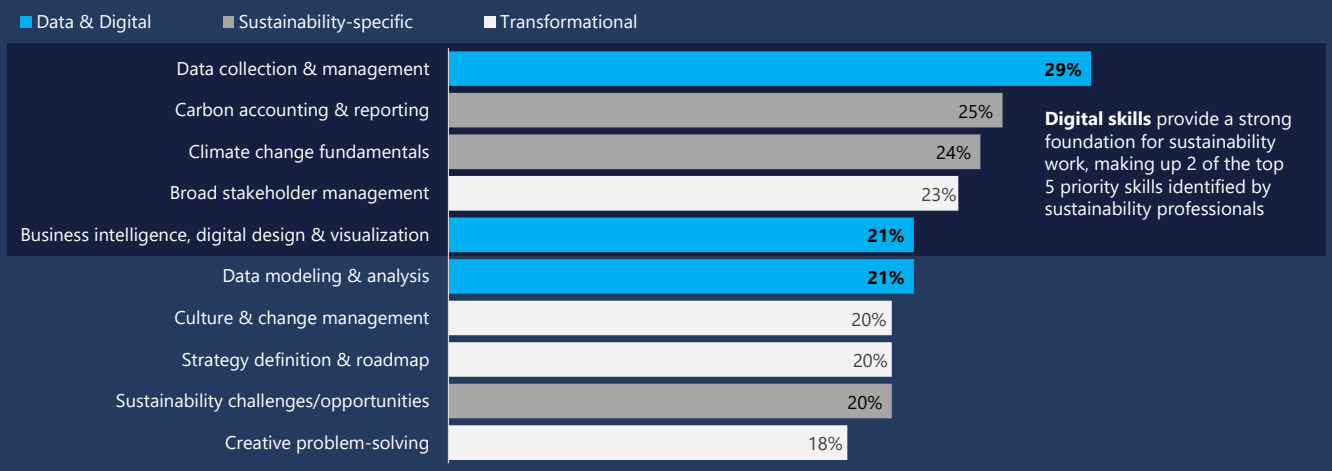
The core role of digital skills

Digital skills and technology will be critical to achieving a sustainable world. Technology-enabled measurement and data—through remote sensors and other IoT devices, satellites, and connectivity, combined with big data analytics and AI/machine learning (ML)-enabled modeling[15]—will play a critical role in monitoring and optimizing resource use. Core tasks of recording and reporting environmental impacts will rely upon evolving digital tools, such as Microsoft's Cloud for Sustainability, which helps companies track their emissions and removals as well as develop strategies to set and meet sustainability targets. Recording and reporting jobs will depend on the ability to collect, manage, and aggregate data from an ever-growing array of sources. In addition, digital-twin technologies offer the promise of reducing impacts by optimizing every aspect of manufacturing, logistics, and supply chain management. New applications of AI/ML offer ways of letting companies better understand and manage the risks that climate change poses to their business.

Individuals increasingly need to be able to use these technology tools to handle sustainability-related tasks. This is borne out in the strong presence of digital skills in profiles of sustainability specialists. Excluding specific function-specific skills, two of the top five priority skills for sustainability work are digital skills.

Digital skills have become foundational to organizational sustainability roles. What is more, as these tools evolve, they will incorporate functionality to enable a wider range of workers to use them—which means that workers may not need to have as in-depth sustainability expertise, but they must have the requisite digital skills to use technology tools to achieve results.

Highest priority skills for sustainability work



Source: 2022 BCG/Microsoft Sustainability Talent and Skills Survey

The cross-disciplinary nature of many sustainability specialist roles and the rapid pace of change both underscore the need for real-time data and flexible frameworks that identify needed skills and knowledge for, as well as potential career and education pathways leading to, these evolving roles.

Recommendation #1: Develop a common vision of skills for specialized sustainability roles

Developing a clearer picture of the sustainability skills and labor gaps, present and future, will require a common taxonomy and framework. Research and studies like those conducted by the ILO, UNESCO, the National Academy of Sciences, and the EU present overviews of the landscape, and several countries have begun to collect data on broad green jobs categories. Private sector companies and associations also have analyzed the state of sustainability jobs.[16] However, the picture of newer specialized sustainability jobs has yet to be brought into sharp focus.

In other technical arenas with fast-changing skills, a collaborative approach involving private sector, government, and the education sector to define a skills and competencies framework has been foundational to shape education and training curricula and inform targeted training and hiring initiatives and policy.

The world needs similar clarity in sustainability specialist jobs and the skills needed to do them. The changing nature of many of these jobs demands a dynamic and flexible framework that can continue to evolve. Such a framework could serve as a common reference point for employers, jobseekers, students, educators, and policymakers to understand the evolving skills and labor landscape for sustainability roles.

Recommendation #2: Develop and standardize sustainability credentials

Once we identify the key skills and competencies for sustainability jobs, employers and workers still need a clear way to demonstrate those skills have been attained. Over the past decade, a wide range of sustainability degree programs, online training, and certificate programs have emerged. However, without a common framework, employers, workers, and educators are at a loss to know which programs can deliver on the promise of creating a workforce to drive the needed transformations.

There is a desperate need to harmonize and standardize credentials for sustainability skills.[17] This can be enabled through the common frameworks discussed above that link specific skills and competencies with specific job functions: those can in turn be connected to identified certifications and training providers. They can also be mapped to roles and career paths, so individuals and employers can see how skills and experience build upon each other and can lead to increased expertise over time.

NICE Framework

In the United States, the **National Initiative for Cybersecurity Education (NICE) Framework** is a resource to help develop a workforce capable of meeting organizations' cybersecurity needs. The concept for the NICE Framework began within the Department of Homeland Security (DHS) and initially focused on understanding cybersecurity roles within the federal government. DHS subsequently gathered input across industry, academia, and government. The Framework maps cybersecurity skills through a set of competencies and associated tasks, knowledge, and skills. This enables employers in all sectors to define work roles through a common language as well as identify gaps in cybersecurity staffing. Through a mapping tool, employers can input desired skills and competencies to build job profiles aligned to the framework. This supports staffing needs while also creating consistency in the way organizations describe their cybersecurity needs. In a reciprocal way, education and training providers leverage the Framework to design and deliver industry-aligned courses. This ensures that current and future cybersecurity workers gain in-demand skills and credentials.

The Framework has been instrumental in development of collaborative tools like **CyberSeek**, which enables users to map job titles to specific certifications and required skills. It also provides an interactive heat map with specific skilled jobs by state and metropolitan area and lays out career pathways so individuals and employers can see how roles build upon each other.

There are uses for different types of credentials at different levels. Online self-paced, self-attested learning programs can be effective to promote rapid, entity-wide skilling and help existing employees address sustainability-related issues in their day-to-day workflows. They can also be useful for individuals seeking to learn more about the field and develop basic competencies in sustainability fluency. General sustainability certificate programs are also becoming widely available. And numerous professional associations have established general sustainability certificate programs designed to help professionals gain a baseline understanding of sustainability practices.[18]

Additionally, for more specialized sustainability areas, industry-recognized certifications that verify acquired skills through examination can be particularly valuable. It is common for skilled technical jobs—such as those in information technology—to require widely recognized, high-value industry certifications. Those certifications are developed by experts who carefully analyze the specific tasks for the roles in question, have that analysis reviewed and validated frequently by industry experts, and engage psychometrics experts to develop evaluative criteria. Certifications are only awarded via rigorous examination.

Today, widely recognized sustainability credentials already exist, particularly where robust standards and compliance regimes are in place, such as around LEED certification or green construction.[19] But in arenas where compliance standards and reporting requirements are still evolving—such as carbon accounting, climate adaptation, and ecosystem evaluation—or where roles have cross-cutting responsibilities, such as chief sustainability officer, required skills do not yet fit neatly within existing pathways and certifications. This proliferation of credentials and certificates is difficult to decipher for workers and employers. For example, there are multiple frameworks and certifications for GHG accounting and reporting (e.g., **GRI**, **CDP**, **FSA**).

Sustainability experts, industry stakeholders, government, and certification experts should collaborate to drive standards and clarity in specialized sustainability areas. Such standards can be supported through national or international accreditation bodies or industry associations.

To further a shared understanding of the skills, knowledge base, and competencies for the sustainability workforce, Microsoft commits to:

Work with others in the public and private sector to map jobs and needed skills: *Microsoft and LinkedIn will support efforts to define skills and competencies, and to share near-real-time information on sustainability skills across sectors, occupations, and geographies. We will continue our partnership with the International Labour Organization and leverage our existing partnership with the* ***Development Data Partnership****, which includes the Organisation for Economic Co-operation and Development (OECD), World Bank, Inter-American Development Bank (IADB), United Nations Development Programme (UNDP), International Monetary Fund (IMF), and others to provide data to enable partners to map the evolution of sustainability skills and jobs.*

Action 2 Provide sustainability skills to today's workforce

Ambitious initiatives are needed to ensure that the millions of individuals around the world who need to develop sustainability skills and knowledge do so. The private sector, and particularly organizations that have made sustainability commitments, must be at the leading edge of the needed change. Their skills and training efforts can also help support industry talent pipeline development, and coordination with policymakers can help leverage broader change.

Recommendation #1: Develop and disseminate needed training materials

As sustainability skills and tools become more embedded in the day-to-day work of companies, organizations will increasingly need relevant skills training materials that speak to business needs. This work must start with the development of new learning materials that can be used both in person and online. Some key actions that businesses should take include:

- **Work with education and training providers to develop needed sustainability fluency and specialized sustainability skills curriculum**. High-

quality credentials require active participation by employers and industry experts. Companies and industry associations must work closely with training and education providers to develop and continually update curriculum and training that can meet business needs. This includes curriculum to understand and use digital tools to record, report and manage carbon, water, waste, and energy for businesses.

- **Disseminate training resources globally.** Some foundational resources already exist at centralized hubs including the UN Global Compact and the ADBI E-Learning platform[20] as well as through private providers. It is vital that such curriculum be made broadly available in numerous languages, including at points where employers and businesses are most likely to seek resources to upskill their employees. For example, LinkedIn Learning currently offers numerous courses and pathways to support sustainability fluency. Additionally, the Microsoft Sustainability Learning Center includes detailed information about business-focused environmental sustainability topics and technologies.

Recommendation #2: Train today's workers

As we have seen from corporate organizational experience, on-the-job training is critical. Companies highly value business experience and often prefer to train existing workers. Training also can open up opportunities for individuals who hold other roles in the company. These efforts are happening today but need to be exponentially increased. Critical steps that organizations should take include:

- **Invest in broad sustainability fluency across the corporate workforce.** Companies should use a host of strategies to encourage sustainability fluency broadly across their workforce. This includes setting goals for basic sustainability training for all workers or developing in-house academies, badges, rotational opportunities or other incentives to encourage employees to participate in training. Organizations should also engage with suppliers and partners to support their sustainability fluency.

Organizational transformation to net zero and other sustainability goals will require employees to have a basic grasp of business-related sustainability issues. Our own experience and our customers' business needs suggest some key domains of learning for the corporate workforce:

Climate and Environmental Science Fundamentals, which includes an understanding of cycling of matter and the flow of energy through ecosystems, including the carbon cycle and the water cycle. This inclusdes knowledge of the different (GHG), the primary sources of these emissions, and relative warming potentials.

Measurement, Accounting and Reporting, which includes an understanding of categorization of GHG emissions (scopes 1,2 and 3), common reporting frameworks, and the differences between avoided emission offsets and carbon removal. It also includes an understanding of approaches and frameworks for accounting for biodiversity and ecosystems. These areas include an understanding of the major sources of risk to a company and ways to measure and manage these risks. This also includes the ability to leverage relevant tools and technologies in support of measurement and reporting.

Management of GHGs, Energy and Water, which requires an understanding of methods to reduce GHG emissions across scopes 1, 2, and 3, energy efficiency and renewable energy procurement, and processes to operationalize efficiency and reduce emissions across the supply chain and the value chain, including construction. This also includes understanding strategies for water conservation and recycling.

Systems and Circularity, which includes a knowledge of what systems thinking is and how to apply it when trying to understand and minimize impacts to our climate and environment. It also provides an understanding of concepts of circularity and the need to use and reuse resources.

Governance, Law and Policy, which includes international, national, and local policy frameworks. This includes common policy measures and regulatory trends.

- **Employ upskilling strategies to build the talent pipeline.** Businesses should identify areas where targeted skilling can help individuals move into sustainability roles (including individuals whose prior jobs were not sustainability-focused). Strategies that combine both work and learning, including rotations and apprenticeships, can be effective here. Such initiatives could target experienced and midcareer individuals that have business experience but need to gain sustainability knowledge and skills, or they can focus on local communities or traditionally underrepresented populations. Organizations should consider how investments and partnerships with nonprofits and education providers can help build the broader sustainability talent pipeline.

- **Use a wider lens to identify potential talent.** Data and experience demonstrate that many sustainability professionals come from diverse backgrounds and gain skills on the job. Companies should take a skills- and experience-based approach to identify talent that can fill specialized sustainability roles, with the right training. By focusing on skills and experience from prior roles rather than only four-year degrees and exact title matches, employers will widen the aperture of who they view as qualified for in-demand sustainability roles. Employers could apply this approach in conjunction with data aggregation tools to refine transitional training programs to develop a broader pool of potential talent.

> "Our strategy to hit net zero is very much at the heart of everything we do in our operations, but we need to know where we're impacting, which part of our process, which part of our supply chain is either causing the most risks to those goals or can give us the most opportunity to make a real dent in the goal and move forward at pace. Enabling those digital technologies and digital skills to come together with your net carbon goals and with green skills, that's where the opportunity become reality … When you look at your own workforce, there is real opportunity to harness people who are passionate about this agenda and look to cross skill and upskill people who are already in your organization."
>
> *– Digital services leader at a major utility company*

Recommendation #3: Work with policymakers to bring actions to scale

Many countries—including nations that have set ambitious climate-related goals—have yet to articulate concerted approaches that involve skills and training.[21] To take training efforts to a broader scale, intentional investments on a national and international scale are needed. This will require policymakers to consider incentives, such as training investments and tax policy. In addition, because the private sector is often at the leading edge of innovation and has the ability to move nimbly to address immediate workforce needs, public-private partnerships should leverage that innovation to bring impact to scale. Although we are seeing efforts on this front,[22] we must think bigger and bolder.

Key actions that policymakers can take to drive change and work with private sector and NGO partners:

- **National goals for climate should include national goals for skilling.** Countries that have set Nationally Determined Contributions should develop strategic plans for meeting the workforce needs to achieve such commitments. This calls for bringing together private sector, government, educational, and other stakeholders to incorporate sustainability skills as a critical component of any sustainable infrastructure spending and planning.

- **Support broader participation.** Government programs often have the furthest reach to be able to disseminate training materials and reach and support communities that otherwise would not be touched by traditional private sector routes. Businesses, NGOs, and governments should partner to reach impacted and transitional communities, as well as individuals from traditionally underrepresented groups, with training opportunities and supportive programs to help individuals complete learning and enter sustainability-related jobs.

- **Support the exchange of talent and ideas between industry and academia/research institutions.** Fields like agriculture, healthcare, and pharmaceuticals have built up longstanding national and international networks of research and exchange. Governments should also facilitate and accelerate the flow of sustainability scientific expertise more seamlessly and rapidly to the point of action. This can be of particular benefit to least developed countries, particularly if such resources go beyond standard scientific research to include information exchange with government agencies, civil society organizations, the private sector, citizen-science initiatives, and local communities.[23]

To further sustainability skills and scientific expertise in today's workforce, Microsoft commits to:

Share learning materials: *Microsoft will work with partners to share sustainability learning with millions of workers around the world. These resources will include LinkedIn Learning paths for sustainability as well as business-focused sustainability materials provided through Microsoft's Sustainability Learning Center and our Cloud Solution Center. We will also work with partners to co-develop new learning resources for sustainability fluency and knowledge.*

Reach more workers and communities: *Microsoft will partner with NGOs to help workers, including those in impacted and transitioning communities, to complete sustainability learning pathways. This will include partnership with INCO Academy to launch a Green Digital Skills course to support up to 10,000 learners, including learners in the Global South.*

Facilitate access to sustainability expertise: *Microsoft will provide our sustainability customers with an advanced forum for sharing learning and best practices, which includes convening a summit of chief sustainability officers.*

Action 3 Build the sustainability talent pipeline of the future

Just as governments, NGOs, and the educational and private sectors have worked together to bring digital skilling and computer science into schools, we will need similar partnerships to do the same with sustainability skills. Opportunities for learning should be accessible from everywhere, and we should leverage investments and innovation in sustainability education to benefit people around the world.

A sustainability workforce must be built upon a populace that has basic sustainability education—and the need for fundamental sustainability education is part of the UN Sustainable Development Goals. (SDGs).[24] Every country will have a different focus and priorities in how they incorporate concepts into curriculum. However, the broad-based understanding of sustainability education at an international level is, as framed by UNESCO: "to develop and expand educational activities that focus on sustainability issues such as climate change, biodiversity, disaster risk reduction, water, the oceans, sustainable urbanization, and sustainable lifestyles."[25] Students of all ages should have the knowledge, skills, and agency to address these interconnected global challenges.

Paris Agreement Article 11 explicitly refers to the need to enhance the capacity and ability of developing countries, including those particularly vulnerable to the adverse effects of climate change.[26] And in the UNFCCC October 2022 synthesis report on National Determined Contributions under the Paris Agreement, 66 percent of party signatories cited the importance of building capacity to facilitate training, education, skills development and workforce transition, and related items.[27] Supporting sustainability education must be part of building this capacity; strategies must focus on reaching those impacted by sustainability transformation and traditionally underserved communities. They must also consider the differing needs of different regions, impacted areas, and specific climate vulnerabilities.

There is more work to be done. Analysis across 46 UNESCO member states showed that over 50 percent of primary and secondary education policies and curricula studied made no mention of climate change; 45 percent made little-to-no reference to environmental themes; and only 19 percent referred to biodiversity.[28] The European Commission has found that education for environmental sustainability is not yet a systemic feature of education policy, and although many EU countries commit to some sustainability goals and embed education for environmental sustainability in education policy strategies, few follow up with clear action plans.[29] More countries are beginning to include sustainability issues and concepts in their curriculum.

However, even where this is the case, there is no clear data on how much sustainability concepts are flowing into schools.

Recommendation #1: Build capacity and incentives to support inclusion of foundational sustainability in primary and secondary education

The **UNESCO Education for Sustainable Development (ESD) Learning Objectives** provide key guidance for incorporating sustainability content into primary and secondary education. Yet currently less than 40 percent of teachers express confidence in teaching about climate change, and far fewer can explain the effects of climate change on their region.[30] This signals an opportunity for ministries of education to build more capacity for teaching core competencies that will enable students to better understand the impacts of a changing climate and prepare them to deliver the next generation of solutions. The **UNESCO roadmap** provides guidance for the incorporation of ESD into national education agendas, but more countries must act.

Promising practices for capacity building are emerging

Strong collaboration among ministries, particularly those focused of education and environment, enables effective climate change education.[31] Specific examples include collaborative national platforms (Costa Rica, Japan, and Hungary), mainstreaming ESD in the curricula (Colombia, and Morocco), and teacher training and development (Kenya, Peru, and South Africa). This type of collaboration between ministries should be further encouraged and incentivized where possible. Additionally, education policymakers benefit from the continued development of resources to support research-based sustainability policies, plans, and initiatives. The **Sustainability Education and Policy Network**, located at the University of Saskatchewan in Canada, is an example of such a center, providing researchers and policymaker with a framework for collaboration.

The extent to which countries are addressing these issues in curriculum varies greatly. A focused tracking of implementation, monitoring, and reporting of climate education is needed to mark progress. Leaders can look to resources like **the MECCE Project** for global monitoring tools, country profiles, case studies, and a digital resource library. Additionally, UNESCO's newly formed **Greening Education Partnership** will help deliver coordinated action with the goal of preparing every learner with the needed sustainability knowledge, skills, values, and attitudes.

Foundational sustainability content should also include building cross-cutting competencies

The application of sustainability content in schools and in the workforce will require cross-cutting competencies. The UNESCO ESD Learning Objectives highlight competencies such as systems thinking, collaboration, critical thinking, and integrated problem solving. Additionally, as we have illustrated earlier in this report, digital skills are essential for the current and future sustainability worker and so provide examples for how schools might integrate sustainability content while attending to cross-cutting competencies. The **Climate and Sustainability Subject Kit** and **Sustainability City learning map** from Minecraft are examples of content that builds cross-cutting competencies.

Recommendation #2: Post-secondary education needs to be designed to shape, respond, and adapt to sustainability workforce needs

Strengthening sustainability education at the post-secondary level—from technical and vocational opportunities to Ph.D. research programs—is critical to ensuring that the workforce has foundational sustainability fluency and can attain specialized sustainability skills.

There are key ways in which cross-cutting collaboration can help meet these goals. First, higher education institutions have traditionally focused within national boundaries, but the global urgency surrounding this issue and the opportunity for immediate real-world application call for a global approach. Second, the real-world urgency of these issues calls for crafting partnerships that are not only academic (university to university) but also cut across industry, research, and applied teaching. Third, partnerships to develop and exchange learnings, curricular resources, and best practices are needed to strengthen transdisciplinary linkages. Finally, although some competencies and skills are universal, others will need to be focused locally to meet unique community needs. Making sure sustainability curricula reaches and is informed by traditionally underserved communities, often the most impacted by climate change, will better enable success.

Some actions to support these goals include:

Strengthen sustainability programs through country-level networks and centers of excellence

To drive change at scale, institutions around the world need support to establish or grow their sustainability education programs. This includes addressing the need for faculty training and the integration of sustainability content across the curriculum. This need is particularly pressing in resource-constrained countries and ones with a smaller base of scientific support and research institutions. Building a strong network of institutions that can support each other in growing their programs is one potential solution. Several countries have already developed these networks through programs such as the **UN Sustainability Development Network**. These networks support the advancement of institutions in the country by functioning as resource hubs for sustainability education.

A related model is to develop Centers of Excellence with expertise in sustainability higher education. As an example, the Association for the Advancement of Sustainability in Higher Education (AASHE) **Centers for Sustainability Across the Curriculum** program builds capacity for transdisciplinary education by increasing the availability and accessibility of faculty development opportunities related to sustainability. This enables students in various academic disciplines to engage in sustainability content in authentic ways.

It is also possible to focus centers of excellence for the purpose of ensuring a more inclusive sustainability workforce. In this model, the focus is on institutions that serve historically excluded populations or in areas with fewer resources. For example, the **NSF Centers of Research Excellence in Science and Technology** program provides support to enhance the capabilities of minority-serving institutions in areas of national significance in science and engineering research. This includes commitments to address issues of recruitment and retention of historically excluded populations. A similar program could be developed with a focus on sustainability education.

Build and strengthen international professional forums and communities of practice

Professional forums can also help address differences in resources and capacity for this work among countries and variance in engagement of the private sector in green jobs education.[32] More systematic collaboration between higher education institutions offering advanced sustainability programs and those with less advanced programs can lead to more equitable access to sustainability education and can support the development of curriculum and tools to address local needs. This will also help drive greater integration of sustainability education and application of sustainability skills to real-world problems.[33] Such forums could enable collaboration on global sustainability challenges, transnational research sponsorship, industry exchange programs, and programs focused on recruiting and retaining historically excluded populations. The **UN HESI Education for Green Jobs Initiative**, for example, is focused on enhancing communication between employers and educators to further align curriculum to workforce needs. Another example is the **Mainstreaming Environment and Sustainability in Africa (MESA) Universities Partnership**, which currently has a membership of more than 85 universities in Africa.

Such projects should strive to increase the workforce relevance of academic programs, such as through industry participation in developing and evaluating curriculum to ensure alignment to workforce needs, planning for both core and interdisciplinary educational experiences and development of new case study applications for the classroom.

Provide real-world interdisciplinary learning opportunities for students

One of the most critical aims of post-secondary education must be preparing students for the sustainability workforce. That means integrating opportunities for real-world experience into the curriculum. The UN Global Guidance for Education on Green Jobs[34] recommends applied projects and applied research as high-impact learning opportunities. Potential tools to advance this aim include:

- **Virtualized workforce experience:** The private sector and academia can work together to create opportunities for students to engage in narrative driven, simulated sustainability challenges in virtualized business environments. The **NICE Challenge** is an example of this model in the cybersecurity domain. These challenges can be shared globally if they are delivered online, which would help students in regions with fewer real-world workforce opportunities.

- **Experiential learning/internships:** Experiential learning provides a valuable base for students to move into practical applications of sustainability knowledge. Given the scale of need, such programs can be structured to enable students to work on immediate applications. For example, internships or volunteer service learning could connect students to organizations that need help defining, measuring, and meeting their emissions goals. Such a program would provide a needed service to the organization while also providing critical practical experience for students. And such programs can be connected to recruiting mechanisms to bring diverse talent into the field. Programs such as the Global Sustainability Scholars program enable students and early-in-career professionals from underrepresented groups to work with leading scientists on critical sustainability challenges.[35]

- **Interdisciplinary research**: The National Socio-Environmental Synthesis Center has a program to foster and support interdisciplinary, team-based synthesis research specifically for advanced graduate students, with the aim to develop a cohort of researchers committed to socio-environmental synthesis.[36]

To further the sustainability talent pipeline of the future, Microsoft commits to:

Curriculum and training for primary and secondary education: *Microsoft will provide new curricular and training materials including Minecraft Frozen Planet II. This adds to the Climate and Sustainability Subject Kit and Sustainability City learning map, available through Minecraft Education. Microsoft FarmBeats for Students provides students a hands-on experience to explore how big data, AI, and machine learning apply to real-world sustainability challenges. Finally, Microsoft will join UNESCO's* ***Greening Education Partnership*** *to deliver strong, coordinated action that will empower learners with the skills required for inclusive and sustainable economic development.*

Capacity building in post-secondary education: *Microsoft will join the international research partnership* ***MECCE*** *(Monitoring and Evaluating Climate Communication and Education Project) to support the implementation, monitoring and reporting of sustainability education worldwide. Additionally, we will partner with the* ***Association for the Advancement of Sustainability in Higher Education****, providing support to its* ***Centers for Sustainability Across the Curriculum program****.*

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33. Strengthening Sustainability Programs and Curricula at the Undergraduate and Graduate Levels | National Academy of Sciences

34. Global Guidance for Education on Green Jobs | UN Environment Programme

35. Strengthening Sustainability Programs and Curricula at the Undergraduate and Graduate Levels | National Academy of Sciences

36. Strengthening Sustainability Programs and Curricula at the Undergraduate and Graduate Levels | National Academy of Sciences