CORPORATE CLIMATE TARGET SETTING, ACTION AND GLOBAL COLLABORATION TOWARDS A NET-ZERO FUTURE

ACCELERATE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT THROUGH GLOBAL DEVELOPMENT INITIATIVE
This white paper is produced as part of a series of publications to implement the UN Global Compact China Strategy.
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The world today is facing unprecedented global challenges including recovery from COVID-19 pandemic, climate change, conflicts, rising poverty and hunger, and structural inequalities between and within countries. Among all, the current climate crisis is one of the most urgent issues to take action on since we are already perilously close to hitting the 1.5-degree limit that science tells us is the maximum level of warming to avoid the worst impacts of climate change.

Climate action is also in the best economic and commercial interests of governments and commercial, public, and private enterprises. Reducing carbon emissions can go hand-in-hand with economic development. Climate-responsible economies that invest in renewable energy will increase their wealth in a way that is lasting and equitable. It will help them remain more stable in the face of other crises in health, migration, and the economy.

At this inflection point in history, the United Nations welcomes innovative global initiatives by any Member State that marshal ideas, capacities, and resources in support of the 2030 Agenda for Sustainable Development, including the Global Development Initiative (GDI). As the UN Secretary-General António Guterres stressed, “we are fast approaching the mid-point of the time available to reach the Sustainable Development Goals” but the “progress is in peril” and “discussions through the Global Development Initiative can help move the needle on development progress across all countries”.

The United Nations also acts as a bridge for global collaboration between the public and private sectors. The Science Based Targets initiative (SBTi) is a notable example of our collaborative mechanism to drive ambitious corporate climate action by enabling organizations to set science-based emissions reduction targets so that we can achieve a thriving economy in harmony with the natural world that sustains us all. As businesses are major contributors to greenhouse gas emissions and at the same time a crucial source for financing and expertise, we call for more private sector players to take credible corporate action towards net-zero through validated science-based targets (SBTs).
I am happy to see that this report occurs at this critical time with not only theoretical elucidation on the global macro environment and the corporate climate targets setting standards, but also introduction on the current progress in focused industries and proposals on key Net-Zero initiatives in operations and in value chain. Most importantly, this report illustrates existing best practices of corporate forerunners in different industries across the globe — these global best practices not only benefit the world, but also demonstrate that credible corporate action based on climate science towards net-zero is possible.

While much has been achieved, much remains to be done. We need more and eventually all companies in every continent, every country, and every city, to join us on this journey to take credible and ambitious climate action.
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<td>ACWI</td>
<td>All Country World Index</td>
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<tr>
<td>ADM</td>
<td>Archer Daniels Midland</td>
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<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
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<td>AIoT</td>
<td>Artificial Intelligence of Things</td>
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<tr>
<td>API</td>
<td>Application Programming Interface</td>
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<tr>
<td>ASEAN</td>
<td>Association of Southeast Asian Nations</td>
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<td>AU</td>
<td>African Union</td>
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<td>CAA</td>
<td>Climate Ambition Accelerator</td>
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<td>CBAM</td>
<td>Carbon Border Adjustment Mechanism</td>
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<td>CCA</td>
<td>Clean Competition Act</td>
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<td>CCER</td>
<td>China Certified Emission Reduction</td>
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<td>CCUS</td>
<td>Carbon Capture, Utilization and Storage</td>
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<td>CO₂e</td>
<td>Carbon Dioxide equivalent</td>
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<td>COFCO</td>
<td>China National Cereals, Oils and Foodstuffs Corporation</td>
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<tr>
<td>COP</td>
<td>Conference of the Parties of the UNFCCC</td>
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<td>DESA</td>
<td>The United Nations Department of Economic and Social Affairs</td>
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<tr>
<td>EPEAT</td>
<td>Electronic Product Environmental Assessment Tool</td>
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<tr>
<td>ESG</td>
<td>Environmental, Social, and Corporate Governance</td>
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<td>ETS</td>
<td>Emissions Trading System</td>
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<td>EU</td>
<td>European Union</td>
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<tr>
<td>EV</td>
<td>Electric Vehicles</td>
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<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<td>FLAG</td>
<td>Forest, Land, and Agriculture</td>
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<tr>
<td>FY</td>
<td>Fiscal Year</td>
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<td>GDI</td>
<td>Global Development Initiative</td>
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<td>GHG</td>
<td>Greenhouse Gases</td>
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<td>GW</td>
<td>Gigawatts</td>
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<td>GWP</td>
<td>Global Warming Potential</td>
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<td>HFC</td>
<td>Hydrofluorocarbons</td>
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<td>HPE</td>
<td>Hewlett Packard Enterprise Company</td>
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<td>ICT</td>
<td>Information and Communication Technology</td>
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<td>IMF</td>
<td>International Monetary Fund</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>IoT</td>
<td>Internet of Things</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>ITN</td>
<td>IT&amp;Networks</td>
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<tr>
<td>LAR</td>
<td>Linear Annual Reduction</td>
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<td>LCA</td>
<td>Lifecycle Assessment</td>
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<tr>
<td>LTS</td>
<td>Low-Temperature Soldering</td>
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<td>MEG</td>
<td>Mono Ethylene Glycol</td>
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<td>MSCI</td>
<td>Morgan Stanley Capital International</td>
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<td>MW</td>
<td>Megawatts</td>
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<td>OBP</td>
<td>Ocean Bound Plastic</td>
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<td>PC</td>
<td>Personal Computer</td>
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<td>PCC</td>
<td>Post-Consumer Recycled Content</td>
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<td>PCR</td>
<td>Post-Consumer Resin</td>
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<td>PET</td>
<td>Polyethylene Terephthalate</td>
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<td>PHA</td>
<td>Polyhydroxyalkanoate</td>
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<td>PHEV</td>
<td>Plug-in Electric Hybrid Vehicles</td>
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<td>PP</td>
<td>Polypropylene</td>
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<td>PPA</td>
<td>Power Purchase Agreement</td>
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<td>PUE</td>
<td>Power Usage Effectiveness</td>
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<td>PV</td>
<td>Photovoltaic</td>
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<td>RE</td>
<td>Renewable Energy</td>
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<td>SBT</td>
<td>Science-Based Target</td>
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<td>SBTi</td>
<td>Science Based Targets initiative</td>
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<td>SDGs</td>
<td>Sustainable Development Goals</td>
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<tr>
<td>SDK</td>
<td>Software Development Kit</td>
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<td>SE</td>
<td>Schneider Electric</td>
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<td>SER</td>
<td>Social and Environmental Responsibility</td>
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<td>SME</td>
<td>Small and Medium-Sized Enterprises</td>
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<td>TMT</td>
<td>Technology, Media, and Telecommunications</td>
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<td>TPI</td>
<td>Transition Pathway Initiative</td>
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<td>UNDP</td>
<td>The United Nations Development Programme</td>
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<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>UNFCCC</td>
<td>The United Nations Framework Convention on Climate Change</td>
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<td>UNIDO</td>
<td>The United Nations Industrial Development Organization</td>
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<tr>
<td>UNITAR</td>
<td>The United Nations Institute for Training and Research</td>
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<tr>
<td>US</td>
<td>The United States of America</td>
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<tr>
<td>VMS</td>
<td>Video Management System</td>
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<td>WELL</td>
<td>The WELL Building Standard</td>
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<tr>
<td>WMO</td>
<td>World Meteorological Organization</td>
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<td>WRI</td>
<td>World Resources Institute</td>
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<td>WWF</td>
<td>World Wide Fund for Nature</td>
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<td>XDC</td>
<td>X-Degree Compatibility</td>
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<tr>
<td>ZELP</td>
<td>Zero Emission Livestock Project</td>
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Executive Summary

The world is calling for immediate and collective action towards a universal climate goal, outlined in the Paris Agreement. As of November 2022, 195 parties had signed the agreement to work together to limit increases in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit temperature increases to 1.5°C above pre-industrial levels (UN, 2022). However, as the COVID-19 pandemic and geopolitical instabilities stall progress in climate actions, it is imperative that we mobilize the resources around us, at an unprecedented scale.

Working with top talents from around the world, the United Nations is taking urgent actions to standardize guidelines for achieving Net-Zero, creating a platform of global collaboration. China takes the lead in fostering a conducive environment for global collaboration through proposing the Global Development Initiative (GDI), with a series of initiatives surrounding eight key areas including climate actions. A just transition to a Net-Zero future requires bold actions from all parties, and corporates are an indispensable force. The key to success is knowing “where to go” — setting climate targets, and “how to get there” — implementing Net-Zero initiatives.

To set climate targets, corporates first need to imagine their final destination. Many international organizations such as the Intergovernmental Panel on Climate Change (IPCC) and the Science Based Targets initiative (SBTi) have paved the way by defining Carbon Neutrality and Net-Zero in a scientific context. To ensure corporates fulfill their commitments, SBTi maps out the journey based on sector and corporate types for both near and long-term, striving to align with the 1.5°C climate goal and reach Net-Zero before 2050. Among existing target setting standards, SBTi is the most widely adopted and impactful international standard, having covered 35 per cent of global market capitalization with committed corporates. As of October 12, 2022, 71 companies in mainland China have committed to SBTi, and eight companies and 24 SMEs have approved SBTi targets. Going forward, we expect to see an increase in participation from Chinese companies due to three main reasons: climate awareness campaigns from international organizations, the influence of climate pioneers in value chains, and the transition to sustainable growth.

Implementing Net-Zero initiatives both in operations and in the value chain is essential to positioning the corporate for long-term climate advantage and lasting business and social impact. This white paper proposes three key Net-Zero initiatives in operations and nine in value chain, grouped into three general directions:

In operations

1) Increasing the share of renewable energy (RE)
2) Improving energy efficiency
3) **Recovering energy from production waste**

**In value chain**

- **Climate-friendly supply chain management**
  1) Optimizing raw-material procurement
  2) Evaluating and tracking suppliers’ climate performance
  3) Optimizing packaging design
  4) Decarbonizing transportation and storage

- **Climate collaboration with ecosystem partners**
  5) Setting emission reduction targets together with ecosystem partners
  6) Co-developing decarbonization technologies with ecosystem partners
  7) Establishing a climate change fund

- **Product innovation and recycling**
  8) Developing and launching green/low-carbon products/services/solutions
  9) Promoting a circular economy

The white paper illustrates the best practices of forerunners for corporates to reach Net-Zero, based on an extensive study of 74 corporates in three industries — food and agriculture, manufacturing, technology, media and telecommunications (TMT) — spanning Asia, Europe, Africa and the Americas and featuring 49 members of UN Global Compact and 32 corporates from mainland China.

In the center of these initiatives stand technological innovations. In addition to the nine emerging climate technologies detailed in the *Corporate Net-Zero Pathway* report published in July 2021, this white paper points out two prospective areas where we have witnessed continuous technological innovation: **AIoT-based energy and carbon emissions management solutions** and **regenerative agriculture**. Cemented in these areas is a latticework of global collaborations, in which different industries contribute their best, working together towards one climate goal.

As the GDI, among many global programs, continues to foster climate actions on a global scale, we believe clear and scientific Net-Zero initiatives, in line with the Ten Principles of the UN Global Compact, will help corporates accelerate the realization of the Sustainable Development Goals (SDGs).
1. Global Macro-Environment

1.1 The Call to Action

The world is undergoing profound changes unseen in a century. The COVID-19 pandemic has upended almost every aspect of our lives, jeopardizing the progress towards the 17 SDGs outlined in the United Nations (UN) 2030 Agenda (UN, 2022). In the meantime, global economic growth is slowing down, pointing to signs of a recession (IMF, 2022). Amid these challenging times, the exacerbating climate crisis continues to remind us of the criticality and urgency of climate action. According to a new climate update issued by the World Meteorological Organization (WMO), there is still a 50 per cent chance the global annual mean temperature will rise beyond 1.5°C above pre-industrial levels in at least one of the next five years (WMO, 2022). This year, we have again witnessed the disastrous ramifications of global warming, with rising billion-dollar disasters and widespread upheaval of extreme weather events (The Washington Post, 2022), including scorching heat waves and flooding.

To ensure the global community fulfills its Net-Zero pledges and continues on the pathway of sustainable development, the entire UN system has taken speedy and proactive measures. UN Secretary-General António Guterres initiated the first Expert Group on Net-Zero to develop stronger and clearer standards for Net-Zero emissions pledges by non-state entities, addressing criteria and standards, the process of verification and accounting, and a road map to translate into regulations. He also appointed Simon Stiell as the new Executive Secretary of the United Nations Climate Change Secretariat (UNFCCC, 2022).

While developed countries primarily focus on climate change mitigation, developing countries prioritize adaptation to buffer against climate risks. Adaptation and mitigation, when implemented appropriately and timely, boost the resilience of corporates. Mitigation is defined as any human intervention that can either reduce the sources of GHG emissions or enhance their sinks (UNFCCC, 2008), which translates into decarbonization measures taken by corporates. Adaptation refers to the adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts (UNFCCC, 2022). For corporates, this means building the processes, practices, and structures to moderate potential damages resulting from climate change. Resilience is the collective vision in which “by 2050, we all live in a 1.5°C warmer world where all regions, countries, cities, businesses communities, and individuals thrive in the face of multiple risks, uncertainty, and threats posed by climate change (UNFCCC, 2016).” A resilient corporate will better absorb the shock of disasters, experience a speedy recovery, and flourish in the new circumstances, holding a significant competitive advantage over those who start late.
The UN Global Compact, We Mean Business, and the World Resources Institute (WRI) developed the concept “The Ambition Loop”, and pointed out that corporate efforts in building resilience cannot be accomplished without governmental support (UN Global Compact, We Mean Business, WRI, 2018). Major economies, following their Net-Zero pledges, are taking actions through legislation and policymaking to adapt to climate change and jointly mitigate the effects of global warming. Meanwhile, they are pushing ahead with investments in technologies that enable a green transformation, with a focus on digital technologies.

The European Union (EU) aims to be climate-neutral by 2050, a commitment proposed in the European Green Deal and enshrined in the European Climate Law (European Commission, 2022). The intermediate goal of reducing net GHG emissions by at least 55 per cent by 2030 is now the new strategic priority (European Commission, 2022). To achieve these targets, the EU began the revision of its climate, energy, and transport-related legislation and added new initiatives, together forming a series of proposals, known as the “Fit for 55” package. In June 2022, the Council reached a deal on the proposed “Fit for 55” in five areas:

- Effort Sharing Regulation: Setting goals and emissions trajectories of each member state.
- EU Emissions Trading System (ETS): Deeper and steeper cuts in emissions allowances and expansion of the scope to maritime shipping, aviation, buildings, and road transport sectors, with a Social Climate Fund to shield vulnerable populations from the transition.
- Carbon Border Adjustment Mechanism (CBAM): Expanding the measurement scope to include indirect emissions.
- Land Use, Land Use Change and Forestry: Building a larger carbon sink to achieve at least 310 million tons of CO₂e net removal by 2030 (Reuters, 2022).

The United States (US) has pledged to achieve a 50-52 per cent of net GHG emission reduction from 2005 levels in economy-wide in 2030 and reach net-zero emissions by 2050 (US Department of State, 2021). In January 2021, President Biden signed an executive order for the US to rejoin the Paris Agreement, placing climate action at the center of his domestic and foreign policy agenda (The White House, 2021). At COP26, the US and China issued the U.S.-China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s, committing to cooperate in a variety of climate initiatives, including monitoring and abating methane emissions (US Department of State, 2021). The Build Back Better Bill was proposed, which included about $555 billion dedicated to subsidizing the shift from fossil fuels towards clean energy sources (The White House, 2022). The Inflation Reduction Act was passed in August 2022, promising to invest $369
billion in energy security and climate change (Senate Democrats, 2022). Recently, US Senator Whitehouse and colleagues proposed the Clean Competition Act (CCA) as the American alternative to CBAM. Starting in 2024, the CCA would impose a carbon border adjustment fee on energy-intensive imports and domestic manufacturers (Sheldon Whitehouse and colleagues, 2022).

**China:** In 2020, Chinese President Xi Jinping announced that China would achieve a peak in carbon dioxide emissions before 2030 and carbon neutrality before 2060. Subsequently, the “1+N” policy framework was established, where “1” refers to the long-term approach to fighting climate change, and “N” refers to the specific solutions and measures to achieve the climate goal. To elaborate on the “N”, implementation plans were released for key areas such as energy, construction, and transportation, and for key sectors such as coal, iron, and steel, coupled with supporting measures in technology and finance. Notably, the State Council issued a roadmap for reaching peak emissions in 2030, detailing 10 key initiatives in transitioning to RE, supporting technological innovation, decarbonizing transportation and manufacturing, and promoting the circular economy (The State Council of PRC, 2021). Implementing the “N” requires a backbone of national standards and a talent pool — the Ministry of Ecology and Environment released standards of carbon emission allowance allocation, carbon emission rights registration and trading, and GHG emission measurement and disclosure (Ministry of Ecology and Environment of PRC, 2021), while the Ministry of Education issued a document to improve climate literacy and develop a system of talent training (Ministry of Education of PRC, 2022).

**Africa:** While Africa has contributed negligibly to the changing climate, with just about four percent of global emissions, it stands out disproportionately as the most vulnerable region in the world. This vulnerability is driven by the prevailing low levels of socio-economic growth in the continent (Global Carbon Atlas, 2022). The continent has realized the urgency to invest in climate adaptation, build the foundation for low-carbon development, and create local green manufacturing capabilities. To mobilize the private sector, the UN Global Compact has led CEOs in Africa to form the Africa Business Leaders Coalition and convene to discuss the blueprint for climate adaptation and building resilience against climate change.
1.2 The Role of the Global Development Initiative (GDI)

As our world is riven by geopolitical conflicts and instability, the UN has called for the urgent scale-up of global collaboration, in which climate is the most urgent breakthrough point (UN Affairs, 2021). Against this backdrop, Chinese President Xi Jinping proposed the Global Development Initiative (GDI) in 2021, focusing on eight key areas of development, including poverty reduction, food security, pandemic response and vaccines, financing for development, climate action and green development, industrialization, digital economy, and connectivity in digital-era (Ministry of Foreign Affairs of the PRC, 2022).

More than 100 countries from the EU, the Association of Southeast Asian Nations (ASEAN), and the African Union (AU) have announced their support for GDI. More than 50 countries across five continents have joined the Group of Friends of the GDI set up by China on the UN platform (Ministry of Foreign Affairs of the PRC, 2022). The GDI is also supported by UN Secretary-General António Guterres and UN organizations like the UN Global Compact, the United Nations Development Programme (UNDP), the United Nations Department of Economic and Social Affairs (UNDESA), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Industrial Development Organization (UNIDO), etc (Ministry of Foreign Affairs of the PRC, 2022). Under the GDI, China is leading global cooperation by establishing the Global Development and South-South Cooperation Fund, increasing investment in the China-United Nations Peace and Development Fund, and launching a global development knowledge network (Ministry of Foreign Affairs of the PRC, 2022).

Climate action and green development, as one of the eight key areas, directly affects the fundamental building blocks of human survival, including food security and housing. Collaboration in climate action on a global level, across industries and sectors, is a major driving force towards a better world.
1.3 The Importance of Corporate Climate Action

Corporates play a vital role in bridging the gap between high-level climate commitments and real change on the ground. As an important contributor to climate action, corporates urgently need to set targets and stay on track to fulfill them.

- **Corporates are the true executors of emission reduction.** While governments and international organizations are setting high-level targets and providing guidelines for the journey, corporates are the executors who design and implement decarbonization solutions. Through trial-and-error, corporates learn from their own experiences and other’s. Moreover, corporates also influence individuals, who drive change through initiatives such as shifting to a greener lifestyle.

- **Corporates provide timely and measurable feedback on government policies** and boost the confidence of governments in enacting climate-related legislation and policies in the future. For example, in response to the EU’s policies on clean energy, European companies voiced their demand for easier access to renewable electricity through a joint declaration. Encouraged by the demand, EU policymakers set a higher clean energy target and removed barriers for corporate Power Purchase Agreements (PPAs) in the post-2020 Renewable Energy Directive (UN Global Compact, We Mean Business, WRI, 2018).

For corporates, committing to Net-Zero comes with five benefits — strengthened brand reputation, boosted investor confidence, stronger resilience against regulations, increased innovation, and increased bottom-line savings (Galvin, 2018).

- **Strengthened brand reputation:** The increasing awareness of climate change among customers is reflected by the strengthened brand reputation of a company’s climate performance.

- **Boosted investor confidence:** As investors make more environmentally conscious bets on the future, corporates with a clear climate commitment tend to stand out among others.

- **Stronger resilience against regulations:** Having a forward-looking climate commitment prepares the corporate to ride the waves of uncertainty in regulations, e.g., carbon taxes, energy consumption controls, etc.
- **Increased innovation**: Emission targets are becoming a driving force of innovation, inspiring the creation of low-carbon/zero-carbon products.

- **Increased bottom-line savings**: Corporates, which taking climate actions proactively, are beginning to see savings from more efficient operations and will achieve significant savings by avoiding/minimizing carbon tax exposure.
2. Corporate Climate Target Setting Standards

“Net-Zero” and “Carbon Neutrality” are two commonly used terms reflecting the same intention, i.e., neutralizing the impact of human activity on the climate system (CDP, 2019). The Intergovernmental Panel on Climate Change (IPCC) defines the scope of climate forces (elements that force change in the climate) for each of the two terms (IPCC, 2018) (Exhibit 1). Based on this, the Science Based Targets initiative (SBTi), launched by CDP, the United Nations Global Compact (UN Global Compact), World Resources Institute (WRI) and the World Wide Fund for Nature (WWF), further defines corporate Net-Zero as — one, reducing scope 1, 2, and 3 emissions to zero or to a residual level that is consistent with reaching net-zero emissions at the global or sector level in eligible 1.5°C-aligned pathways; and two, neutralizing any residual emissions at the net-zero target year and any GHG emissions released into the atmosphere thereafter. (SBTi, 2021). Given the more rigorous requirements from Net Zero, if a company reaches Net-Zero, it automatically achieves Carbon Neutrality.

<table>
<thead>
<tr>
<th>Term</th>
<th>Scope of climate forces</th>
<th>Definition from IPCC SR15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon neutrality or Net-Zero CO₂ emissions</td>
<td>CO₂ emissions</td>
<td>Achieved when anthropogenic CO₂ emissions are balanced globally by anthropogenic CO₂ removals over a specific period.</td>
</tr>
<tr>
<td>Net-Zero emissions</td>
<td>All GHG emissions*</td>
<td>Achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specific period. If multiple greenhouse gases are involved, the quantification of net-zero emissions depends on the climate metric chosen to compare emissions of different gases (such as global warming potential, global temperature change potential and others, as well as the chosen time horizon).</td>
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</table>

* The GHG Protocol requires inclusion of all the GHGs required by the UNFCCC/Kyoto Protocol at the time a corporate or product inventory is being compiled: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆), and nitrogen trifluoride (NF₃).

Source: IPCC SR15; BCG Analysis.

Exhibit 1. Definitions of climate-neutrality-related terms from IPCC

Countries adopt different terms in setting their Net-Zero commitments in law, proposed legislation or national policy documents. When setting Net-Zero targets, corporates need to follow the specific standards released by the countries where they are operating, and then strive for international standards in order to obtain global recognition. Several existing international standards, such as those of the SBTi, PAS 2060, Transition Pathway Initiative (TPI), X-Degree Compatibility (XDC) and the SME Climate Hub, allow corporates to
determine their Net-Zero or Carbon Neutrality targets. Meanwhile, some international organizations are trying to develop new standards to form part of the roadmap towards Net-Zero or Carbon Neutrality. For example, after publishing detailed carbon footprint accounting standards, the International Organization for Standardization (ISO) is developing a certification standard for carbon neutrality (ISO/CD 14068).

Among existing target setting standards, SBTi, aligned with the Paris Agreement 1.5°C pathways, is the most widely adopted international standard. SBTi reviews estimates of the remaining emissions budget, top-down mitigation scenarios, and sectoral studies to determine 1.5°C-aligned pathways at the global and sectoral levels. Its 1.5°C-aligned pathways stay within the 500 GT global carbon budget and aim to reduce emissions at least 90 per cent by 2050 from 2020 levels and neutralize the remaining emissions with qualified carbon removals. On the way to Net-Zero, SBTi encourages corporates to set near-term science-based targets (SBTs) (five to ten year emission reduction targets in line with 1.5°C pathways) and long-term SBTs (to reduce emissions to a residual level in line with 1.5°C scenarios by no later than 2050) (SBTi, 2021). SBTi categorizes eligible organizations into three types:

- **Companies.** Eligible organization that is not a subsidiary and does not operate in the financial sector or oil and gas sector, with 500 or more employees;
- **Financial institutions.** Eligible organization that operates in the financial sector;
- **Small and Medium-sized Enterprises (SMEs).** Defined as a non-subsidiary, independent organization with fewer than 500 employees, not including financial institutions or oil and gas companies.

In this white paper, we will address all eligible organizations as corporates. **As of October 12, 2022, the SBTi joiners reached 3,821 total (2,004 committed and 1,817 approved), among which 1,399 has specific Net-Zero commitments. The SBTi committed corporates cover 35 per cent of global market capitalization.** Meanwhile, more than 27 per cent of the global corporates with potentially high impact on climate have been covered by the SBTi, surpassing the 20 per cent threshold which SBTi regards as a critical mass for promoting the SBTi standard within a sector or geography. In terms of progress towards carbon reduction, SBTi-approved corporates have achieved an 8.8 per cent linear annual reduction (LAR) in Scope 1 and 2 emissions since their target setting year, twice as fast as the 4.2 per cent LAR required by SBTi (SBTi, 2022).

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1. Organizations that are not NGOs or public organizations.
2. Companies in the oil and gas sector must wait for upcoming guidance in order to submit targets for validation.
3. Global market capitalization, which equals to around $110 trillion by December 31, 2021, is estimated based on the MSCI ACWI Index retrieved from Bloomberg. Market capitalization data of SBTi companies was retrieved from Bloomberg with a date of December 31, 2021 (data could be retrieved for 53 per cent out of 2,253 companies). Refer to SBTi Progress Report 2021 for more information.
In Mainland China, 71 companies have submitted commitment letters to SBTi, including Alibaba, China Shengmu, Chalco Ruimin Co., Ltd., Envision Group, Jinko Solar, Qingdao Haier Special Freezer, and Yili Group; eight companies and 24 SMEs had their targets approved by SBTi as of October 12, 2022. Among the companies are industry leaders such as Lenovo, JD Logistics, and Shanying, all of which are driving the decarbonization of the entire value chain, extending their influence beyond operational boundaries. Lenovo is committed to reducing Scope 1 and 2 GHG emissions by 50 per cent by Fiscal Year (FY) 2029/30, while reducing Scope 3 emissions by 25 per cent in the use of sold products, purchased goods and services, and upstream transportation and distribution. JD Logistics committed itself to reducing Scope 1, 2, and 3 GHG emissions by 50 per cent and increasing the sourcing of renewable electricity to 100 per cent by 2030, in conjunction with the goal that half of their suppliers commit to SBTi by 2025. Shanying plans to reduce Scope 1 and 2 GHG emissions to 39 per cent and Scope 3 to 20 per cent of the 2020 base year per metric ton of paper and packaging by 2030. It is important to note that if a company’s relevant Scope 3 emissions are 40 per cent or more of total Scope 1, 2, and 3 emissions, it is required to set a Scope 3 target, which could be achieved through encouraging upstream suppliers to commit to SBTi, aligning with the well-below 2°C ambition (2.5 per cent LAR) at the minimum (SBTi, 2021).

We have seen that other companies with targets approved by SBTi — Dongguan City O.T. Composite, Guangzhou Battsys, Salcomp, Yingyang Aroma Chemicals, and Zhejiang Arcana — are potentially influenced by their downstream key clients due to this requirement, besides their own endeavor in climate actions.

The pool of participants in mainland China is relatively small mainly due to two reasons. First, most Chinese corporates are still not aware of SBTi. Second, for those corporates that are aware, most are still in the stage of rapid development and capacity expansion, and the SBTi’s 4.2 per cent LAR requirement may constitute a big challenge. In the future, we expect to see an increase in Chinese participants in SBTi, thanks to driving forces from all sectors of society. International organizations, notably UN Global Compact, CDP, and WWF, are mobilizing resources to strengthen climate awareness and train corporates on the steps needed to align their climate goals with SBTi. Corporates, in turn, are playing increasingly constructive roles and leading by example, both in decarbonizing their own operations and in urging upstream and downstream ecosystem partners to prioritize climate action. More corporates are transitioning from robust expansion to a more mature stage of sustainable growth, which leads to stabilization of GHG emissions and increasing viability to follow through with scientific climate commitments.

4. M stands for UN Global Compact members as of August 31, 2022.
5. SBTi stands for companies whose targets have been approved by SBTi, as of August 31, 2022.
3. Science Based Target Setting Progress in the Three Focused Industries

GHG emissions come from various industries, among which food and agriculture, manufacturing and TMT deserve particular attention. On the one hand, these three industries are key to driving the sustainable development of human society in the post-pandemic era: the food and agriculture industry ensures food security; the manufacturing industry provides essential materials for life and production; and the TMT industry promotes digital transformation and technological innovation. On the other hand, the value chain of these three industries spans a wide variety of upstream and downstream sectors, so the emissions from them account for more than half of the global total GHG emissions:

- **Food and Agriculture:** Before bring to the table, food goes through farming or fishing, processing, packaging, distribution, and retailing. While farming activities are usually the biggest emitters, every step in the value chain generates GHG emissions, which comprise 20 to 25 per cent of the global total GHG emissions.

- **Manufacturing:** The manufacturing industry takes raw material inputs from upstream sectors, such as mining and petrochemicals, and makes them into various industrial goods like iron, steel, electronic equipment, paper, chemicals, and aviation. Those goods are then shipped and used by consumers or in different downstream sectors such as construction and transportation. As a result of its long and complex value chain, manufacturing emissions are the biggest among all industries, accounting for 25 to 30 per cent of total global GHG emissions.

- **TMT:** The TMT industry includes technology hardware and services, media, and telecommunications. Its upstream typically consists of component and equipment providers. Its downstream is spread across the consumer and industrial sectors, as digitalization is becoming prevalent in all industries and aspects of consumers’ lives. Although the emissions of TMT only make up 2 to 4 per cent of the global total GHG emissions, it is a crucial driver in GHG emissions mitigation, which impacts all other industries.

While the SBTi Corporate Manual provides a detailed step-by-step guide for most industries, companies must also align SBTs with the requirements established through sector development work approved by the SBTi:
Food and Agriculture: SBTi launched the Forest, Land, and Agriculture (FLAG) Science Based Target Setting Guidance on September 28, 2022, which is the world’s first standard for companies in land-intensive sectors to set SBTs. From April 2023 onwards, companies that meet FLAG criteria are required to disclose FLAG and non-FLAG emissions separately and set separate targets. FLAG abatement (like biogenetic removals) cannot be used to meet non-FLAG abatement targets. The FLAG SBTs can follow the FLAG commodity approach, while the non-FLAG SBTs shall comply with the cross-sector target setting guidance.

Manufacturing: The SBTi is developing sector-specific guidance for the steel, chemicals, and aluminum sectors, while other sectors can follow the cross-sector guidance. The Cement Science Based Target Setting Guidance was published in September 2022, addressing a dedicated cement pathway due to its process emissions from limestone calcination that differ from other sectors. The guidance for the Steel sector is being drafted and expected to launch in April 2023 officially. For the chemicals sector, SBTi is still reviewing available sector resources and plans to publish the guidance before 2024. The guidance for the aluminum sector is still at its earliest scoping phase to identify challenges for aluminum companies when applying the cross-sector approach.

TMT: In early 2020, the SBTi published guidance for Information and Communication Technology (ICT) companies to set science-based emissions reduction targets. This guidance offers a simplified absolute contraction approach for the mobile network operators, fixed network operators and data centre operators.

In these three industries above, corporates in all countries have been actively setting Net-Zero targets. As of October 12, 2022, 1,346 corporates in these three industries had committed to setting an SBT or have had their climate targets approved, among which 501 corporates also have long-term Net-Zero commitments. Participants from these three industries accounted for more than one-third of total SBTi participants. These corporates offer many advanced practices in promoting and facilitating carbon neutrality in their value chain that other corporates can learn from.

6. Companies from the FLAG-designated sectors and companies in any other SBTi-designated sector with more than 20 per cent revenues or emissions come from FLAG-related areas. Refer to FLAG Science Based Target Setting Guidance FLAG-C1 by SBTi for more details.
4. Corporate Climate Action and Global Collaboration

4.1 Food and Agriculture

Meeting a fundamental human need, the food industry is essential for the health and well-being of humanity. The agricultural activities set the foundation for this industry. Forest and land use is a large source of GHG emissions, and global food consumption is expected to grow by up to 70 per cent in the next few decades due to the growing global population and changes in dietary structure in favour of high meat diets (European Environment Agency, 2015). Reducing carbon emissions while meeting the needs of the growing human population, therefore, presents a major dilemma for the industry.

A company’s position on the value chain usually determines its main source of emissions. Companies which operate or own farms (such as raising animals or growing crops) mainly produce emissions from land use and farming activities (more than 60 per cent of total emissions). For food manufacturers sourcing ingredients from suppliers or farming contractors, about 90 per cent of their total emissions come from Scope 3 activities, including ingredient sourcing, packaging and logistics.

We have seen four directions that global leading food and agriculture companies are taking on their path to reaching Net-Zero.

1. Production process decarbonization

Production process is where most food and agriculture companies can have a direct impact and control. Therefore, it is usually the starting point in a company’s Net-Zero journey.

- Increasing the share of renewable energy (RE): With close-to-zero emissions, RE can significantly reduce Scope 1 and 2 emissions compared with fossil fuels. As methane (CH₄) released from manure management is one of the biggest emission sources in this industry, methane recovery plays a crucial role in food and agriculture companies’ efforts to increase the use of RE. China Modern Dairy was one of the first companies...
to install anaerobic manure management systems in China. Its anaerobic manure management system releases at least 40 per cent of CH₄ less than other traditional systems like liquid storage, solid storage and composting. Most CH₄ generated from the system is collected as biogas and used to replace fossil energy. In 2021, biogas energy accounted for 60 per cent of China Modern Diary’s total energy consumption and helped avoid 290,000 tons CO₂e of GHG emissions from coal firing (China Modern Dairy, 2022). Also, companies can deploy on-site photovoltaic (PV) panels, replace fossil fuels with biofuels, or sign PPAs with RE providers to further increase the use of RE. By 2021, Mengniu Group, one of China’s leading dairy producers, had installed 15 MW PV panels across its plants, generating 8,698,000 kWh of electricity per year. Furthermore, for production purposes, Mengniu uses biomass fuels and biogas pellets generated from its wastewater treatment system to fuel the steam boilers instead of using coal or natural gas, which generates 290,000 tons of steam every year. As a result, the total share of RE reached 10 per cent by the end of 2021, leading to an emission reduction of 80,000 tons of CO₂e (Mengniu Group, 2022).

**Improving energy efficiency:** Enhancing energy efficiency reduces companies’ total energy consumption, leading to lower Scope 1 and 2 emissions. Archer Daniels Midland (ADM), a global premier agricultural origination and processing company, implemented more than 75 energy-saving projects across its business units, expecting to reduce energy use by 175,000 mWh. ADM also continued its global Energy Treasure Hunt program, through which it can identify additional energy reduction opportunities of about 177,000 mWh annually, such as heat recovery technology, waste heat optimization, and compressed air system improvements (Archer Daniels Midland, 2021). In FY 2021, General Mills completed 35 energy efficiency and reduction projects across its manufacturing facilities. By focusing efforts on common systems such as compressed air, lighting, and steam/hot water, these projects saved 4.1 million kWh of electricity and 58,000 MMBTU of natural gas, and avoided 370,594 tons of CO₂e (General Mills, 2022). Bunge, a global leading agribusiness and food production company, improved its energy efficiency through initiatives such as implementing heat reuse methodologies and updating performance systems, achieving a 6.7 per cent reduction in energy intensity compared to the 2016 baseline (Bunge, 2022). China National Cereals, Oils and Foodstuffs Corporation (COFCO), China’s leading food and agriculture company, carried out energy conservation and efficiency improvement initiatives in corn deep processing, including process optimization, boiler upgrades, energy-saving transformation of the steam system, waste heat recovery, energy efficiency improvement of the motor system, and industrial water saving. In 2020, the comprehensive energy consumption per 10,000 yuan of output value was cut by 67 per cent, and carbon emissions per 10,000 yuan of output value dropped by 68 per cent compared to 2005 (COFCO, 2022).
2. Climate-friendly supply chain management

As ingredient sourcing or production is the most prominent GHG-emitting activity, managing the supply chain and empowering suppliers to become climate-friendly is essential for food and agriculture companies.

- **Reducing emissions from land use and farming activities:** The enteric fermentation and manure of animal releases CH₄, while activities like fertilization and irrigation usually lead to the loss of carbon sinks in soil and the emission of nitrous oxide (N₂O). Notably, the 100-year global warming potential (GWP-100) of CH₄ and N₂O is rated at 27.9 and 273 respectively, further driving up the global warming impact from land use and farming activities. Therefore, leading food and agriculture companies have been promoting regenerative agriculture and developed a set of new techniques that improve and restore ecosystems. PepsiCo®⁷ helps farmers transition towards regenerative agriculture by assisting them in identifying and implementing adaptive practices such as cover crops to sequester CO₂ underground, no-till cultivation for minimal soil disturbance, and systemic crop-livestock rotation. By 2021, more than 345,000 acres of land were being farmed using regenerative farming practices, accounting for 5 per cent of PepsiCo’s total land use. On its demonstration farms in Thailand, PepsiCo implemented integrated pest and nutrient management and installed drip irrigation systems, increasing yields on average by 25 per cent and cutting GHG emissions by 23 per cent (PepsiCo, 2022). General Mills launched 115,000 acres of pilot programs across North America to advance regenerative agriculture. In addition to providing farmers with coaching, technical assistance, customized plans and workshops to facilitate the adoption of regenerative practices, General Mills also collaborated with numerous scientific organizations to conduct in-depth research on the impacts of these practices and to find the best path to expanding the program to 1 million acres of farmland by 2030 (General Mills, 2022).

- **Evaluating and tracking suppliers’ climate performance:** To truly raise the climate awareness of suppliers, especially small individual farms, many companies have started to add climate indicators to their evaluation of suppliers. At the same time as helping its suppliers become more aware of the threat of climate change and adopt sustainable practices, Nestlé® introduced climate-related criteria with its Responsible Sourcing Standard. The standard requires that Nestlé’s farmers must not convert new peat soils for agricultural purposes and avoid peat-related GHG emissions. The standard also encourages Nestlé farmers to have a year-round nutrient management plan, preferring the use of recycled organic materials, to minimize the run-off of nutrients and GHG emissions (Nestlé, 2018). Cargill® clearly states its expectation for suppliers in its Supplier Code of Conduct to strive to reduce environmental impact through efforts such as ending deforestation, minimizing GHG emissions and waste, and using resources efficiently (Cargill, 2022).

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⁷ GWP-100 is a measure of how much energy the emissions of one metric ton of a gas will absorb over 100 years, relative to the emissions of one metric ton of CO₂. According to IPCC AR6 7.SM.6, the GWP-100 of CH₄ and N₂O are 27.9 and 273 respectively. For more information, please consult [https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter07_SM.pdf](https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter07_SM.pdf)
3. Climate collaboration with ecosystem partners

Achieving Net-Zero requires the collective effort of players up and down the value chain, including research institutes, ingredient suppliers, technology and equipment providers, logistics companies, packaging manufacturers, retailers, and so forth.

- **Setting emission reduction targets together with ecosystem partners:** This is the first and fundamental step towards stimulating climate collaboration in the ecosystem. Given that approximately 85 per cent of its total GHG emissions come from purchased materials, The Coca-Cola Company\(^{\text{M SBTi}}\) has been providing suppliers with resources, tools, and knowledge to support their climate journey, as well as encouraging suppliers to respond to the CDP Supply Chain Climate Change questionnaire, for years. By 2021, 70 Coca-Cola suppliers had set SBTs and an additional 49 committed through SBTi to set near-term SBTs. In December 2021, the Coca-Cola system in Europe announced the goal of reaching Net-Zero across all European markets, and thus the entire European value chain, by 2040. This effort seeks a reduction of 30 per cent of CO\(_2\) equivalent annually in Europe by 2030 compared to 2015 (The Coca-Cola Company, 2021). Mengniu Group collaborates with its top two raw milk suppliers — China Modern Dairy and China Shengmu — to systematically audit their carbon emissions and set a shared goal of peaking emissions by 2030 and reaching Net-Zero by 2050 (Mengniu Group, 2022). In 2021, China Shengmu committed to setting the SBTi 1.5°C scenario and the Net-Zero target (SBTi, 2022).

- **Co-developing decarbonization technologies with ecosystem partners:** Technologies could make a critical difference in the agriculture industry and mitigate its climate impact. Cargill and the Zero Emission Livestock Project (ZELP) have partnered to bring European dairy farmers an innovative solution to reduce methane emissions, combining methane oxidation and data processing technology to minimize the environmental impact of dairy production while improving animal welfare. The “wearables” technology — a mask-shaped smart device that neutralizes methane from cattle burps — is currently undergoing testing and promises to decrease livestock methane emissions by up to 53 per cent (Cargill, 2021).
4. Product innovation and recycling

Besides all the efforts from the operational side, product design could fundamentally change a company’s emission structure.

- **Developing and launching green/low-carbon products:** Many leading companies are collaborating with research institutions and suppliers to develop innovative ingredients such as plant protein or lab-grown meat to avoid the heavy emissions from land use and farming activities. Bunge offers a wide range of plant protein ingredients from faba bean, pea, canola, and soy as substitutes for meats and dairy products. It enables its customers to develop plant-based meatballs, nuggets, burgers, cheese and ice cream that are as delicious and nutritious as their usual counterparts. By reducing the demand for meat and dairy, Bunge’s plant-based protein could effectively reduce carbon emissions from animal breeding activities (Bunge, 2022). Other companies have developed feed additives to alleviate methane emissions from animal breeding or developed chemicals like nitrogen inhibitors to reduce Nitrogen-loss from land use. Since 2017, Cargill has worked closely with its partner, Delacon, to understand how the composition of the feed given to livestock can improve cows’ gut health, which in turn significantly affects how much gas each animal emits. Natural phytogenic feed additives derived from herbs, spices and other plants are being scaled for global use to help farmers meet the demand for meat, milk and eggs while improving animals’ digestive health and reducing their environmental impact (Cargill, 2021). Another major area of innovation is replacing fossil fuels with biofuels, which are low-carbon products. COFCO pioneered the mass production of ethanol fuel through co-processing with alternative crops (crops other than corn), such as cassava, aged wheat, and aged rice. From 2016 to the end of September 2022, COFCO processed 11.5 million tons of alternative crops to produce 3.15 million tons of ethanol fuel, indirectly reducing the crude oil imports by nearly 1.5 million tons and emissions by 5 million tons of CO2e, 69 per cent lower than the emissions of regular gasoline when used as automobile fuel (COFCO, 2022).

- **Promoting a circular economy:** Some companies are switching to eco-friendly packaging that is recycled, recyclable and naturally biodegradable. As packaging accounts for approximately 30 per cent of its overall carbon footprint, Coca-Cola launched the World Without Waste initiative in 2018, focusing on eliminating package-related impact. Coca-Cola is redesigning its beverage packaging, setting lightweight, renewable, and recycled materials as its top priorities. By the end of 2021, 90 per cent of Coca-Cola’s beverage packaging was recyclable and 23 per cent used recycled materials for all packaging types (and 13.6 per cent for plastics), avoiding half a million tons of virgin plastic usage. Coca-Cola is also helping create a closed-loop recycling system globally by investing in recycling infrastructure and education programs. In 2021, 61 per cent of used bottles and cans were collected for refilling or recycling globally (The Coca-Cola Company, 2021). In China, Mengniu Group aims to cut 300 tons of emissions by applying Post-Consumer Resin (PCR) as outer packaging film for its products from 2023. Mengniu has also joined hands with its auxiliary material suppliers to replace traditional cartons with eco-friendly Polypropylene (PP) crates, which can be reused.
multiple times and leave a carbon footprint 57.5 per cent smaller than that of traditional paper cartons. It is estimated that the PP crates can replace up to 670 million paper cartons, indirectly reducing consumption of 103,000 tons of virgin paper, and reduce GHG emissions by 80,000 tons per year (Mengniu Group, 2022). Meanwhile, other companies are returning organic waste to the soil or feed. Ololo Farm, a small regenerative farm in Kenya, Africa, modelled a “farm to fork to farm” program where 50 per cent of food produced on the farm is consumed at the lodge and 100 per cent of the food waste is upcycled into high-value organic plant nutrients and animal protein for the farm. This circular food model helps reduce the farm’s carbon emissions by 50 per cent. The farm also collaborated with its supply chain partners to integrate Black Soldier Fly farming technology — using insects to transform organic waste into high-value protein. This initiative is expected to slash the farm’s GHG emissions by 90 per cent (Ololo Farm, 2022).
4.2 Manufacturing

Manufacturing is a major contributor to global GHG emissions. At the same time, the manufacturing industry is the infrastructure that connecting and underpinning many other industries’ upstream and downstream. Naturally, manufacturing companies have a large demand for raw materials, and products of this sector are ubiquitous in everyday life, from materials such as steel to end-user products like domestic equipment and cars. Therefore, corporates must realize that every action they take to counter carbon emissions is paramount to the survival of the planet, and they must adopt immediate measures to move toward their climate goals.

Raw-material supply (production, transportation, and storage), processing, and the use of finished products are the three highest-emission activities in manufacturing. Scope 1 and Scope 2 account for the majority of emissions, mainly from processing, including direct emissions from fossil fuel combustion, the use of refrigerants on site, and electricity. Emissions related to product processing account for roughly 40 to 60 per cent of the total reported emissions. In Scope 3, emissions related to raw materials and the associated logistics account for around 10 to 20 per cent of total reported emissions; downstream emissions (resulting from the use of sold products) account for another 10 to 20 per cent; both should be viewed as major decarbonization levers.

Manufacturing companies are encouraged not only to focus on reducing emissions in operations, but also to take the lead in driving decarbonization across the entire value chain. We have seen four directions that pioneers are taking on their way to reach Net-Zero:

1. Manufacturing process decarbonization

Manufacturing production lines involve heavy demand for energy consumption and high GHG emissions. Thankfully, leading players have discovered various measures to reduce emissions from operations.

- **Increasing the share of RE:** Purchasing green electricity via PPAs and RE certificates, and investing in constructing RE systems, are the most common approaches. LONGi and Jinko Solar, both world-leading PV system manufacturers, are members of RE100 and are committed to gradually increasing the share of RE to 100 per cent by 2028 and 2025, respectively. In 2021, LONGi’s share of renewable electricity reached 40.19 per cent, thanks to its implementation of a combination of on-site power generation facilities, purchases from third-party power generation facilities, and PPAs (LONGi, 2022). Jinko Solar operates three 100-per-cent RE factories in Leshan and Chuxiong in China, and Penang in Malaysia (Jinko Solar, 2022). KLabin, one of the largest paper and

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8. RE100 is the global corporate renewable energy initiative led by The Climate Group, bringing together hundreds of large and ambitious businesses committed to 100 per cent renewable electricity.
pulp producers and exporters in Brazil, sourced 89.5 per cent of energy from RE in 2021. The impressive progress was made possible by using low-carbon technologies such as biomass boilers, biomass gasification and crude tall oil plants, as well as the process efficiency improvements. The Puma unit, one of the two largest industry units of Klabin, is now self-sufficient by generating enough RE for its own operations and supplying the excess of 820,490 MW to the Brazilian energy matrix annually (Klabin, 2021).

- **Improving energy efficiency:** Applying new manufacturing technology is one of the many effective ways that manufacturing companies can improve energy efficiency. Eaton M SBTi, an intelligent power management company, implemented capital projects that conserve electricity through more efficient and automated manufacturing equipment and technologies as well as building envelope and system improvements, reducing energy use at manufacturing sites by 11 per cent from 2018 to 2022 (Eaton, 2021). Envision Group, a clean energy company in China, invested in technologies that increase energy efficiency in production. In 2021, Envision plants across the country achieved a carbon emission reduction of 13,000 tons CO2e, equivalent to 11 per cent of the group’s annual operating carbon emissions (Envision Group, 2022). Its peer, LONGi Solar, had installed energy management systems in eight of the 28 production facilities as of 2021, increasing the energy efficiency by 54 per cent compared to 2015 (LONGi, 2022). China Baowu Steel Group, one of the largest steel producers in China and in the world, is applying the best available technologies to increase efficiency along the steel production line in its subsidiary Baosteel, resulting in energy savings of 460,000 tons of standard coal in the past five years. Key measures included better interaction interface efficiency, a lower iron-to-steel ratio, and improved system capacity (China Baowu Steel Group, 2022).

- **Recovering energy from production waste:** This is a powerful initiative for decarbonization. Baowu, in its subsidiary Baosteel, successfully applied the sensible heat recovery technology of coke oven rising pipe waste gas and the deep recovery technology of sintering waste heat in 2020. Their technology readiness level reached the stage of operation and evaluation and have been promoted rapidly in the group (China Baowu Steel Group, 2022). Envision Group implemented a series of upgrades to the Jiangyin factory in 2021, including a waste heat recovery system for steam condensate in the coating oven (Envision Group, 2022).

2. **Climate-friendly supply chain management**

The upstream of the manufacturing industry involves intense GHG emissions from activities such as metal smelting. Selecting suppliers with climate advantage is only the first step; managing and empowering suppliers to become forerunners in climate action is essential to reducing Scope 3 emissions and enhancing the overall sustainability of the supply chain.

- **Optimizing procurement of raw materials:** Sourcing sustainable raw materials is essential for starting the product life cycle in a low-carbon way. Leading players often specify their sustainability requirements for raw materials along two dimensions — low
Electrolux, a Swedish home appliance manufacturer, initiated a significant shift in raw materials from iron-ore steel to scrap-based steel from 7 per cent in 2013 to 24 per cent in 2018, which has reduced the average annual carbon emissions per ton of steel from 2.1 to 1.7 tons of CO₂, and cut the annual CO₂ emissions by 251,000 tons. (Electrolux, 2018).

Evaluating and tracking suppliers’ climate performance: To improve the climate awareness of their suppliers, many companies have started to incorporate climate indicators into their suppliers’ code of conduct and/or evaluation criteria. The first step to evaluation is ensuring data transparency — requiring suppliers to provide primary data for analysis and auditing and disclose emission data on internationally recognized platforms such as the CDP. Eaton invites a subset of Tier 1 suppliers, chosen based on risk and spend, to disclose emissions data through the CDP Supply Chain Program. In 2021, Eaton scored an ‘A’ for supply chain supplier engagement from CDP with an increase in supplier engagement by 56 per cent (Eaton, 2021). The second step is evaluating the suppliers based on climate performance, in a risk-based approach. As of 2022, Klabin engages 56 per cent of critical suppliers in the Sustainable Supply Chain Management Program (Klabin, 2021), which evaluates and ranks suppliers through the EcoVadis methodology, with energy consumption and GHG as one of primary environmental criteria (EcoVadis, 2020). In 2022, Klabin upgraded the program to include an assessment of GHG emissions management maturity for all strategic suppliers, collecting and evaluating suppliers’ climate performance, including Scope 1, 2, and 3 emissions, SBTi status, and disclosure in CDP (Klabin, 2022).

3. Climate collaboration with ecosystem partners

Achieving Net-Zero takes the collective efforts of players across the entire value chain, including raw material suppliers, technology and equipment providers, logistics companies, etc.

Setting emission reduction targets together with ecosystem partners: The first step to galvanizing ecosystem-wide collaboration is committing to a common climate target. At its 2021 supplier conference, LONGi launched the “LONGi Green Supply Chain Decarbonization Initiative” with 150 suppliers, calling on supply chain partners to act on climate commitments. As an important upstream partner of LONGi, Asia Silicon joined the initiative and carried out renovation projects including waste heat recovery that saved steam consumption of 4.12 metric tons/hour of low-pressure steam, equivalent to 2.4 million kWh of electricity annually. Asia Silicon also replaced its electrolytic cells with energy-saving cells, which helped save 1.8 million kWh of electricity every year (LONGi, 2022). In 2021, Electrolux secured commitments from 281 top direct material suppliers (corresponding to 78 per cent of its direct material spend), as well as 14 global logistics companies (30 per cent of its total logistics spend), to disclose emissions and set targets through the CDP Supply Chain Program (Electrolux, 2020). Philips is helping suppliers decarbonize by integrating their climate commitments into Philips’ own climate KPI — encouraging at least 50 per cent of suppliers to join SBTi by 2025. Philips has created a pyramid framework to provide targeted support to suppliers in key areas,
such as training and on-site energy scans to help identify decarbonization bottlenecks. As of the first quarter in 2022, 35 per cent of its suppliers had joined SBTi (Philips, 2022).

**Co-developing and deploying decarbonization technologies with ecosystem partners:** Cutting-edge technologies accelerate climate progress. Plenty of decarbonization technologies has emerged over the years, and the deployment of these technologies could significantly moderate carbon emissions throughout the value chain. Eaton has a long history of working with ecosystem partners to develop new technologies in energy and transportation. In the realm of energy, Eaton joined the Breakthrough Energy Ventures to invest in the grid technology company, Reactive Technologies. The organization’s innovative GridMix technology can help address challenges around grid instability, which can occur with renewable energy sources, such as wind, solar and battery storage. In transportation, Eaton partnered with Ballard Fuel Cell Systems and the National Renewable Energy Laboratory to develop heavy-duty truck fuel cell technology. Eaton’s Twin Vortices Series (TVS) supercharger technology could improve the fuel cell efficiency (Eaton, 2021). In the iron and steel industry, leaders are uniting global talents. In 2021, China Baowu Steel Group announced the establishment of the Global Low-Carbon Metallurgical Innovation Alliance with industry partners and global ecosystem partners. Baowu also established a 50-billion-yuan Net-Zero Fund, with the first phase of 10 billion yuan, committing to funding the establishment of a green and low-carbon ecosystem and advancing the R&D and implementation of green technologies in the China steel industry (China Baowu Steel Group, 2022). Today, most of the hydrogen is generated from traditional fossil fuels, which leads to high GHG emissions in the production process. Hence, green hydrogen becomes another field of innovation in the spotlight. To tackle this problem, LONGi improved its technology to produce “green hydrogen”, by using RE in electrolysis. In 2021, Sinopec announced the first 10,000-ton green hydrogen demonstration project, the largest green hydrogen project in China and globally. LONGi is participating in this project and planning to install a 300 MW PV station which produces 618 million kWh of electricity per year, as well as an electrolysis water hydrogen production plant with an annual production capacity of 20,000 metric tons. It is expected that after completion in 2023, the plant will produce green hydrogen to partially replace the existing grey hydrogen production capacity, reducing emissions by 485,000 tons of CO₂e per year (LONGi, 2022).

4. **Product innovation and recycling**

Many products developed by the manufacturing sector are heavy carbon emitters themselves. Green and low-carbon product design could slash the carbon emissions generated from downstream product usage.

**Developing and launching green/low-carbon products:** Many leading companies are focusing on product design that minimizes carbon emissions throughout the product lifecycle. Revolutionary product design is a game-changer. BROAD Group developed a new type of building made from ultimate lightweight structural material—stainless steel B-Core slabs. Floor slabs made from stainless steel B-Core slabs and beams/
columns made from stainless steel sections together form the unique factory-made Holon Building. Holon Building is designed per Nearly-Zero Energy Building Standard and is equipped with various thermal insulation measures (22cm thermal insulated walls, 4-paned glass windows, exterior shades, interior shades, and fresh air with heat recovery), which makes the building 90 per cent more energy efficient than traditional ones (Broad Group, 2022).

Jinko Solar had sold more than 100GW of PV systems cumulatively as of the first quarter in 2022, producing 130 billion kWh of RE every year and reducing carbon dioxide emissions by about 130 million tons for customers, which is equivalent to the carbon emission from burning 52.52 million tons of standard coal, or the carbon capture from planting about 7.02 billion trees (Jinko Solar, 2022). In the field of energy management, Envision Group launched the AIoT\(^9\) operating system EnOS platform, a new generation of integrated solutions for production and marketing, with a suite of connectivity and device management tools and applications for decarbonization and digitalization, including asset monitoring, operational performance tracking, equipment health analysis based on big data and AI, wind and solar power forecasting, a smart energy trading terminal, source-grid-load-storage optimization, multi-source synergistic optimization etc., to continually promote the low-cost production of more RE. In the field of carbon emissions management, Envision Group developed the Envision Ark powered by the EnOS platform, an energy and carbon emissions management system based on AI, IoT, big data, and blockchain. It offers real-time carbon footprint monitoring, generates carbon emission reports, simulates and optimizes emission reduction pathways, and provides access to green electricity, RE certificates, carbon sink, CCER\(^{10}\) and other carbon credits, realizing carbon offset and compliance at the lowest cost, via one stop, and in a closed loop. As of 2022, the software has helped customers reduce and manage more than 1 billion tons of CO\(_2\)e (Envision Group, 2022).

**Promoting a circular economy:** A resource-efficient circular economy is critical to decarbonizing the entire value chain, mainly because it lowers demand for virgin materials and energy consumption in production. Corporates in B2B\(^{11}\) business are generally focused on diverting waste from landfill or traditional incineration through a variety of initiatives. NIO\(^{11}\), in collaboration with battery supplier Contemporary Amperex Technology Co., Limited (CATL), is pioneering EV battery recycling. NIO collects batteries through a network of battery swap stations, while CATL decomposes the batteries to recycle, reaching a 50 per cent comprehensive recycling rate in China (CATL, 2022). As a key subsidiary of CATL, Hunan Brunp is currently the largest recycling base for used batteries in China, with a total of more than 6,000 tons of used batteries recycled and processed annually (CnEVPost, 2021). B2C\(^{12}\) companies, on the other hand, have committed to increasing the recyclability of products and launching recycling programs.

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9. Artificial Intelligence of Things, the combination of artificial intelligence (AI) technologies and the internet of things (IoT) infrastructure.
10. China Certified Emission Reduction, emissions reduction activities conducted by companies on a voluntary basis that are certified by the Chinese government. Such activities include renewable power generation and waste-to-energy projects, as well as forestry projects.
12. B2C stands for business-to-consumer, as in business that takes place between a corporate and an end customer.
Electrolux experimented with circular concepts on several products, including the first bioplastic concept fridge made from recycled polyethylene that has an 80-per-cent lower carbon footprint than that of conventional plastics (Electrolux, 2018), and a vacuum cleaner made of 90-per-cent recycled materials originating from consumer electronic products. In 2021, Electrolux used 8,600 metric tons of recycled plastic in products and launched a “sustainable trade-in program” in Vietnam, enabling consumers to trade in their old washing machines for a discount on new ones (Electrolux, 2021).
4.3 Technology, Media and Telecom

The TMT industry has revolutionized the world, from the ways people communicate and do business to every aspect of life. An immense quantity of information is transmitted through the Internet every day, assisted by advanced technologies, and this electronic leviathan has become an indispensable piece of infrastructure for modern society.

Companies in the TMT industry are, in general, not heavy Scope 1 emitters — such emissions mainly come from the gasoline or diesel combustion in vehicles. For TMT companies, emissions from the supply chain and use of end-products can make up more than 90 per cent of the total emissions.

1. Production process and data center decarbonization

TMT companies have generally started their decarbonization efforts from their own factories and data centers.

- **Increasing the share of RE**: Electricity occupies the lion's share of TMT companies’ internal operational energy consumption. PPAs and RE certificates are the most common methods via which corporates gain access to green electricity. **Cogeco M SBTi**, a Canadian telecommunications and media company, increased RE consumption by 50 per cent by purchasing RE certificates and green utility tariffs in Virginia and Maine, and reduced Scope 1 and 2 emissions by 23 per cent in 2021, compared with 2019 (Cogeco, 2021). **Sopra Steria M SBTi**, a European tech consulting and software development company, achieved 99.2 per cent renewable electricity consumption in 2021 via purchasing electricity directly from suppliers and using either Guarantee of Origin certificates or International Renewable Energy Certificates (Sopra Steria, 2022).

- **Improving energy efficiency**: Many companies have reduced the energy consumption of their factories or on-site data centres. Some companies have installed advanced technologies, such as uniform computing infrastructure, customized blade servers, consolidated storage, and advanced power supply units. **Honor M**, a Chinese leading smart device provider, applied energy-saving concepts to the design of its Honor Intelligent Manufacturing Industrial Park in Shenzhen. The industrial park was installed with advanced energy monitoring and management systems, including the building automation system, chiller plant control system, and air compressor group control system. With the support of these systems, this site is expected to save more than 2 million kWh of electricity per year (Honor, 2022). **Orange M SBTi**, a leading telecommunications company in Europe, launched the Green IT and Networks (ITN) program to replace old network infrastructure with more eco-efficient equipment, avoiding approximately three million tons of CO₂ emissions between 2010 and 2019. Its latest data centres, opened in
Chartres and Val de Reuil in Normandy, employ free cooling — a technology that reduces the use of artificial air conditioning by 80 per cent (Orange, 2022).

2. Climate-friendly supply chain management

Electronic devices require very complex material design. Up to 69 elements from the periodic table can be found in electronics (UNITAR, 2020). Climate-friendly supply chain management is therefore particularly important in the TMT industry.

- **Optimizing raw-material procurement:** Recyclable or low-carbon materials can be sourced and used more in electronic devices. The majority of metal parts in devices translate into tons of GHG emissions released during the mining, refining, smelting and casting processes. Using low-carbon materials, on the other hand, could be difficult but hugely beneficial to the environment. Nokia[^SBTi] is increasing the use of recycled material content in its products from the design stage. In 2021, 72 per cent of its 28,000 tons of cast aluminum parts contained recycled content. Nokia is also expanding this work to look at the closed loop for gold, with plans to broaden to copper and has worked to increase circularity of plastic used in products (Nokia, 2022). While expanding the use of 100 per cent recycled aluminum in the enclosures of products in 2021, Apple[^SBTi] prioritized the use of aluminum which smelted by using low-carbon sources of electricity rather than fossil fuels. These changes alone have decreased the carbon emissions associated with the use of aluminum, which represent a quarter of product manufacturing footprint, by 68 per cent since 2015 (Apple, 2022).

- **Optimizing packaging design:** Similar to companies in the food and agriculture industry, TMT players have been re-designing their consumer product packaging as a lever to reduce emissions. One way is to minimize the use of packaging materials by reducing the package size or adopting a lightweight design. Another approach is to enable and encourage recyclable packaging by using recyclable materials or launching package recycling programs. Nokia’s fixed networks product packaging replaces foam, rubber and plastic wrappings with organic materials like corrugated cardboard. With its ground-breaking flexible cardboard packaging design, Nokia reduced package size by 50 per cent, garnering the Red Dot Design Award: Best of the Best (Nokia, 2022). JD.COM[^SBTi:13] uses reusable recycled express boxes, foldable insulation crates, and recycled transit bags instead of disposable plastic packaging. JD also launched the “Green Stream Initiative” in 2017, which has reduced industry-wide disposable packaging usage by nearly 10 billion pieces. By the end of 2021, the disposable packaging in the program has been used for more than 200 million times (JD.COM, 2021).

[^SBTi:13]: JD Logistics, a subsidiary of JD.COM, has set SBTs approved by SBTi in line with the 1.5°C trajectory.
Decarbonizing transportation and storage: Optimizing logistics networks and minimizing inventories for both raw materials and finished goods can reduce emissions from transportation and storage. Amazon uses electric vehicles, e-cargo bikes and walkers, which have less climate impact than the traditional delivery vans, for last-mile delivery. In 2021, more than 100 million packages were delivered by zero-emission vehicles in Europe and 30 million packages were delivered by cargo bikes and walkers in Manhattan, New York (Amazon, 2022). Meanwhile, Amazon deployed a new routing algorithm, Customer Order and Network Density OptimizeR (CONDOR), to enable carriers to deliver more packages to more customers on time while reducing miles driven and carbon emissions from fuel. CONDOR was deployed across the US in 2021, cutting miles driven by millions, and Amazon plans to expand to other countries in the next few months (Amazon, 2022). Xiaomi\(^\text{TM}\) is also improving its logistics efficiency through increasing the full load rate of transportation vehicles and optimizing distribution routes. In 2021, Xiaomi asked all logistics service providers to increase the vehicle full load rate from 60 per cent to 70 per cent, and added eight new direct-line routes through delivery flow analysis, reducing annual fuel consumption by 20 per cent and 290,000 kilometers of delivery distance, equivalent to 220 tons of CO\(_2\)e. Additionally, Xiaomi used lightweight pallets for overseas product delivery, reducing the weight of each pallet by 7 kg on average and the use of wood by 280 tons per year, which indirectly reduces aviation fuel consumption by 460 tons, corresponding to 1,423 tons of CO\(_2\)e (Xiaomi, 2022).

Evaluating and tracking suppliers’ climate performance: While assisting their suppliers with improving their climate data tracking and emission reporting, many TMT companies, like Sopra Steria and Huawei\(^\text{TM}\), have already started to use sustainability and climate criteria in making purchasing decisions. Sopra Steria incorporated carbon performance into its supplier evaluation system, requiring suppliers to disclose their carbon footprint and reduction action plan to ensure a low environmental impact from sourced products and services. Sopra Steria commits that 70 per cent of its suppliers by emissions will manage their GHG emissions and 90 per cent of these suppliers will have GHG reduction targets by 2025 (Sopra Steria, 2022). Huawei has incorporated environmental and sustainability requirements as the core of its procurement strategy. Factors such as climate impact are fully considered and routinely evaluated in the entire process of supplier admission, certification, selection, performance evaluation and management. In May 2021, Huawei held its Supplier Carbon Emissions Reduction Conference, engaging more than 1,000 representatives from 400 major suppliers, to explain its strategy and requirements for saving energy and reducing carbon emissions throughout the supply chain. Huawei successfully encouraged 98 per cent of the top 100 suppliers by spending and suppliers with high energy consumption to set targets on reducing emissions (Huawei, 2021).
3. Climate collaboration with ecosystem partners

Given the notable emissions from supply chain and use of end-products, climate collaboration within the ecosystem is essential.

- **Setting emissions reduction targets together with ecosystem partners:** Setting a common goal of emissions reduction with suppliers and corporate clients is the first step towards climate collaboration. Cogeco increased the number of suppliers committed to SBTi from 13 per cent of procurement spend in 2019 to 22 per cent in 2021 (Cogeco, 2021). Similarly, in 2021, Telefónica M SBTi, a leading telecommunications company in Spain, has encouraged 262 suppliers to join the CDP Supply Chain Programme, which accounts for 90 per cent of emissions in the supply chain (Telefónica, 2022). For more than 10 years, Nokia has engaged suppliers in environmental improvement programs to encourage them to disclose their climate impacts and set carbon reduction targets. In 2021, 296 suppliers had active targets for emission reduction and 154 of them are aligned with SBTi. In addition, 80 suppliers proposed reduction initiatives and collaboration opportunities with Nokia (Nokia, 2021).

- **Co-developing decarbonization technologies with ecosystem partners:** Collaboration of ecosystem partners is key to spark innovation in carbon reduction technologies. Apple has worked with Carnegie Mellon University’s BioRobotics Lab on new approaches and methods for recycling, including developing machine learning models to sort electronic waste (e-waste) at scale, incorporating X-ray imaging with RGB imaging to improve the accuracy of disassembly and recovery of materials, and enabling a robot to “feel” by using high-frequency force feedback and machine learning. This collaboration can potentially deliver major advances in developing truly intelligent recycling and disassembly technology (Apple, 2022). In 2017, Microsoft M SBTi started the AI for Earth program, empowering individuals and organizations to develop innovative solutions to monitor, model and manage Earth’s natural system through grants, technology, and access to data. This program has supported 950 projects and deployed more than 20 impactful solutions. In 2020 the program evolved to building the Planetary Computer, a platform that enables scientists, developers, and policymakers to use and build applications that monitor and manage environment and climate impacts by providing computing environment, APIs, and petabytes of data (Microsoft, 2022).

- **Establishing a climate change fund:** To further contribute to the ecosystem, some large corporates have set up a dedicated climate change fund to encourage innovation. Orange launched the first European single-investor carbon fund, Orange Nature, in December 2021. With an investment of 50 million Euros, the fund will finance global carbon capture projects, including reforestation and restoring natural ecosystems, to create carbon sinks that naturally and sustainably absorb the CO₂ in the atmosphere (Orange, 2022). In 2019, Amazon created the Right Now Climate Fund, a 100 million USD fund for nature-based solutions to restore and conserve forests, wetlands, and grasslands around the world. Furthermore, in June 2020, Amazon announced the Climate Pledge Fund with an initial investment of 2 billion USD to support the develop-
ment of sustainable and decarbonizing technologies and services. As of the end of 2021, Amazon had invested in 13 companies in various industries (Amazon, 2022). Microsoft has launched a 1 billion USD Climate Innovation Fund to accelerate technology development and deployment of new climate innovations. Focusing on areas such as direct carbon removal, digital optimization, advanced energy systems, industrial materials, the circular economy, and sustainable agriculture, Microsoft has helped and invested in 23 companies (Microsoft, 2022).

4. Product innovation and recycling

Nowadays, technology acts as a social infrastructure and is a critical force in pushing forward the digitalization and decarbonization of almost all industries. Innovative green products and product recycling have become the key focus of many TMT companies.

- **Developing and launching green/low-carbon products/services/solutions:** Efforts to reduce product energy consumption could be made in product design or even after product launches with subsequent upgrades. Telefónica developed a smart Wi-Fi router that consumes 30 per cent less energy and weighs 40 per cent less than the pre-existing solution, using therefore fewer materials such as plastics or metals. In addition, Telefónica reuses the equipment and materials of the network transformation and decommissioning process through MAIA, an internal digital platform launched in 2020 that allows visualization of available equipment and connect with other operators to encourage its internal reuse. Thanks to this initiative, Telefónica has managed to reuse more than 73,000 pieces of equipment, aligning with the industry’s goal of becoming a Zero Network Waste company by 2025 (Telefónica, 2022). Moreover, some TMT companies provide digital tools and solutions as a lever to help with decarbonization at an even larger scale. *China Mobile* took an active role in harnessing the carbon reduction effect of digital-intelligent technologies such as 5G, IoT, Cloud Computing & Big Data and Artificial Intelligence to build “Intelligent and eco-friendly” solutions, facilitating higher energy efficiencies across sectors and industries to reduce emissions across the society. China Mobile’s 9-One platforms advanced to the 2.0 era in 2021, with deeply integrated 5G+AICDE capabilities, industry-specific data, know-how and business processes to empower digital and intelligent transformation of sectors like industrials, healthcare, finance, and smart city. In 2021, China Mobile leveraged its IT products and solutions to help reduce 115 kg of CO₂ emissions for every TB of internet traffic in society (China Mobile, 2021). Leveraging its capabilities in cloud computing and AI, Huawei is facilitating the evolution of Smart Agriculture, which could fundamentally change how agricultural activities are carried out and reduce their climate impact, both in China and overseas. In 2020, Huawei partnered with China Mobile to deploy the first 5G site on the Hefeng Unmanned Farm in Zibo, China (Huawei, 2020). On October 4th 2022, Huawei and Dronetech, Austria’s largest drone service provider, announced new applications in 5G smart farming facilities, showcasing how 5G and IoT technologies can advance sustainability in the agriculture field (Huawei, 2022). Alphabet, the parent company of Google, is providing solutions to boost consumer climate awareness and make more sustainable choices. In the US, Canada, and Europe, Google Maps has rolled
out eco-friendly routing, which indicates the most fuel-efficient route based on drivers’ engine type. This functionality helped remove more than half a million tons of carbon emissions since launching in the US and Canada (Alphabet, 2022). Google Travel now provides estimated carbon emissions for flights and marks hotels with an eco-label to enable consumers to make greener travel plans (Alphabet, 2022). In 2022, Google search engine started to show emissions estimates for car models and mark pre-owned clothing with eco-labels to assist consumers seeking to make climate-aware purchasing decisions (Alphabet, 2022).

Promoting a circular economy: Increasing amount of e-waste poses significant risks to the environment and human health. Yet only 17.4 per cent of 54 million tons of e-waste are properly collected and recycled globally (UNITAR, 2020). Leading TMT companies are tackling this issue by launching product recycling programs to promote a circular economy. Telefónica is a pioneer in recycling electronic devices. Its recycling program has given new life to nearly 4.7 million devices, saving 381,569 tons of CO₂e (Telefónica, 2022). Apple collects devices for refurbishing and reuse through several programs, including its Apple Trade In, the iPhone Upgrade Program, AppleCare, and the corporate Hardware Reuse program. In FY 2021, Apple sent 12.2 million devices and accessories to new owners for reuse. Apple also recycles end-of-life products in 99 per cent of the countries where it sells products. Apple directed more than 38,000 tons of e-waste to recycling globally in FY 2021 (Apple, 2022). Xiaomi launched its global recycling and trade-in programs to reduce e-waste and promote a circular economy. Xiaomi also formulated a strict product protocol to ensure that waste was handled properly. In 2021, Xiaomi recycled over 650,000 smartphones worldwide (about 197 tons), 80 to 90 per cent of which were resold and reused (Xiaomi, 2022). Similarly, OPPO, a Chinese consumer electronics provider, has established a recycling system and conducted a trade-in business in Chinese and international markets to promote the recycling and reuse of used mobile phones. In 2021, 1.2 million mobile phones were recycled in the Chinese market (OPPO, 2021).
5. Representative Corporate Deep Dive
5.1 Danone™ SBTi — Food and Agriculture

1. Company Background

Danone is a leading global food and beverage company, aiming to bring health through food to as many people as possible.

2. Target Setting

By 2030, Danone commits to reduce Scope 1, 2 and 3 emissions intensity by 50 per cent and to achieve an absolute reduction of Scope 1 and 2 emissions by 30 per cent, from a 2015 baseline. Both targets were officially approved by SBTi in 2017 under the 2°C scenario, making Danone one of the first 100 companies to align its carbon reduction trajectory with the Paris Agreement. Furthermore, in September 2019, Danone strengthened its commitments through the signature of the Business Ambition for 1.5°C pledge (Danone, 2022).

3. Climate Action and Global Collaboration Highlights

In operations, through renewable energy and efficiency improvement, Danone reduced its Scope 1 and 2 CO₂ emissions by 48.3 per cent in 2021 compared to 2015 (Danone, 2021). In addition, two of Danone’s Mizone plants in China achieved carbon neutrality in 2022 and the remaining ones are expected to be carbon neutral by 2023 (Danone China, 2022).

Increasing the share of RE: Being a member of RE100, Danone committed to use 100 per cent renewable electricity by 2030. With continuous efforts globally, Danone’s share of renewable electricity purchased reached 68.5 per cent in 2021 (Danone, 2021). More remarkably, in 2021, its two pilot carbon-neutral plants in China achieved not only 100 per cent renewable electricity but also 100 per cent green energy. The renewable electricity is provided by on-site solar panels and purchased green power, supplemented

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with renewable energy certificates. And their steam demands are met via purchasing clean steam heat, such as biomass steam at Qionglai factory (Danone China, 2022).

- **Improving energy efficiency:** In its daily operations and manufacturing, Danone has also actively and continuously implemented a series of projects to improve energy efficiency and reduce energy consumption. For example, Danone’s manufacturing plant in Zhongshan, China, replaced the traditional air conditioners with advanced absorption heat pump technology, saving 230,000 kWh of electricity and 76,000 cubic meters of natural gas annually. In addition, the heat recovery project launched in 2015 can reduce steam consumption by 46,000 tons every year. Furthermore, the low mold temperature bottle-blowing technology co-developed with suppliers reduces the mold temperature by 20°C, reducing steam demand in the bottle-blowing process. With the above and other advanced initiatives, Danone’s Mizone products achieved an average decrease of 70.5 per cent in energy consumption from a 2004 baseline (Danone China, 2022).

In the value chain, Danone reduced Scope 3 emissions from 24,974 tons in 2020 to 23,733 tons in 2021, a 4.1 per cent reduction achieved through multiple initiatives that promote collaboration in the ecosystem (Danone, 2021).

- **Evaluating and tracking suppliers’ climate performance:** As a foundation, all suppliers of Danone are required to adhere to Danone’s Sustainability Principles for Business Partners. As set forth in the principles, all suppliers shall work at measuring direct and indirect GHG emissions and minimize overall GHG emissions (Danone, 2022). To make sure that the decarbonization efforts are associated with measurable outcomes, Danone is collaborating with suppliers through platforms like Cool Farm Tool. Cool Farm Tool is a decision support and engagement tool that enables farmers to benchmark and assess their carbon footprint. It keeps farmers informed on their carbon footprint, allows for more data transparency, and encourages climate-friendly practices. In France, Danone measured the results of Les 2 Pieds sur Terre program, which helped French farmers in their carbon footprint reduction journey with training, diagnosis and technical support. Overall, around 1,400 farmers participated in this program, and the partner farms achieved 10 per cent decrease in emission factor compared to 2016 (Danone, 2021).

- **Optimizing packaging design:** Danone aims to make its packaging 100 per cent circular by 2025, keeping materials in use and out of nature. As of 2021, 84 per cent of its packaging is designed to be recyclable, reusable or compostable and 34 per cent comes from recycled materials (Danone, 2021). Danone China takes packaging design optimization even further in beverage products. While keeping high-quality customer experience, the company successfully reduced the plastic weight of the Mizone bottle by 30 per cent vs. the 2004 level through light-weight design, and the bottle was made 100 per cent recyclable by 2021. Meanwhile, Danone is collaborating with LanzaTech to produce sustainable polyethylene terephthalate (PET) bottles from captured carbon. This innovative technology converts carbon emissions directly into mono ethylene glycol (MEG), which reduces carbon emissions significantly compared to traditional processes (Danone China, 2022).
Promoting a circular economy: Besides circular packaging, waste management is another essential action by Danone to drive the building of a circular economy. With its 7R (regulation, recognise, reduce, reuse, recycle, recover, refuse landfill) waste management principles, Danone Mizone plants in China avoided 257 tons of waste and recycled more than 7,827 tons in 2021. All the plants successfully gained the highest three-star award of TÜV Rheinland Zero Waste to Landfill Management System in 2021, which means that more than 99 per cent of waste was fully recycled, embodying the circular economy (Danone China, 2022).

Decarbonizing logistics distribution: Danone actively promotes the electrification of distribution vehicles. Beginning with the first five pilot cities in China (Xi’an, Zhengzhou, Chengdu, Shenzhen, Haikou), more than 80 per cent of the cities will use electric Mizone distribution fleet by 2022. Danone Waters China plans to expand the utilization of electric vehicles to all the plants and cities where a distribution center is based by 2024. Meanwhile, Danone Waters China is actively replacing forklifts with lithium electric drive vehicles, which are 30 per cent more energy efficient. The initiative will save about 380,000 kWh of electricity per year and reduce Danone’s carbon footprint in logistics (Danone China, 2022).

Reducing emissions from land use and farming activities: As a food company with 60 per cent of emissions coming from agriculture, Danone engages in reducing emissions from land use and farming as a leader in regenerative agriculture, both directly implementing decarbonization initiatives and sharing the knowledge with the farming community. In the US, Danone has a comprehensive regenerative dairy program that reduced 80,000 tons of CO₂e and sequestered more than 20,000 tons of CO₂e through practices like reducing tillage and chemical pesticides and expanding cover crops (Danone, 2021). The Danone Ecosystem Fund co-created more than 45 projects with NGOs to help farmers transition to regenerative agriculture (Danone, 2021). Danone carefully documented the lessons learned from these projects. By working with WWF France, technicians, and a group of environmental and agricultural experts, Danone created the Danone Regenerative Agriculture Scorecard and the Danone Environmental Handbook to define best regenerative practices (Danone, 2022). In 2021, Danone launched the Danone Regenerative Agriculture Knowledge Center, an open-source website dedicated to sharing knowledge from the field on a variety of productions (dairy, plant-based, fruits, vegetables, cereals, etc.), with farmers, farm advisors, field technicians and technical partners (Danone, 2022).

Co-developing best decarbonization practices with ecosystem partners: Danone is working with a wide range of partners, designing and deploying sustainable solutions with researchers, consumers, NGOs, health professionals, famers, suppliers, retailers and government agencies (Danone, 2022). Both peer-to-peer long-term collaborations and smaller projects with partners are conducted congruently. A three-year collaboration between Friesland Campina and Danone has led to over 17 per cent reduction in GHG emissions from 2015 to 2020, realised through implementing sustainable farming practices and green energy projects (Friesland Campina, 2022). Parallelly, the Danone
Ecosystem program provides know-how, technical expertise, and financial support to smaller projects in the ecosystems, mainly focusing on responsible sourcing and circular economy (Danone, 2022).

Lessons for Other Corporates

- **Standardize the supplier management process:** Managing a diverse base of 100,000 suppliers and 59,000 dairy farmers and tracking their climate performance may be a daunting task, but Danone has discovered a way that saves time and accelerates impact (Danone, 2021). Danone spends time and resources to identify their key needs in managing suppliers, select the tools that meet their needs, such as the Cool Farm Tool, and deliver the tools to suppliers so that they could improve their climate performance independently. This method allows for an automated process of engagement, powered by digitalized solutions that generate data to inform supplier evaluation and drive further optimization.

- **Scale and replicate the solutions:** As a multinational conglomerate, Danone attaches great importance to joint innovation and problem-solving. In the Danone Ecosystem and many other affiliated programs, Danone identifies the best practices and technological innovations, tests and adopts them, and consolidates the knowledge for others to learn. The proliferation of climate related data and content has generated unprecedented value for both Danone and its ecosystem partners, allowing them to scale and replicate the solutions as needed. Through this approach, Danone has become a climate leader in the industry.
5.2 Mars\textsuperscript{MSBTi} — Food and Agriculture

1. Company Background

Mars, Incorporated is a global family-owned business that operates across confectionery, food, and pet care products and services, with the mission of transforming, innovating, and evolving to make a positive impact on the world.

2. Target Setting

In 2017, Mars set absolute targets to reduce Scope 1, 2 and 3 GHG emissions by 27 per cent by 2025 and 67 per cent by 2050 from a 2015 base year. Within that goal, the company commits to reduce scope 1 and 2 emissions by 42 per cent by 2025 and 100 per cent by 2040. Those near-term targets for 2025 are approved by SBTi in line with the 1.5°C trajectory (SBTi, 2022). In 2021, Mars committed to achieve net-zero emissions by 2050 and will soon set a target for 2030 (Mars, 2022).

3. Climate Action and Global Collaboration Highlights

Through its efforts in both operations and the value chain, Mars had a 6.1 per cent reduction in greenhouse gas emissions in 2021, compared to its 2015 baseline.

In operations, Mars has been focusing primarily on switching to renewable and low-carbon energy, while it continues to pursue innovative solutions to reduce energy use in its direct operations through energy-efficient solutions.

- **Increasing the share of RE:** Mars is taking strides towards transitioning to renewables, and now source 100 per cent renewable electricity for direct operations in 11 markets, accounting for more than 53 per cent of its electricity globally. Mars plans to make the switch to 100 per cent renewable electricity in direct operations in another eight markets by 2025.

- **Optimizing refrigeration systems:** Mars uses refrigeration equipment for building air conditioning, factory production process cooling, and point-of-sale units like ice cream...
freezers and vending machines. Some cooling equipment utilizes synthetic refrigerant gases like hydrofluorocarbons (HFCs), which are potent GHG if they escape into the atmosphere. The GWP-100 of HFCs can be up to 14,600\(^{15}\) times higher than that of CO\(_2\). To make future refrigeration systems more sustainable, Mars is committed to stop installing more HFC-based systems. By 2021, the proportion of natural refrigerants in its factory refrigerant inventory exceeded 50 per cent. In March 2022, Mars committed to more rigorous climate action to avoid additional use of HFCs in its business, which include using low- or zero-global warming potential gases in the confectionery vending machines. (Mars, 2022).

**In the value chain.** Mars primarily focuses on reducing the impact of land use and packaging. In the upstream, Mars is challenging more than 20,000 suppliers to take climate action and to set meaningful targets. In the ecosystem, Mars also emphasizes collaboration with partners to innovate, develop and apply technologies that change the landscape.

- **Reducing emissions from land use:** At Mars, 80 per cent of carbon emissions are from its agricultural value chains, which includes approximately 42 per cent from land use change and 38 per cent from agriculture. To reduce emissions in this area, both deforestation prevention and improvements in agriculture practices were implemented. In deforestation prevention, Mars has committed to deforestation-free supply chains in five key commodities by 2025 and is transforming supply chains to deliver this target. Mars is a part of the Consumer Goods Forum’s (CGF) Forest Positive Coalition, calling for anti-deforestation action beyond its direct supply chain and working with peers to report transparently. In agriculture, Mars is advocating the best practices to improve productivity and yields without permanently destructing the land. To improve productivity, Mars works with farmers and suppliers to promote improved agricultural practices, including climate-smart and regenerative agriculture; partners with suppliers, civil society and other companies to promote sustainable land use; and supports science and technology, such as genomics research, that produces more resilient and higher yielding crops to reduce attrition. As a result, while keeping business strong, Mars has achieved a reduction in land use by 3.1 per cent, resulting in an 8.9 per cent reduction in GHG emissions by 2021 (Mars, 2021).

- **Optimizing packaging design and promoting a circular economy:** Mars intends to contribute to a circular economy where most packaging material never becomes waste. Mars is investing hundreds of millions of dollars in eliminating and/or redesigning more than 12,000 packaging components to ensure it is using 100 per cent recyclable, reusable or compostable packaging. Eliminating unnecessary packaging is an essential pillar in achieving the goal. In China, Mars saved 450 tons of plastic by reducing the amount of packaging material used in Dove chocolate containers, and has deployed eight programs so far to test reusable packaging and innovative reuse models in markets, on track to reach the goal of 10 programs by 2025. In 2021, Mars launched M&M Color Walls with French retailer Carrefour\(^{14}\). SBTi, enabling consumers to fill reusable contain-

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\(^{15}\) According to IPCC AR6, the GWP-100 value of HFC-23 is 14,600.
ers with the M&M color of their choice. Additionally, Mars is redesigning necessary packaging for circularity. Almost half of its packaging portfolio is undergoing a redesign to become compostable or fit within the recycling infrastructure. As a pilot example of Mars’ exploration of alternative packaging materials, more than 90 per cent of the packaging in almost a million Balisto bars in Germany was changed to paper. Moreover, Mars is investing to close the loop. Working towards using 30 per cent recycled content across its plastic packaging portfolio, it is helping to create demand for recycled materials and encourage investment into recycling systems. In 2020, Mars launched SHEBA pet food pouch made from recycled plastic, the first in the pet food industry to use food-safe recycled material in wet-food flexible packaging. In October 2022, its KIND brand in the United Kingdom and Ireland announced it would move to a mono-material packaging that incorporated 30 per cent advanced (chemical) recycled film plastic material. In Thailand, Mars’ SWAP Recycling program offered pet owners discounts for returning their empty pet food bags, which resulted in the recovery of more than 35,000 bags of used plastic pet food packaging in 2021 (Mars, 2021).

### Co-developing decarbonization technologies with ecosystem partners

Mars is collaborating with partners on all three initiatives that are key levers to Mars’ own climate performance — thermal energy, regenerative agriculture, and circular packaging. Thermal energy makes up nearly two-thirds of Mars’ current energy demand in direct operations. Mars partnered with the Renewable Energy Buyers’ Alliance and others to launch the Renewable Thermal Collaborative, a coalition for scaling up renewable heating and cooling solutions. The coalition is working on low-carbon (such as certain biomass options) and zero-carbon (such as solar thermal) energy sources at project and structural levels, to make it easier for all companies to procure and source low-carbon thermal energy (Mars, 2022). In regenerative agriculture, Mars is chairing the Sustainable Markets Initiative’s Agribusiness Task Force to uncover what actions are needed from each part of the value chain to make regenerative agriculture a no-brainer business decision for farmers. For circular packaging, congruent with Mars’ internal initiatives, it also forged two-year partnership with Danimer Scientific, a leading developer and manufacturer of biodegradable materials, to develop innovative industrial and home-compostable packaging starting in the US. Danimer Scientific and Mars also plan to introduce Nodax polyhydroxyalkanoate (PHA) into flexible and rigid packaging that reliably breaks down in both industrial composting facilities and backyard compost units, offering an enhanced value proposition for environmentally conscious consumers and retailers. Nodax PHA is produced through natural fermentation processes using plant oils such as soy and canola and biodegrades in both soil and marine environments and can serve as an alternative to traditional petrochemical plastic, exerting a much lower climate impact (Mars, 2021).
Lessons for Other Corporates

■ **Decouple emissions from business growth:** Mars set credible climate targets and work to implement them by decoupling their emissions from business growth, which means that all climate actions are prioritized based on science, not on business objectives. Mars includes all three scopes when setting climate goals and marks 5-year milestones to track progress. Mars is concerned about not only the business values from partnerships in the value chain, but also the long-term climate progress of its suppliers and partners.

■ **Embed GHG reductions in the business agenda:** Mars understands the criticality of delivering “long-term value” beyond profit. To drive direct impact, Mars has embedded its sustainability agenda into the Mars Compass, the company’s shareholder objectives, ensuring from start to finish that their initiatives are beneficial for both the business and the world, for generations to come. For example, executive remuneration for the company’s top 300 leaders is weighted based on not just financial but also emissions and packaging goals. This is critical for consistently delivering results on climate goals.

■ **Build cross-industry partnerships:** Mars recognizes that businesses can not fight climate change alone; fixing climate issues is a generational challenge, so it is imperative to build lasting partnerships with NGOs, governments and industry partners, to help transform the systems that have resulted in pervasive and intractable changes to the climate. Fostering and joining coalitions, such as Forest Positive Coalition and Renewable Thermal Collaborative, could create synergy in the collaborations with partners up and down the value chain and accelerate the progress towards the climate goals.
5.3 Schneider Electric M SBTi — Manufacturing

1. Company Background

Schneider Electric (SE) is a leading company in energy management and automation, with the purpose of empowering all to make the most of our energy and resources, bridging progress and sustainability for all.

2. Target Setting

SE has committed to reduce its absolute carbon emissions across the value chain by 25 per cent from a 2021 baseline, by 2030. SE also targets “net-zero ready” operations (scopes 1 and 2) by 2030, a commitment to reduce its operational carbon footprint by at least 90 per cent (compared with its 2017 base year) and remove residual emissions. This 2030 target is validated by the SBTi as part of a 1.5°C ambition and their Net-Zero Corporate Standard. The 2040 goal is to reach carbon neutrality across its full end-to-end footprint (scopes 1, 2, and 3) (Schneider Electric, 2022).

3. Climate Action and Global Collaboration Highlights

In operations, SE reduced carbon emissions by 60 per cent between 2017 and 2020, targeting Net-Zero by 2030 (Schneider Electric, 2022).

- Increasing the share of RE: Since 2017, SE has accelerated the sourcing of RE through PPA, renewable certificates, and green tariffs. The installation of on-site solar panels, coupled with SE’s metering and power architectures, also effectively decoupled SE from non-renewable sources of energy. By 2021, about 200 SE sites used 100-per-cent RE, and 47 sites had on-site solar power. As of 2021, SE was sourcing 82 per cent of electricity from renewable sources, a significant improvement from 2 per cent in 2017 (Schneider Electric, 2021).
Improving energy efficiency: Parallel to restructuring its sources of energy, SE was also determined to increase energy productivity, which is the economic output from every unit of energy consumed. The Schneider Energy Action program engages site energy experts along with Schneider’s Sustainability Business consulting team to report and analyze energy consumption. This program helps identify energy-saving opportunities and deploy actions. This agile mechanism improved the productivity of SE production lines and helped SE achieve a 76-per-cent energy productivity increase in 2021, compared with the 2005 baseline (Schneider Electric, 2021).

In the value chain, SE is making a climate impact both upstream and downstream.

Optimizing procurement of raw materials: Raw materials are responsible for about 20 per cent of upstream purchasing Scope 3 emissions. Defining the standards of green materials pulls the thread that unleashes change that can be measured and evaluated. Starting with steel, aluminum, and plastics — materials that constitute about 30 per cent of SE’s entire purchasing volume, SE consulted experts to set reasonable yet rigorous standards based on carbon emissions cut-off, degrees of recyclability and other climate and resource indicators. In 2022, SE sources 14 per cent of materials that meet the green standards (Schneider Electric, 2022).

Setting emission reduction targets together with ecosystem partners: The supplier network of SE accounts for emissions of more than 7 million tons of CO₂ per year (Schneider Electric, 2021). As SE began to audit and manage the climate performances of their suppliers, they realized that many lacked the resources and tools, albeit being aware of climate issues, to take climate action. To overcome this inertia, SE launched the Zero Carbon Project as part of the 2021-2025 Schneider Sustainability Impact program, engaging the top 1,000 suppliers from 64 categories across direct material, indirect material, and project procurement. The project requires participating suppliers to make commitments to reduce and quantify their Scope 1 and 2 emissions and share their progress with SE (Schneider Electric, 2021). By August 2022, 70 per cent of suppliers have disclosed their carbon footprint and 30 per cent had set climate targets, a significant improvement from less than 30 per cent disclosing their footprint in April 2021 (Schneider Electric, 2022).

Co-developing decarbonization technologies with ecosystem partners: From the onset, SE has joined forces with many long-time industry partners in green co-innovation—Microsoft, Cisco Systems, and SAP, to name a few. Moreover, SE established open-access platforms and programs for digital collaboration with ecosystem partners, bringing together the top talents from the entire industry to solve real-world sustainability and efficiency challenges. Members of the platform could exchange ideas on green technology, shop the marketplace for digital solutions, access developer resources such as data sets, APIs, and SDKs, and engage in dialogues with a global network of peers (Schneider Electric, 2022). The open ecosystem had attracted more than 650,000 members, reaching 300 apps, and 100 communities as of 2021 (Schneider Electric, 2021).
Delivering decarbonization services and solutions to customers: Helping customers decarbonize is at the core of SE’s values and aligns with SE’s vision of building a more sustainable world. At the core of the offering is the EcoStruxure platform — an IoT-enabled architecture that collects data from sensors and analyzes data to discover meaningful insights. To quantify the impact, SE calculated carbon emissions saved and avoided for customers through a standard developed with ecosystem partners and material experts. Per the calculation, SE has helped customers save and avoid 347 Mt CO₂e since 2018 (Schneider Electric, 2021). SE also offers consulting services for customers who wish to decarbonize their supply chain. The Energize Initiative will help 10 pharmaceutical giants reduce emissions in their supply chain by aggregating demand from interested suppliers to purchase RE so that companies can benefit from economies of scale (Schneider Electric, 2022).

Lessons for Other Corporates

- **Take a step-by-step approach:** Schneider has set specific, measurable, and realistic goals in five company programs (2005-2008, 2009-2011, 2012-2014, 2015-2017, and 2018-2020). These programs are tracked and published quarterly and audited annually. By the end of each cycle, the leadership reviews the progress and iterates the targets. The company secures the low-hanging fruits, such as sourcing RE first and aggregate small steps into a remarkable impact. By 2021, SE passed the halfway point to Net-Zero within operations and embarked on the 2021-2025 plan (Schneider Electric, 2022).

- **Trickle-down the incentives:** Both short-term and long-term incentives at SE include climate as an important component. In short-term incentives, SE embeds all aspects of sustainability under six pillars, one of which is climate. Since 2011, sustainability performance criteria have been embedded in the incentive goals for group executives. They are directly linked to the Schneider Sustainability Impact (SSI) targets. From 2019, the weight of the SSI criteria has increased from 6 per cent to 20 per cent in the collective part of the annual short-term incentive, further highlighting the importance of sustainability on Schneider Electric’s business agenda. About 64,000 managers in the group have short-term incentives linked to the achievement of 11 sustainability goals, including short-term climate targets. Similar to the short-term incentive, the long-term incentive plan also has a portion of the award subject to the achievement of sustainability objectives, including long-term climate targets (Schneider Electric, 2022).

- **Lead with openness:** Breaking the silos, openness and collective effort are ingrained in the DNA of SE. Over the years, SE has shared insights, innovations, and resources across the ecosystem, as evidenced by the 17 training sessions
engaging more than 1,300 suppliers and partners in 2021. To turn the one-off engagements into systematic partnerships, SE established open-access platforms and programs to collaborate seamlessly with ecosystem partners on green innovations and share ideas in real time. This pivotal move formed a coalition of industry partners with climate advantages and accelerated the climate progress of the entire value chain (Schneider Electric, 2021).

Think one step ahead: For SE, climate action is not merely one of the strategic targets. Rather, it represents a long-term vision and a group-level transformation. To start, SE has set an example for the industry by staying ahead in setting and fulfilling climate targets. SE does not stop there — it aims to “Empower all to make the most of our energy and resources” (Schneider Electric, 2022). Each year, SE devotes 4 to 5 per cent of revenue to develop greener products and solutions for its operations and the ecosystem (Schneider Electric, 2022). As a climate solution provider, SE empowers customers to save and avoid carbon emissions with digital solutions and field expertise.
1. **Company Background**

Siemens is a global technology powerhouse focusing on intelligent infrastructure, automation and digitalization, and intelligent mobility solutions. Via its majority stake in Siemens Healthineers, it also provides medical technology and digital health services. With expertise in digitalization, electrification and automation, Siemens strives to pioneer a sustainable future across the globe.

2. **Target Setting**

Siemens committed to reduce absolute Scope 1 and 2 GHG emissions by 50 per cent by 2030, with a near-term target of 1.5°C. In the value chain, Siemens also committed to 15 per cent emissions reduction by 2030 compared to 2019 and to a Net-Zero supply chain by 2050. The “D” in Siemens environmental, social, and governance (ESG) strategic framework DEGREE refers to decarbonization, representing the company-level commitment to the 1.5°C global warming target (Siemens, 2021).

3. **Climate Action and Global Collaboration Highlights**

**In operations**, Siemens reduced its carbon footprint by 54 per cent between 2014 and 2020. Most recently, Scope 1 and 2 emissions were slashed by 12 per cent from 2020 to 2021 (Siemens, 2021).

- **Increasing the share of RE**: For Siemens, RE is sourced primarily through purchasing green electricity. In FY 2021, more than 78 per cent of purchased electricity was from renewable sources. Compared with the average electricity mix, Siemens successfully reduced emissions by a total of 518,000 metric tons of CO₂e per year. To gain more control of its energy sources, Siemens is also exploring other means, including signing PPAs for wind power and use of biogas. In 2021, Siemens reduced carbon emissions by 225,000 metric tons of CO₂e compared to the base case of using conventional natural gas (Siemens, 2022).
Construct Net-Zero sites: To fulfill the commitments of EP100, an initiative by the Climate Group, Siemens has chosen the pathway of Net Zero Carbon Buildings: By owning, occupying, and developing buildings that are Net-Zero in operation and embodied carbon by 2030 (The Climate Group, 2022). Leveraging the expertise on power management and automation, Siemens is building new carbon-neutral buildings, modernizing existing buildings, and leasing office space with the lowest possible emissions. As of September 2022, 32 Siemens locations have achieved Net-Zero emissions in operations (Siemens, 2022). In 2022, Siemens put into operation the Digital Native Factory in Nanjing, a highly energy-efficient and sustainable production site with dedicated PV power, automatic LED lighting, and high-efficiency pumps, fans and cooling elements. The factory is projected to save 5,000,000 kWh of electricity and 3000 tons of CO₂e per year, compared with traditional production sites (Siemens, 2022).

In the value chain, Siemens reduced emissions by 7.6 per cent from 2020 to 2021. To decarbonize the value chain, Siemens has underscored the importance of product lifecycle assessment by developing a framework of Robust Eco-Design, which governs the entire process from procurement, manufacture, sales/service, use, reuse, to restoration/recycling. The program aims to upgrade the design of products, services, and solutions to meet strict standards of environmental compatibility. Siemens spares no effort in this program: in FY 2021, 26 per cent of Siemens’ products were aligned with the Robust Eco Design criteria, and the goal is to roll it out to all products by 2030.

Optimizing procurement of raw materials: At the procurement stage, Siemens focuses on increasing the proportion of secondary raw materials — recycled materials — for metals and plastics, thereby decoupling from natural resources. In 2021, 38 per cent of procured metals was secondary. For industrial plastics, because recycling chains have not yet been fully established, Siemens is taking the lead in publishing guidelines for purchasing secondary plastics internally. By maintaining close contact with recycling partners and as a member of the European Circular Plastics Alliance, Siemens hopes to further develop and publicize eco-friendly product specifications and material standards for industrial plastics (Siemens, 2022).

Setting emission reduction targets together with ecosystem partners: Siemens started the roll-out of the “Carbon Reduction@Suppliers” program in January 2021, and by the summer of 2022, the program had engaged approximately 10,000 suppliers. Suppliers are keen to participate, and the response rate was more than 50 per cent in 2022. At the heart of the program is the Carbon Web Assessment tool, a comprehensive tool that allows suppliers to assess their carbon footprint and understand which targets would prove most efficient in reducing their carbon emissions (Siemens, 2022). To start, the digital tool embodies two elements: it trains suppliers on the basics of decarbonization and collects their emissions data periodically through questionnaires. After periodic engagements with suppliers, the tool analyzes the data and suggests about possible decarbonization methods, comparing supplier data with sector averages. In 2021, the average emission reduction (against calculated sector average) was 7.6 per cent per supplier (Siemens, 2022).
Delivering decarbonization services and solutions to customers: The Environmental Portfolio of Siemens consists of products, solutions, and services that enable customers to reduce their carbon emissions, lower lifecycle costs, and protect the environment. The offerings include components for smart and distributed power grids, frequency converters, rail transportation of passengers and goods, and building technology. The revenues generated on the Siemens Environmental Portfolio amounted to €19.1 billion in the past FY, accounting for 31 per cent of total revenue. With all the Environmental Portfolio elements in use, Siemens helped customers reduce 87.5 million metric tons of CO₂e in FY 2021 (Siemens, 2022).

Lessons for Other Corporates

- **Decarbonize the entire product lifecycle:** The Robust Eco Design program manifests Siemens's determination to decarbonize every stage of the product life cycle, and exhibits the company's strong product stewardship. This program ensures that corporate climate performance can be evaluated on a product basis, ensuring a clear delineation of responsibilities, and increasing the effectiveness of climate actions.

- **Understand suppliers and guide them to the answer:** As corporates extend their range of climate actions, Scope 3, especially supply chain carbon emissions, has begun to take center stage. In 2018 and 2019, Siemens surveyed 9,000 suppliers in 93 countries, asking if they had transparency in their carbon footprint, and only 15 per cent could show results. The major pain point of suppliers was data transparency: measuring and monitoring their own footprints regularly and setting reasonable climate targets. Moreover, it takes prepared guidance with regular check-ins to make a reverberating impact. With the Carbon Web Assessment tool that helps suppliers get out of the shadows, Siemens not only sheds light on its own Scope 3, but also mitigates value chain risks and strengthens climate leadership.

- **Harness the power of digitalization:** Digital technologies have proven to be a powerful tool for decarbonization in operations, and for upstream suppliers and downstream customers. In operations, Siemens is designing the next generation of digital factories, connecting the dots in the operations to maximize efficiency and minimize carbon footprint. In the supply chain, the Carbon Web Assessment tool manifests the value of digital connectivity. For customers, Siemens is providing low-carbon digital solutions, which could be applied to various scenarios in industries that are key to climate action — energy, construction, transportation, and so forth. All the progress Siemens has made reveals the potential of digitalization in Net-Zero initiatives.
5.5 Lenovo™ SBTi — Technology, Media and Telecom

1. Company Background

Lenovo is a multinational technology company in personal computer (PC), server, storage, mobile, solutions and services, focused on a vision to deliver smarter technology for all and build a more inclusive, trustworthy, and sustainable digital society.

2. Target Setting

Lenovo committed to reducing absolute Scope 1 and 2 GHG emissions by 50 per cent and the emission intensities of the three largest Scope 3 categories by 25 per cent by FY 2029/30 from the FY 2018/19 baseline. These targets were approved by SBTi in line with the Paris Agreement’s 1.5°C trajectory. Additionally, in March 2022, Lenovo signed the SBTi commitment letter, committing to a vision to achieve Net-Zero by 2050 (Lenovo, 2022). Lenovo’s Net-Zero targets are currently under review by SBTi for alignment to their Net-Zero Standard.

3. Climate Action and Global Collaboration Highlights

In operations, Lenovo has implemented more than 190 operational energy-efficiency projects worldwide and increased the amount of on-site generated and purchased RE. Lenovo’s absolute Scope 1 and 2 GHG emissions were reduced by 15 per cent in FY 2021/22 from the FY 2018/19 baseline, a remarkable step towards the 50 per cent target in FY 2029/30. In 2021, Lenovo launched a “Carbon Neutral Factory” project, the Tianjin Smart Innovation Service Industrial Park, a lighthouse project that automates up to 60 per cent of the production line through IoT, AI, and Digital Twin technologies, equipped with distributed PV panels producing 2,630,000 kWh per year (Lenovo, 2022). In September 2022, the Tianjin Smart Innovation Service Industrial Park was officially put into operation.

- Increasing the share of RE: Lenovo has set a target to obtain 90 per cent of its global operation’s electricity from renewable sources by FY 2025/26. It plans to achieve through the installation of on-site RE generation units, signing of PPA agreements, and the purchase of renewable energy certificates (Lenovo, 2022).
Improving energy efficiency: To boost production efficiency, Lenovo developed and deployed a variety of energy-saving technologies, including low-temperature soldering (LTS) and cryogenic nitrogen generation. Notably, the LTS technology led to a carbon emission reduction of more than 10,000 metric tons since its launch. To further decarbonize the production line, Lenovo also developed the Lenovo Advanced Production Scheduling System (LAPS), a smart resource dispatch system which slashed carbon emissions by more than 2,000 metric tons of CO₂e per year by increasing productivity and decreasing the equipment vacancy rate (Lenovo, 2022).

In the value chain, Lenovo’s Scope 3 emissions intensity from purchased goods and services and use of sold products decreased by 7 per cent and 2 per cent, respectively, in FY 2021/2022 from a base year of FY 2018/19. Lenovo has also committed to eliminating one million tons of GHG emissions from the supply chain by FY 2025/26 from a base year of FY 2018/19.

Empowering and evaluating suppliers’ climate performance: In Lenovo’s “Supplier Code of Conduct”, suppliers are required to set climate targets. Climate change-related indicators are added to the Supplier ESG Scorecard, including the indicator of “committed or have set scientific climate targets”. The scorecard is updated every quarter, and the procurement team follows up on the progress of suppliers’ ESG performance including climate target setting and provides the necessary support. In 2021, Lenovo’s supplier engagement efforts covered the top 94 per cent of procurement spend; 92 per cent of suppliers by total procurement spend had public GHG reduction goals, and 54 per cent by total procurement spend had RE goals (Lenovo, 2022).

Developing and launching low-carbon products/services/solutions: Lenovo has demonstrated that electronic products have a high potential to be more sustainable. In 2022, Lenovo launched the Yoga Slim 9i, a laptop certified for carbon neutrality by TÜV Rheinland (TÜV Rheinland, 2022) and ENERGY STAR, also rated as Silver EPEAT. For the future, Lenovo has set a goal of increasing the energy efficiency of its desktops and servers by 50 per cent and notebook and Motorola products by 30 per cent by FY 2029/30, compared to FY 2018/19. In services, Lenovo offers a CO₂ offset service that CCER can be purchased at point of sale for the estimated carbon emissions associated with select devices over their entire lifecycle, including raw materials, manufacturing, shipping, and usage. Neptune liquid-cooling technology is one of Lenovo’s flagship solutions for low-carbon data centers. Lenovo has installed more than 50,000 liquid cooling nodes in data centers around the world. This energy-efficient technology has been applied to multiple milestone projects including decarbonizing data centers of China’s East-to-West Computing Resource Transfer Project, supporting the Beijing Meteorological Bureau during the 2022 Winter Olympics, and contributing computing power to the first image of the black hole at the center of our galaxy. The liquid-cooled data centers can attain a PUE \(16\) of less than 1.1, reducing energy usage and carbon emission by more than 42 per cent compared with other methods of cooling (Lenovo, 2022).

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16. Power usage effectiveness, the ratio of the total amount of power used by a computer data center facility to the power delivered to computing equipment.
Optimizing packaging design: Decarbonization of packaging is achieved through two initiatives: reducing packaging materials and size by design and upgrading the packaging with more sustainable materials. In FY 2021/22, Lenovo reduced the use of packaging materials by 497 metric tons. In addition, through innovative packaging technologies such as bamboo fiber and tapeless box design, ThinkPad X1 and Z series packaging became “zero plastic” (Lenovo, 2022).

Collaborate with partners on decarbonization: Lenovo believes that collaboration is key to a more sustainable future. Lenovo developed the Low Temperature Soldering (LTS) method for product manufacturing in 2018. LTS is a versatile technology that can be used to reduce the emissions created during the manufacturing of computer parts such as the motherboard, RAM\textsuperscript{17}, SSD\textsuperscript{18}, touchpad, and WLAN/WWAN\textsuperscript{19}. In 2020, Lenovo launched the industry’s first LTS memory in collaboration with an upstream supplier. After achieving mass production in 2020, Lenovo shared the technology with other upstream partners, resulting in five million units sold, reducing carbon emissions by four per cent compared with traditional soldering method. Lenovo plans to collaborate with more partners to drive the entire value chain towards low-carbon transformation (Lenovo, 2022). In the process, Lenovo has realized that effective collaboration requires well-written industry standards. In September 2022, the “General Specifications for Assessment of Carbon Neutrality Factory” was officially published by an alliance of academia and industry, including companies such as Lenovo and research institutions such as China Electronics Standardization Institute, after a test-run at the Lenovo (Tianjin) Smart Innovation Service Industrial Park (Cesi Certification Co., LTD., 2022). Earlier in 2022, Lenovo launched a collaborative initiative called Lenovo 360 Circle with downstream ecosystem partners. Lenovo aims to empower its channel ecosystem to influence and support new market needs while accelerating decarbonization. Lenovo is building this community to break down barriers and encourage collaboration around sustainability. Since the end of 2021, Lenovo has been partnering with key channel players to develop an industry blueprint around product life extension and product transformation. Raising awareness while ensuring collective learning will accelerate the transition to more sustainable business models and support climate change mitigation efforts.

Promoting circular economy: Lenovo’s approach to circular economy is primarily focused on product end-of-life management (PELM), a program which reduces the input of raw materials through product recycling and product/component refurbishment. In 2021, 5.5 per cent of all waste was reused as products or components, and 88.2 per cent was recycled. In January 2021, Lenovo took the lead in mass-producing chargers with 95 per cent Post Consumer Recycled Content (PCC), whereas the PC industry generally uses 25-50 per cent, and increased the ratio to 97 per cent in battery pack enclosure and 98 per cent in the speaker enclosure. In total, Lenovo reduced carbon

\textsuperscript{17} Random-access memory, the hardware in a computing device where the operating system, application programs and data in use are kept so they can be quickly reached by the device’s processor.

\textsuperscript{18} Solid-state drive, a solid-state storage device that uses integrated circuit assemblies to store data

\textsuperscript{19} Wireless local-area network/Wireless wide area network.
emissions by about 1,600 tons in 2021 and is expected to achieve a carbon reduction of about 2,800 tons in 2022. Additionally, Lenovo continues to explore the use of recycled metals and other materials, using recycled aluminum and magnesium alloys for select covers in select products. For example, in 2021, Lenovo introduced 75 per cent recycled aluminum for the A/C covers of the ThinkPad Z13 Gen 1 and ThinkPad Z16 Gen 1, and 50 per cent recycled aluminum for the A cover of the Yoga 6 Gen 7, and 90 per cent recycled magnesium for the A/C covers of the ThinkPad X13s Gen 1. Plastic recycling is also becoming a critical component. As a starting point, Lenovo used “zero virgin plastic” for notebook adapters and battery products. Additionally, the packaging of ThinkPad L14 Gen2/3 and L15 Gen3 products is made of 90 per cent recycled materials and 30 per cent of Ocean Bound Plastic (OBP)\textsuperscript{20}. Lenovo estimates that it will use 70 to 80 tons of OBP annually, which equals 4 million supermarket shopping bags. Additionally, in 2021, Lenovo expanded the application of closed-loop post-consumer recycled plastics (CL PCR) to 248 products, up from 103 products the previous year (Lenovo, 2022).

**Lessons for Other Corporates**

- **Plan near-, mid-, and long-term targets systematically:** Lenovo has unveiled a roadmap broken down into three major topics: climate change, circular economy, and sustainable materials. For each topic, Lenovo has set measurable goals based on priority, further broken down to operational levels. Specifically, Lenovo has set climate change KPIs for its direct operations, supply chain, and products; circular economy KPIs for repairs, recycling and reuse of products; and sustainable materials KPIs for different product types (Lenovo, 2022).

- **Empower the value chain:** Lenovo collaborates with the industry and shares experiences and lessons learned with value chain partners. The initiatives have mobilized industry-wide efficiency improvement, sustainable manufacturing practices, and digitalization upgrades. By driving upstream and downstream partners on a global scale, Lenovo is working toward its Net-Zero vision.

- **Bolster cross-industry collaboration:** Lenovo has exemplified the integration of digital and real economies and low-carbon development through externalizing its own experience in the low-carbon transition journey. As of 2022, Lenovo partnered with automobile manufacturing, petroleum and petrochemicals, energy, electronics manufacturing, and other industries to achieve decarbonization, empowering more than 300 companies in China. Lenovo’s pioneering efforts will attract more attention and support for low-carbon innovations and initiatives (Lenovo, 2022).

\textsuperscript{20.} Ocean Bound Plastics generally refers to abandoned plastic waste of all sizes found within 50km from shore.
1. Company Background

Hewlett Packard Enterprise Company (HPE) is a multinational company that delivers unique, open and intelligent technology solutions as a service, with offerings spanning Cloud Services, Compute, High Performance Computing & AI, Intelligent Edge, Software, and Storage.

2. Target Setting

In the near term, HPE commits to reducing absolute Scope 1 and 2 GHG emissions by 70 per cent and Scope 3 by 42 per cent by 2030. HPE’s long-term target is to reduce absolute Scope 1, 2, and 3 GHG emissions by 90 per cent and achieve Net-Zero by 2040. Both the near and long-term reduction targets are approved by SBTi in line with the 1.5°C trajectory (HPE, 2022).

3. Climate Action and Global Collaboration Highlights

Emissions in operations only accounted for 3 per cent of HPE’s total emissions. From 2020 to 2021, HPE reduced Scope 1 and 2 emissions by 16 per cent globally from 193,747 to 162,770 tons of CO₂e, through sourcing renewable electricity (from 278,315 mWh in 2020 to 292,772 mWh in 2021) and upgrades in building efficiency, operations, occupancy, vehicle emissions, etc. (HPE, 2022).

Increasing the share of RE: To transition to clean energy, HPE has taken a hybrid approach that includes owned renewable assets, on-site and off-site PPAs, green tariff programs, green contracts, and bundled and unbundled RECs. In 2021, HPE sourced 49 per cent of electricity (292,772 mWh) from renewables globally, with 56,045 mWh sourced in the Asia Pacific and Japan. As part of the climate target, HPE aims to source 50 per cent renewable electricity in operations by 2025 and 100 per cent by 2030 (HPE, 2022).
Deploying electric vehicles: HPE regularly replaces company vehicles to minimize environmental impact, including implementing hybrid and electric vehicles in markets with matured EV-infrastructure. In 2021, HPE began integrating both fully electric and plug-in hybrid electric vehicles (PHEV) into its corporate fleet of more than 7,000 vehicles in 31 countries. The goal is to transition the majority of its fleet to either EVs or PHEVs by 2030 in markets with matured infrastructure, proven technology, and economic feasibility. The initiative is expected to significantly reduce the carbon footprint in logistics and transportation (HPE, 2022).

Emissions in the supply chain accounted for 31 per cent of HPE’s total emissions, while use of products and solutions contributed the rest 66 per cent. To abate the emissions in these areas, HPE is collaborating up and down the value chain to reduce carbon footprint while dedicating efforts to reduce emissions from product/solution use, minimizing the impact on the environment (HPE, 2021).

Empowering and evaluating suppliers’ climate performance: In 2017, HPE announced a comprehensive supply chain management program. The landmark initiative demonstrated a modeling effort of supply chain management, developed a global standard for supplier GHG management and abatement and provides its suppliers with tools to develop a customized plan to reduce emissions. The program requires 80 per cent of HPE production suppliers by spend to set science-based emissions reduction targets in their operations by 2025. In 2021, HPE hosted engagements with 50 per cent of its manufacturing suppliers by spend, addressing different ESG issues. 130 representatives from among HPE direct suppliers attended supplier training, with an additional 568 participants attending from the extended supply chain. The training raised awareness of climate change and empowered suppliers to use tools to develop emission inventory and set climate targets. Building upon the successful launch of the supply chain data management software — built and hosted by Optera — HPE began sharing supplier-facing GHG emissions management dashboards. To date, 80 per cent of its manufacturing suppliers by spend can access the software’s customizable dashboard which provides them with company-specific emissions data, modeled science-based GHG emissions reduction targets, the ability to track progress toward their publicly stated emissions reduction goals, and benchmark performance against that of their peers. HPE further customized a performance dashboard for suppliers to track their individual GHG performance against a set of HPE-defined requirements. These requirements are part of its supplier Social and Environmental Responsibility (SER) scorecards and are referenced in key procurement decision-making (HPE, 2022).

Decarbonizing logistics and distribution: By using EVs in operations, HPE is dedicated to reducing the carbon footprint of logistics and distribution, using both short-term and long-term initiatives. In the short term, HPE is encouraging modal shift of logistics and deploying zero-/low-emission vehicles for final-mile deliveries in selected markets. In the long term, HPE is deploying advanced technology vehicles and collaborating with partners in aviation to use fuel-efficient aircraft and sustainable aviation fuel. In May
2021, to help boost suppliers’ ambitions in climate and sustainability, HPE recognized outstanding climate performance by awarding the “Sustainable Logistics Partner of the Year”. Over the past five years, HPE has reduced logistics-related carbon emissions by 20 per cent. In September 2021, Gebrüder Weiss™, a logistics service provider of HPE based in the EU, started delivering more than 50 per cent of its final-mile deliveries into Slovakia via electric trucks. Between 50 to 100 HPE shipments per month moved from the Gebrüder Weiss hub in Vienna to ASBIS, HPE’s largest customer in Slovakia. This EV transition has helped avoid approximately 100 metric tons of GHG emissions every year (HPE, 2022).

- **Developing and launching low-carbon products and services:** There are four IT-related efficiency-raising pillars in HPE’s approach to reducing emissions from product/solution use: energy efficiency, equipment efficiency, resource efficiency and software efficiency. HPE focuses on delivering the value of these pillars bundled as a service to help clients tackle IT efficiency challenges. HPE GreenLake is an open and secure Edge to Cloud Platform that brings the hybrid cloud to customers. It can reduce the environmental impact of IT by enabling customers to flexibly scale their IT to meet their needs. One customer, Auckland Transport, transitioned its video management system (VMS) to HPE GreenLake platform, resulting in a 41 per cent rack space reduction and a 37 per cent decrease in energy consumption. The potential environmental benefits of HPE GreenLake are further magnified when combined with energy-effective IT solutions. For instance, composable infrastructure solutions such as HPE Synergy have lowered customer IT infrastructure costs by 22 per cent. HPE Moonshot systems built on HPE GreenLake use 25 per cent less power than traditional server designs. Combining HPE high-performance computing solutions and HPE GreenLake enables companies to access high-performant processing power and run simulations with a reduced carbon footprint. For instance, high-performance systems in the HPE Apollo, HPE SGI, and HPE Cray families are available with direct liquid cooling as a standard feature, which reduces power consumption from cooling significantly, offering a potential 84 per cent reduction in emissions according to an estimate from a recent financial services customer (HPE, 2022).

- **Promoting a circular economy:** HPE has the largest IT manufacturer refurbishing facilities in the world, one in the US and one in Scotland. Multiple programs — HPE Renew, HPE Asset upcycling services, HPE certified pre-owned products — support the global society in transitioning to circular economy. HPE has established more than 80 IT asset recycling stations in more than 50 countries and regions around the world, which not only recycle HPE assets but also refurbish and sell IT hardware from other manufacturers, sharing the value with customers. In 2021, HPE processed more than three million IT assets, weighing nearly 27 million pounds, of which 85 per cent has been refurbished and resold. To reduce waste, HPE also provides IT asset assessment services, including auditing the inventory of IT assets and issuing circular economy reports to help customers optimize resource usage and disposal (HPE, 2022).
Collaborating with ecosystem partners to develop decarbonization technologies: To help reduce unintended roadblocks and encourage the acceleration of breakthroughs for low-carbon technologies, HPE co-launched the Low-Carbon Patent Pledge in 2021 with founding partners Facebook\textsuperscript{21} and Microsoft. More than 400 patents that could support low-carbon solutions for generating, storing, and distributing low-carbon energy have been made available for royalty-free. This collaborative initiative has the potential to attract patents from across industries and open the door for additional sharing of knowledge, technology, and resources efforts to address the world’s climate emergency (HPE, 2022).

Giving back to the community through business strategy: HPE has a tradition of leveraging internal talents to support tech non-profits that address the critical needs of the world and help the community build resilience. Since 2019, HPE has organized “Accelerating Impact” annual campaign in which each HPE employee received a credit from the HPE Foundation to give to one tech non-profit of their choice. In the 2021 campaign, more than 28,000 employees around the world directed nearly $1.3 million in HPE Foundation funds to 40 tech non-profits (HPE, 2022).

Lessons for Other Corporates

- **Embed climate strategy into corporate strategy:** HPE believes that climate strategy does not work independently but is an intrinsic part of the corporate strategy and should effectively engage with it. HPE focuses on developing and offering more energy-efficient and environmentally friendly products and solutions such as HPE GreenLake, not only reducing carbon emissions in all three Scopes but also supporting the long-term growth of the business at large.

- **Drive top-down implementation:** To close the gap between strategy and implementation, HPE believes that all leaders carry the responsibility to pioneer changes. In 2021, HPE required all its executive-level employees to complete climate training on how to fully align with the company’s emissions reduction strategy and ensure they incorporate climate into business principles. This initiative also marked the first time HPE tied climate strategy directly to the incentives of the executive team.

- **Mobilize employees to accelerate impact:** HPE recognizes that a part of the purpose as a large corporate is being a force for good and using technology to advance the way people live and work. HPE fulfills this purpose through distributing support for tech non-profits through its employees. The “Accelerating

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\textsuperscript{21} Facebook has changed its name to Meta Platforms as of October 2021.
“Impact” annual campaign mobilized employees to bring to light the best technologies and invest in them, fully leveraging the power of individuals to fund transformative technologies and accelerate climate action. This initiative not only raises awareness of climate issues among employees but also allows HPE to be involved in promising climate technologies at an early stage, creating an overall more conducive environment for innovation.
5.7 China Energy Conservation and Environmental Protection Group

1. Company Background

As a centrally administered state-owned enterprise with the mission of “making the sky bluer, mountains greener, water clearer, and life better”, China Energy Conservation and Environmental Protection Group (CECEP) aims to become a world-leading carbon neutral solution provider, and is committed to becoming a leader in high-quality development of green industries and a source of low-carbon, zero-carbon and carbon-negative technologies. CECEP strives to enhance its technological innovation, intellectual supply and demonstration capabilities, and to become an important participant, a prominent contributor and an active leader in achieving carbon peaking and carbon neutrality in China (CECEP, 2022).

2. Target Setting

CECEP’s “3060” goals (national carbon peaking by 2030, carbon neutrality by 2060) can be summarized in three steps. The first step is to become a world-leading provider of carbon reduction solutions by 2030, expanding its services from traditional fields to new infrastructure and other emerging fields. The second step is to strive for operational carbon neutrality. The third step is to strive to realize carbon neutrality in the supply chain (CECEP, 2022).

3. Climate Action and Global Collaboration Highlights

In operations, CECEP is vigorously promoting a digital transformation strategy, accelerating the implementation of low-carbon remodifications of operational facilities and zero-carbon pilot work, building an intelligent digital low-carbon operation and carbon asset management system, tapping operational management potential to continually reduce carbon emissions, and
encouraging employees to adopt green and low-carbon behaviors — all in order to create a model of “3060” carbon action for low and medium-emission enterprises (CECEP, 2022).

- **Building an intelligent digital carbon asset management system:** CECEP is establishing a carbon asset management system that integrates carbon monitoring, carbon emission verification, carbon emission reduction, carbon asset development, carbon trading and carbon financial services, while exploring the establishment of an internal investment carbon pricing mechanism, and gradually developing carbon asset management technology service (CECEP, 2022).

- **Tapping operational management potential to continually reduce carbon emissions:** CECEP Guozhen, a subsidiary of CECEP, has proposed a management improvement project to build and develop “low-carbon water operations.” Four low-carbon working groups, each focusing on an area such as electricity saving, low-carbon, phosphorus removal or sludge drying, are working top-down to demonstrate benchmark technological refinement, model replication and dissemination, to establish an evaluation framework and to upgrade the operational management system and eventually improved the low-carbon performance of the wastewater treatment system. In 2021, the company’s water operations costs per ton of wastewater treated fell by 5.7 per cent year-on-year, with year-on-year annual carbon emissions reduced by more than 70,000 tons (CECEP, 2022).

- **Encouraging employees to take green and low-carbon actions:** CECEP is widely promoting the “CECEP Employees’ Green and Low-Carbon Behavior Initiatives” (“Ten Rules for CECEP Employees”) and exploring the establishment of internal carbon rewards and other mechanisms to incentivize employees to participate in carbon reduction (CECEP, 2022).

**In the value chain,** CECEP plays a leading role in reducing supply chain emissions and continues to promote the iterative innovation of technology and service solutions, to push forward the application of advanced technology and equipment, and to accelerate the shift to digital intelligence in carbon neutral services, in order to technologically empower the drive for carbon peaking and carbon neutrality (CECEP, 2022).

- **Empowering and evaluating suppliers’ climate performance:** CECEP is developing green, low-carbon procurement standards and promoting the establishment of a green, low-carbon supply chain system for “green design, green materials, green manufacturing, green procurement, green packaging, green transportation, waste recycling and disposal” , to act as a model “3060” action plan for low and medium-emission enterprises (CECEP, 2022).

- **Developing and launching low-carbon products and services:** CECEP is committed to further developing innovative low-carbon technologies, strengthening cutting-edge zero-carbon technologies and their dissemination, and laying the ground for forward-looking negative-carbon technologies (CECEP, 2022).
Further developing innovative low-carbon technologies in three areas. The first area is low-carbon energy-saving, where efforts are focused on making breakthroughs in core energy-saving technologies in the field of new infrastructure and strengthening the R&D and manufacture of key equipment. CECEP is strengthening the research, development and optimization of key technologies for integrated solutions for regional energy systems. The second area is low-carbon green building. Responding to the development needs of green low-carbon parks and ecological cities, CECEP is working to improve green building technologies and related R&D systems. CECEP is putting significant resources into R&D and applied research in new green building technology. The third area of focus is low-carbon environmental management technologies that for greater value reclamation and high-value applications of resources, as well as recycling of retired new energy devices. CECEP is also advancing the application of new technologies in areas such as solid waste and wastewater processing. The CECEP Guiyang Future Ark project creatively applied the regional river/sewage-source heat pump power supply technology at large scale for the first time to set up a combined energy supply system that has various sources, including river-source heat pumps, sewage-source heat pumps, heat source towers, gas driven CCHP system and etc. By integrating multiple technologies, the project has achieved multi-energy complementarity, interconnected pipeline network and intelligent power management platform that allows for intelligent control of power stations to effectively monitor operations and energy savings. The project saves 219,942 tons of standard coal and reduces 53,844 tons of CO2e per year. (CECEP, 2022).

Improving cutting-edge zero-carbon technologies related to both energy source and energy storage. In terms of energy sources, CECEP is actively exploring high-efficiency PV modules, wind power and geothermal power generation technologies. In terms of zero-carbon energy storage technology, CECEP is actively researching hydrogen power and power storage applications. Taking the CECEP Hangzhou Energy and Environment Industrial Park—a green energy-saving and low-carbon demonstration park—as an example. CECEP applied a number of effective green building technologies to reduce the park’s energy consumption and produce green energy to offset carbon emissions. As a low-carbon demonstration project in the park, the CECEP Hangzhou Green Building Science and Technology Museum has adopted state-of-the-art building energy-saving systems to reduce energy consumption effectively, such as a self-shading system, passive ventilation, environmental perimeter protection, smart external shading, independent temperature and humidity control air conditioning, RE generation, energy regenerating elevators, rainwater collection, wastewater reuse, intelligent control, and itemized energy-use monitoring. In 2020, the electricity consumption of the Science and Technology Museum was only 42 per cent of the limit set by the National Energy Consumption Standard for Civil Buildings, equivalent to a reduction in carbon dioxide emissions of nearly 136 tons. In addition, there is a 2 MW rooftop PV grid-connected generator in the CECEP Hangzhou Energy and Environment Industrial Park, which is the first megawatt-class rooftop PV grid-con-
connected power plant in China. This project has delivered a cumulative carbon dioxide emission reduction of more than 12,000 tons since it was completed and connected to the grid in 2009 (CECEP, 2022).

- **Laying the ground for forward-looking negative-carbon technologies** in two areas. The first area is carbon capture, utilization and storage (CCUS). CECEP is strengthening the tracking and exploratory research into negative carbon technologies, prospectively initiating R&D in CCUS related technologies as well as their applications, taking the lead in exploring biomass coupled with carbon capture and storage technology (BECCS), waste-to-energy coupled with CCUS, and other demonstration projects. The second area is carbon sink. CECEP is setting up R&D in new ecological carbon storage products and materials, exploring a carbon sink ecosystem solution combining with carbon-rich agricultural technology and forest carbon sink development, and working to further enhance the vertical greening of buildings and land-use technology for greening large spaces (CECEP, 2022).

- **Promoting a circular economy**: CECEP Hangzhou Energy and Environment Industrial Park has set up garbage sorting and collection points in new low-carbon buildings, which can transform organic waste from canteens into bio-sediment for fertilizer use and recycles all kinds of recyclable materials. It also has separate recycling points for waste batteries, paper, glass, plastic and metal (CECEP, 2022).

### Lessons for Other Corporates

- **Use innovation to drive new integrated energy services**: Explore new zero-carbon energy replacement solutions for buildings, industry and transportation based on digitization and advanced energy-saving technologies.

- **Explore the synergy between pollution reduction and carbon reduction**: Creating new environmental management solutions that reduce pollution, reduce harm, and reclaim resources will give new momentum to green and low-carbon development.

- **Improve decarbonization capability of smart supply chain**: Actively advance research and establishment of carbon-related standards (CECEP, 2022).
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**Exhibit 2. How representative corporates meet the SDGs and the Ten Principles of the UN Global Compact**
6. Key Takeaways for Corporates Moving Towards a Net-Zero Future

Four key takeaways are summarized for corporates to embrace a Net-Zero future.

1. **Set a Net-Zero target:** Among existing international target setting standards, SBTi, aligned with the Paris Agreement 1.5°C pathways, is highly recommended. Meanwhile, it is imperative that corporates are up to speed with governmental policies and align with governmental standards.

   To help accelerate the journey to setting SBT, the UN Global Compact has launched the Climate Ambition Accelerator (CAA), a six-month program to equip corporates with the knowledge and skills needed to set SBT. Participating companies will gain access to global best practices, peer-to-peer learning opportunities, capacity-building sessions, and on-demand training.

2. **Identify the major GHG emitters and the corresponding decarbonization initiatives:** Corporates should carry out decarbonization in a well-defined and targeted manner, understanding their major emission sources from an industry-specific or company-specific perspective. Prioritizing actions to tackle these key challenges could significantly contribute to achieving Net-Zero in time.

3. **Engage with and win support from key stakeholders, especially the government:** Complying with governmental regulations and leveraging preferential measures such as tax relief to reduce the cost of decarbonization are just two of the many possible ways. Bold actions and strong policies go together.

4. **Take the “T” approach to decarbonization:** Besides drilling down vertically into internal operations, corporates could take the lead in mobilizing ecosystem partners horizontally across the value chain — engaging suppliers to set climate goals, collaborating on technological innovations, launching green/low-carbon products, and carrying out recycling programs, etc.

In the race to reduce emissions, technology is the pillar of climate actions. UN Global Compact and BCG jointly published *Corporate Net-Zero Pathway* report in July 2021, in which we selected and explained nine prospective technologies that corporates and investors could watch closely:

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Autonomous driving
Carbon Capture, Utilization and Storage (CCUS)
Electric vehicles
Energy storage
Hydrogen and fuel cells
Insulation materials
Materials for high-efficiency solar cells
Offshore wind
Superconducting technology

While witnessing technological breakthroughs in these nine areas, it is worth highlighting two prospective areas of cross-industry global cooperation.

**Alot**-based energy and carbon emissions management solutions use real-time data collected from sensors to optimize the use of energy and dynamically adjust the system to the most effective and sustainable energy consumption strategy. This solution allows the digitalization and automation of measuring, monitoring, and abating carbon emissions in different settings such as data centers, shopping malls, and office buildings. AI acts as the “brain”, while IoT is “the nervous system”, together driving the system towards Net-Zero. The successful development and evolution of this technology is dependent upon cross-industry, multidisciplinary collaboration. The manufacturing industry specializes in providing the backbone — the sensors, devices, and other hardware systems — that enable data collection and real-time adjustments to energy use, while the TMT industry develops the thread that weaves together the parts, including the software, computing power, and algorithms. Downstream industries implement the solutions in different real-world settings and provide constructive feedback to optimize the solutions.

**Regenerative agriculture** is a philosophy of land management that considers all aspects of agriculture connected as a web — a network of entities that grow, enhance, exchange, distribute, and consume goods and services — instead of a linear supply chain (NRDC, 2021). In this realm, one increasingly popular approach is precision agriculture, which is a series of targeted key interventions that improve productivity and yields while reducing the need for inputs such as artificial fertilizers and pesticides, reducing N₂O emissions and increasing carbon sequestration in soils. Introducing digitalization to

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23. Artificial Intelligence of Things, the combination of artificial intelligence technologies (AI) and the internet of things infrastructure (IoT).
farming, precision agriculture leverages technologies from the TMT industry — remote sensors, unmanned aerial vehicles (UAVs), IoT, AI, and cloud computing — to make targeted changes in the food and agriculture industry while reducing carbon emissions and preserving the health of the land (UNDP, 2021). Looking forward, scientists are diving into the fundamentals of plant physiology, morphology, and metabolism through nanotechnology, using nanoparticles to generate positive changes in yield, chlorophyll content, and gene expression in plants (Kumari, Bhinda, Sharma, & Parihar, 2022).
7. Conclusion

Over the years, we have witnessed increasing awareness of climate issues. Corporates are recognizing the impact climate change has and will have on their operations and value chain, which necessitates rapid growth in climate commitments and solid technological advancements to follow through on the commitments. However, the world is still a long way away from achieving the well-below-2°C goal, let alone the 1.5°C goal. We cannot afford to continue along current path. Achieving the objectives of the Paris Agreement requires corporates to step up their ambition and follow through with credible and consistent actions.

Thankfully, the battles we have fought have rewarded us with a new wave of technological innovation, especially in digital interconnectivity, which allows us to connect across the planet and share resources, networks, and insights at an unprecedented level. The GDI, established to accelerate the implementation of the UN 2030 Agenda, encourages global collaboration and adds momentum to climate action. Corporates should seek global collaboration opportunities in such initiatives and strive for a more ambitious and inclusive climate target, backed by science-based actions. Corporates who reach beyond the operational boundary, beyond the value chain, and beyond geographic borders will stand a better chance of building resilience and effectively mobilizing the global community towards Net-Zero.
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**About the UN Global Compact**

As a special initiative of the UN Secretary-General, the United Nations Global Compact is a call to companies everywhere to align their operations and strategies with Ten Principles in the areas of human rights, labour, environment and anti-corruption. Launched in 2000, the UN Global Compact guides and supports the global business community in advancing UN goals and values through responsible corporate practices. With more than 20,000 companies and non-business participants based in over 170 countries, it is the largest corporate sustainability initiative in the world.

The UN Global Compact is unparalleled in its ability to unite companies with every stakeholder group working to advance sustainable development, including the United Nations, Government, civil society, investors and academia. Together, through bold actions and collaboration between all sectors of society, we can end extreme poverty and hunger, fight inequalities and address climate change, ensuring no one is left behind.

Visit [unglobalcompact.org](http://unglobalcompact.org) to learn more. For more information, please follow UN Global Compact on social media platforms:

- [UNGC WeChat](#)
- [UNGC Short Video](#)
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**About the UN Global Compact Climate Ambition Accelerator**

The United Nations Global Compact in 2021 launched the [Climate Ambition Accelerator](#), a six-month learning programme to equip more companies with the knowledge and skills they need to help halve global emissions by 2030 and to reach Net Zero by 2050. The Accelerator aims to scale-up credible climate action across companies of all sizes, sectors and regions to enable them to set and deliver on meaningful commitments to reduce emissions and deliver on the Paris Climate Agreement. Through the Global Compact Local Networks around the world, companies participating in the Climate Ambition Accelerator gain access to best practices, peer-to-peer learning opportunities, capacity building sessions and on-demand training. The programme builds on the work of the UN Global Compact to develop and promote the Science Based Targets initiative and the [Business Ambition for 1.5°C campaign](#). It also complements the existing environmental sustainability efforts of the Global Compact such as the Action Platform on Climate Ambition, the Sustainable Ocean Business Action Platform and the Water Resilience Coalition, which in turn contribute to the Race to Zero and Race to Resilience campaigns in the lead up to COP27.
About Boston Consulting Group

Boston Consulting Group partners with leaders in business and society to tackle their most important challenges and capture their greatest opportunities. BCG was the pioneer in business strategy when it was founded in 1963. Today, we work closely with clients to embrace a transformational approach aimed at benefiting all stakeholders — empowering organizations to grow, build sustainable competitive advantage, and drive positive societal impact.

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About the 17 Sustainable Development Goals (SDGs)

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries — developed and developing — in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality and spur economic growth — all while tackling climate change and working to preserve our oceans and forests.

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reducing Inequality
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life On Land
16. Peace, Justice, and Strong Institutions
17. Partnerships for the Goals

Visit sdgs.un.org/goals to learn more.
About the Ten Principles of the UN Global Compact

Corporate sustainability starts with a company’s value system and a principles-based approach to doing business. This means operating in ways that, at a minimum, meet fundamental responsibilities in the areas of human rights, labour, environment and anti-corruption. Responsible businesses enact the same values and principles wherever they have a presence, and know that good practices in one area do not offset harm in another. By incorporating the Ten Principles of the UN Global Compact into strategies, policies and procedures, and establishing a culture of integrity, companies are not only upholding their basic responsibilities to people and the planet but also setting the stage for long-term success. The Ten Principles of the United Nations Global Compact are derived from: the Universal Declaration of Human Rights, the International Labour Organization’s Declaration on Fundamental Principles and Rights at Work, the Rio Declaration on Environment and Development, and the United Nations Convention Against Corruption.

Human Rights

1. Businesses should support and respect the protection of internationally proclaimed human rights; and
2. make sure that they are not complicit in human rights abuses.

Labour

3. Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
4. the elimination of all forms of forced and compulsory labour;
5. the effective abolition of child labour; and
6. the elimination of discrimination in respect of employment and occupation.

Environment

7. Businesses should support a precautionary approach to environmental challenges;
8. undertake initiatives to promote greater environmental responsibility; and
9. encourage the development and diffusion of environmentally friendly technologies.

Anti-corruption

10. Businesses should work against corruption in all its forms, including extortion and bribery.

Visit [unglobalcompact.org/what-is-gc/mission/principles](https://www.unglobalcompact.org/what-is-gc/mission/principles) to learn more. For more information about UN Global Compact, please email [ungc.china@unglobalcompact.org](mailto:ungc.china@unglobalcompact.org).

The Ten Principles of the United Nations Global Compact are derived from: the Universal Declaration of Human Rights, the International Labour Organization’s Declaration on Fundamental Principles and Rights at Work, the Rio Declaration on Environment and Development, and the United Nations Convention Against Corruption.