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Globalization

From Technological Transition to Climate
and Geopolitical Challenges

Edited by José Moleiro Martins



Globalization - From Technological Transition to Climate and Geopolitical Challenges

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IntechOpen Book Series

Sustainable Development

Volume 43

Aims and Scope of the Series

Transforming our World: the 2030 Agenda for Sustainable Development endorsed by United Nations and 193 Member States, came into effect on Jan 1, 2016, to guide decision making and actions to the year 2030 and beyond. Central to this Agenda are 17 Goals, 169 associated targets and over 230 indicators that are reviewed annually. The vision envisaged in the implementation of the SDGs is centered on the five Ps: People, Planet, Prosperity, Peace and Partnership. This call for renewed focused efforts ensure we have a safe and healthy planet for current and future generations.

This Series focuses on covering research and applied research involving the five Ps through the following topics:

1. Sustainable Economy and Fair Society that relates to SDG 1 on No Poverty, SDG 2 on Zero Hunger, SDG 8 on Decent Work and Economic Growth, SDG 10 on Reduced Inequalities, SDG 12 on Responsible Consumption and Production, and SDG 17 Partnership for the Goals
2. Health and Wellbeing focusing on SDG 3 on Good Health and Wellbeing and SDG 6 on Clean Water and Sanitation
3. Inclusivity and Social Equality involving SDG 4 on Quality Education, SDG 5 on Gender Equality, and SDG 16 on Peace, Justice and Strong Institutions
4. Climate Change and Environmental Sustainability comprising SDG 13 on Climate Action, SDG 14 on Life Below Water, and SDG 15 on Life on Land
5. Urban Planning and Environmental Management embracing SDG 7 on Affordable Clean Energy, SDG 9 on Industry, Innovation and Infrastructure, and SDG 11 on Sustainable Cities and Communities.

The series also seeks to support the use of cross cutting SDGs, as many of the goals listed above, targets and indicators are all interconnected to impact our lives and the decisions we make on a daily basis, making them impossible to tie to a single topic.

Meet the Series Editor



Usha Iyer-Raniga is a professor in the School of Property and Construction Management at RMIT University. Usha co-leads the One Planet Network's Sustainable Buildings and Construction Programme (SBC), a United Nations 10 Year Framework of Programmes on Sustainable Consumption and Production (UN 10FYP SCP) aligned with Sustainable Development Goal 12. The work also directly impacts SDG 11 on Sustainable Cities and Communities. She completed her undergraduate degree as an architect before obtaining her Masters degree from Canada and her Doctorate in Australia. Usha has been a keynote speaker as well as an invited speaker at national and international conferences, seminars and workshops. Her teaching experience includes teaching in Asian countries. She has advised Austrade, APEC, national, state and local governments. She serves as a reviewer and a member of the scientific committee for national and international refereed journals and refereed conferences. She is on the editorial board for refereed journals and has worked on Special Issues. Usha has served and continues to serve on the Boards of several not-for-profit organisations and she has also served as panel judge for a number of awards including the Premiers Sustainability Award in Victoria and the International Green Gown Awards. Usha has published over 100 publications, including research and consulting reports. Her publications cover a wide range of scientific and technical research publications that include edited books, book chapters, refereed journals, refereed conference papers and reports for local, state and federal government clients. She has also produced podcasts for various organisations and participated in media interviews. She has received state, national and international funding worth over USD \$25 million. Usha has been awarded the Quarterly Franklin Membership by London Journals Press (UK). Her biography has been included in the Marquis Who's Who in the World® 2018, 2016 (33rd Edition), along with approximately 55,000 of the most accomplished men and women from around the world, including luminaries as U.N. Secretary-General Ban Ki-moon. In 2017, Usha was awarded the Marquis Who's Who Lifetime Achiever Award.

Meet the Volume Editor



José Moleiro Martins is a Coordinator/Associate Professor at the Polytechnic University of Lisbon in Strategic Management, Entrepreneurship, and Knowledge and Innovation Management. He holds a Habilitation and a Ph.D. in Management from ISCTE-IUL. He has business experience in the manufacturing industry (SCA - Svenska Cellulosa Aktiebolaget), the aeronautics and defense sector (AVP - Aero Voo Portugal Lda.), and strategic management consulting across various sectors (Gestão Total). He is a researcher at BRU-Unide/ISCTE-IUL, with research interests in the areas of Knowledge Management, Innovation, Technological Innovation Management, Entrepreneurship, Sustainability, Green Human Resources Management, and the markets of Sub-Saharan Africa and Asia. He has authored books and has publications as a sole author and co-author in reputable journals.

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Preface

In the first decades of the 21st century, it became evident that globalization was no longer a phenomenon of ever-increasing economic and social integration, bringing growing prosperity to all corners of the world. Instead, it has become a complex and tense tapestry, woven from technological acceleration, climate turbulence, geopolitical rivalry, and profound social transformation (and inequality). The chapters in this volume reveal a world torn between convergent pressures and divergent paths, between the promise of unprecedented innovation and the reality of political and trade instability. The *Globalization – From Technological Transition to Climate and Geopolitical Challenges* emerges as both an academic contribution and a timely intellectual guide for navigating an era in which the meaning and context of globalization are being redefined.

The book begins by redefining globalization in a context of greater strategic and commercial fragmentation. Traditional economic blocs continue to shape production and trade, but no longer operate within a stable global order. Nations confront an international environment in which multipolar competition is strengthening, industrial policy is resurgent, and the race for technological self-sufficiency is accelerating. Globalization is in a phase of redefinition, increasing uncertainty among economic actors. Within this shifting landscape, the climate emergency serves as both an aggravating force and an existential constraint. Rising global temperatures, extreme weather events, biodiversity loss, and resource depletion challenge the resilience of societies and the sustainability of economic systems.

The second chapter provides the macro framework for understanding how environmental instability intersects with economic development. The scientific evidence of accelerated warming, rapidly rising sea levels, and unprecedented atmospheric carbon dioxide concentrations is presented not merely as environmental data, but as a structural driver capable of reshaping global markets, social welfare, and geopolitical relations. These environmental pressures are not uniform and exacerbate inequalities, hitting the poorest populations first and hardest. However, the text also shows that significant responses are emerging: carbon pricing instruments, green tax incentives, sustainability-linked bonds, renewable energy programs, and national climate strategies are part of an expanding toolkit. Still, the success of these measures, beyond technological capacity or policy design, depends on governance, cooperation, and the political will to confront uncomfortable trade-offs. In other words, the climate challenge is about emissions and about transforming economic systems by reducing the unequal development patterns of globalization.

In the third chapter, we observe that as the world transitions from the post-Cold War unipolar moment to a contested multipolar order, states increasingly resort to economic tools, trade agreements, industrial policy, and technological competition to assert their influence on the international stage. The rise of radical policy movements, the instrumentalization of tariffs and sanctions, renewed great-power rivalry, and intensified

conflicts in regions like Eastern Europe and the Middle East illustrate how economic and ideological fractures reverberate globally. However, the importance of diplomacy, peaceful conflict resolution, and the pursuit of more equitable models of international cooperation is emphasized. The future of globalization will be determined not only by power struggles but by the collective capacity to prevent rivalry from escalating into systemic rupture.

Following this macro framework, the book moves to the corporate level, exploring how organizations interpret and respond to the pressures of climate risk, geopolitical uncertainty, and societal expectations. In an era in which companies act as agents of social responsibility, the fourth chapter reveals a more nuanced reality: organizationally driven practices of social responsibility do not automatically translate into consistent behavioral change. The analytical model developed in this section offers a sophisticated lens for understanding why organizations often struggle to align ethics with their operational practices.

The fifth chapter looks toward the horizon, examining the technological revolution, particularly artificial intelligence, in relation to environmental sustainability. Here, we encounter a central paradox of our time: the technologies that foster progress increasingly rely on massive energy and water consumption, generate unprecedented volumes of electronic waste, and push against planetary boundaries. In this sense, innovation is not inherently benign. Without regulation and political foresight, technological development can amplify ecological degradation even as it seeks to mitigate it. This tension requires a paradigm shift in legal, economic, and regulatory thinking. Traditional frameworks built for slower, more predictable changes are inadequate for managing systems driven by artificial intelligence, global data infrastructures, and high-intensity resource use. Thus, supranational mechanisms grounded in accountability, prevention, and collective oversight become manifestly necessary. Despite the bureaucratic inertia, often disconnected from the reality of the problems, observed in the European Union, European directives are shaping emerging models that seek to embed environmental and social responsibilities into business operations, supply chains, and governance practices. This legal evolution reflects a philosophical argument present throughout the book: sustainability cannot be reduced to compliance. It is founded on an understanding of ecological solidarity, that is, the recognition that present actions shape the living conditions of future generations, and that states, businesses, and societies must share the responsibility for safeguarding the planet's sustainability. Furthermore, companies must reconsider their role, beyond profit-generating entities, as social institutions whose strategic decisions influence human well-being far beyond their immediate stakeholders.

Collectively, the chapters reveal that globalization has entered a phase of turbulence, reconfiguration, and a need for systemic adaptation. Technological innovation, while transformative, must be guided by principles that respect planetary boundaries. Climate change demands not incremental adjustments, but structural transformation. Geopolitical fragmentation challenges the international cooperation necessary for both peace and sustainability. Moreover, businesses, as key actors in global value creation, must navigate these competitive pressures with integrity, foresight, and responsibility.

This book provides an integrated framework for understanding the interconnected challenges shaping the 21st century. It invites us to reflect on the complexity of our times with clarity and analytical sense. It reminds us that navigating uncertainty is not merely an intellectual exercise, but a moral and political imperative of both citizenship and business. By illuminating the paths where technological innovation, environmental management, and geopolitical prudence intersect, this book offers not just analysis but hope that a more sustainable and just global future remains within our reach, if we choose to build it.

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Perspective Chapter: Globalization at the Crossroads – Climate, Geopolitics, and Technological Transition

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Abstract

This chapter examines globalization as a phenomenon that simultaneously entails uncertainties and offers opportunities. In the face of climate and geopolitical challenges—such as the United States of America (USA)-China rivalry, the energy crisis, or the rise of BRICS+—globalization reveals fragmentation and multipolarity. However, it also encompasses innovation dynamics in technological and digital transitions, offering solutions for more sustainable economies. The text critically analyzes the social, environmental, and economic impacts of globalization, presenting it as a dual phenomenon: a driver of progress and integration, but also of inequalities and instability. Finally, it discusses how technological transition can mitigate risks and foster opportunities, provided it is accompanied by inclusive and sustainable policies. The chapter advocates for a regulated globalization guided by environmental responsibility, social justice, and shared innovation, proposing strategic actions and opening avenues for future research.

Keywords: globalization, climate, geopolitics, technological transition, sustainability

1. Introduction

We are witnessing a historic moment of uncertainty in major economic blocs—such as the European Union (EU), NAFTA/USMCA, ASEAN, Mercosur, APEC, BRICS+, SADC, and China, with informal alliances through initiatives like the Belt and Road Initiative (BRI)—and of reconfiguration driven by various simultaneous and cascading phenomena. On the one hand, these blocs aim to facilitate trade, reduce tariffs, and strengthen economic and political cooperation among their members; on the other hand, they are subject to the existing “balance” between them, which ultimately influences their members. Indeed, countries are undergoing a historic reconfiguration in economic and geopolitical relations, marked by transformative phenomena in the global economic order, including:

- United States of America (USA)-China trade and tech war: involving tariff conflicts, restrictions on companies (Huawei, TikTok, semiconductors), and

decoupling, with reduced mutual sectoral and cross-sectoral dependence, along with supply chain relocations (i.e., friendshoring).

- Expansion of BRICS+ and the challenge to Western hegemony: new members joined in 2024 (Egypt, Ethiopia, Iran, and the United Arab Emirates) to increase trade in local currencies, reduce dollar dominance, and create parallel institutions, such as the New Development Bank (NDB), as an alternative to the IMF.
- Regionalization of production chains (neo-protectionism): a response to global supply chain crises—e.g., due to the COVID-19 pandemic and the Ukraine War—highlighting the risks of external dependence.
- Redesigned strategies: the USA Chips Act (semiconductor investments) and Inflation Reduction Act (green industry); the EU's Critical Raw Materials Act (strategic minerals); and China's push for technological self-sufficiency ("made in China").
- Mega-regional trade agreements: the Regional Comprehensive Economic Partnership (RCEP 2020) among Asia-Pacific countries and the EU-Mercosur deal (under negotiation amid environmental and agricultural pressures from France).
- Ukraine War and energy reconfiguration: European sanctions on Russia reduced its dependence on Russian gas; Russia and China deepened trade ties (Power of Siberia 2 pipeline, trade in yuan/ruble); and OPEC+ cut production to control oil prices.
- Rise of the "Global South": developing nations (India, South Africa, Brazil) gained prominence in the G20; alternatives to SWIFT emerged, such as China's CIPS and Russia's SPFS.
- Green revolution and race for critical minerals: the energy transition turned lithium, cobalt, and rare earths into the "new oil"; China controls 60% of global critical mineral processing; the USA and EU secured supply deals with Chile, Congo, and Australia.
- Artificial Intelligence (AI) and the new tech war: the USA and China compete in AI, quantum computing, and 6G; the USA has banned advanced chip exports to China (ASML, NVIDIA).
- And finally, financial fragmentation: de-dollarization, with trade in yuan, ruble, and rupee (e.g., India buying Russian oil in rupees); and Central Bank Digital Currencies (CBDCs), like China's e-CNY and the EU's digital euro.

In this phase of global reconfiguration among major economic blocs and nations, globalization—as an integrator of economies, societies, and cultures—reflects both growing uncertainty (stemming from climate and geopolitical challenges) and transformative opportunities, particularly those linked to technological and energy transitions.

Since the 1990s, globalization has intensified through trade liberalization (e.g., *via* online channels), capital flows (e.g., investments and equity participation in companies),

and the dissemination of knowledge (e.g., search engines and databases). Additionally, the digital revolution—marked by successive technological advancements and the resulting societal shifts driven by the internet and computing—alongside the digital transition—the gradual and continuous integration of technology into economic sectors and society—and improved communication, have accelerated the political, economic, sociocultural, and ecological dimensions of globalization.

However, the 2007/2008 financial crisis, triggered by the collapse of the USA investment bank Lehman Brothers (known as the Subprime Crisis), the COVID-19 pandemic, and geopolitical tensions stemming from USA-China relations, the war in Ukraine, and heightened instability in the Middle East, have led to renewed fragmentation among trade blocs and strategic realignment—i.e., *slowbalization*—negatively impacting global value chains for businesses and nations.

The climate emergency has become a pressing issue due to its devastating and unpredictable effects on communities, ecosystems, economies, and societies [1]. The conditions of *polycrisis*—i.e., interconnected climate, energy, and financial crises—threaten societal stability, with cascading economic interdependencies. Geopolitics has gained prominence in a context where climate is a top concern, giving rise to *climate geopolitics*. Nevertheless, geopolitical risks—alongside environmental policies and corporate innovation capacity—may hinder the energy transition and the reduction of greenhouse gas emissions [2].

Despite the existing unpredictability, particularly regarding political and economic guiding factors, globalization serves as a chain mechanism for the dissemination of specialized knowledge and technological innovation. It fosters the development and global adoption of new technologies—e.g., AI, 5G (i.e., fifth-generation wireless cellular technology), and industrial automation—as well as advancements in the circular economy, creating opportunities to redefine global value chains and address the effects of climate change [3].

The critical analysis of (contemporary) globalization is based on two perspectives: (i) climate and geopolitical uncertainties as elements of systemic fragility, and (ii) technological opportunities arising from the digital and energy transitions.

The chapter is structured into six sections, as follows:

- i. The introduction establishes the thematic framework of the chapter in connection with the book's overarching theme.
- ii. Methodological explanation of the chapter's development to enable the replication of the research in other future works.
- iii. Globalization as risk or opportunity synthesizes the tensions between competitive vulnerability and innovation as a competitive imperative for organizations.
- iv. Climate and geopolitical challenges deepen the analysis of the international landscape.
- v. Technological transition as an opportunity highlights how innovation and digitalization can reshape competitive strategies.
- vi. The conclusion provides actionable insights and directions for future research.

In practice, the chapter's focus lies in globalization's capacity to simultaneously generate both complex risks and transformative innovation for business competitiveness and sustainability.

Then we proceed to the methodological explanation underlying the chapter's development.

2. Methodological explanation

This chapter employs a qualitative and conceptual research design, grounded in a comprehensive and critical analysis of the existing literature. The methodology is structured to systematically explore the multifaceted nature of globalization at its current crossroads, focusing on the interaction between climate change, geopolitics, and the technological transition. The aim is not to generate new empirical data but to synthesize, critique, and reconceptualize existing knowledge to provide a coherent analytical framework and identify key insights and future research avenues.

The development of this chapter followed a structured process comprising four distinct phases:

2.1 Scoping and problem identification

The initial phase involved defining the scope of the inquiry based on the book's overarching theme. The core research question was formulated as follows: *How do climate, geopolitical, and technological dynamics simultaneously fragment and create new opportunities within contemporary globalization, and what strategic actions can leverage this transition toward sustainability?*

This broad question allowed for an exploration of the dualities (risk/opportunity, fragmentation/integration) that characterize the current global landscape.

2.2 Literature review

A review of academic literature was conducted to map the state of the art. This involved: (i) source identification: scholarly databases (e.g., Scopus, Web of Science, Google Scholar) were searched using keyword combinations; (ii) source selection: priority was given to high-impact peer-reviewed journal articles, books from leading academics, and seminal reports from international organizations and think tanks published primarily within the last decade, with key foundational works included for historical context; (iii) thematic analysis: the identified literature was analyzed to identify central themes, conflicting viewpoints, and emerging consensus. This analysis was organized around the chapter's core pillars: globalization as risk/opportunity, climate-geopolitical challenges, and the technological transition. Contemporary evidence was integrated to ground the theoretical discussion in current events.

2.3 Critical synthesis and framework development

In this phase, the information gathered was synthesized to develop the chapter's critical argument. Rather than merely summarizing literature, the approach was to:

Identify interconnections: draw explicit links between seemingly disparate phenomena (e.g., how US-China tech decoupling affects the diffusion of green technologies, or how climate-induced migration fuels geopolitical instability).

Highlight tensions and dualities: contrast the opportunities presented by technological innovation with the risks of exacerbating inequality and exclusion.

And finally, formulate a conceptual framework: the chapter's structure itself acts as a framework, presenting globalization as a field of tension between destabilizing forces and transformative opportunities, mediated by policy and governance choices.

2.4 Derivation of conclusions and strategic recommendations

The final phase involved interpreting the synthesized knowledge to answer the research question. The conclusions and strategic recommendations are not based on statistical testing but are logically derived from the critical analysis conducted in the previous phases. They represent a set of reasoned, actionable propositions for policymakers, business leaders, and researchers, aimed at navigating the complexities of modern globalization.

2.5 Limitations and replicability

The primary limitation of this methodology is its reliance on the interpretation of existing literature, which introduces an element of subjectivity. However, the process is designed to be transparent and replicable. Future researchers can replicate this study by adopting the same research question and analytical framework, systematically searching the suggested databases using the provided selection criteria, applying the same process of thematic analysis and critical synthesis to the literature retrieved, and testing, refining, or challenging the conclusions and recommendations presented here based on new evidence or emerging trends.

This methodological approach ensures a rigorous, structured, and defensible exploration of the chapter's topic, providing a solid foundation for both understanding the current crossroads of globalization and for guiding future research.

Having outlined our methodology, we now turn to the substantive thematic analysis.

3. Globalization as risk or opportunity?

Globalization is a multidimensional phenomenon that reshapes political, economic, and sociocultural dynamics, with effects felt from the smallest remote village on the planet to Wall Street. It is an engine of progress, integration, and human development on a global scale. Yet, this does not negate the fact that it is also a source of inequality, instability, and exploitation of the most disadvantaged (e.g., labor paid at extremely low wages) [4].

The economic, technological, social, and cultural interconnectedness of nations has been intensified and expanded by globalization, encompassing market liberalization, global corporate value chains, and the digital revolution. This has broken down communication barriers, generated competitive efficiency gains, granted access to more sophisticated markets, and exacerbated inequalities both between and within countries.

In this context, globalization emerges as a dual phenomenon: on one hand, it creates opportunities for economic growth and sustainable innovation; on the other hand, it amplifies disadvantages and vulnerabilities in environmental, social, and geopolitical terms.

This section explores the arguments that position globalization as either a risk or an opportunity, considering its multifaceted implications (i.e., economic and societal).

3.1 Globalization as an opportunity

Globalization has been associated with economic benefits, such as accelerated growth in emerging economies, access to technological innovations, and poverty reduction. Trade openness has led to higher gross domestic product (GDP) growth rates [5]. Trade liberalization enhances productive efficiency (e.g., through access to new knowledge, technology, organizational best practices, and workforce upskilling) and expands market access, benefiting both developed and developing nations.

Globalization has facilitated the diffusion of knowledge and technology, accelerating the transition toward knowledge-based economies. Access to leading global universities, research centers, and information networks has enabled transnational collaboration in research and development (R&D), driving advancements in AI, medicine, energy, and digital transformation. For instance, Industry 4.0 and 5.0 are outcomes of this cooperation, delivering modernization, efficiency, and reduced environmental harm through sustainable practices in traditional sectors.

As a conduit for innovation diffusion, globalization's impact—whether through product or process innovation—and its accompanying policies shape social outcomes. For example, product innovation spurred by global integration reduced unemployment in certain Nigerian sectors [6]. Local political, institutional, and corporate conditions can further technological development, fostering localized value addition. Ultimately, globalization holds transformative potential for economic structures [7], provided it is supported by streamlined regulations, incentive policies, and social safeguards in foreign investment host countries.

On the societal front, globalization has strengthened human rights advocacy and raised awareness of climate change, pushing for sustainable practices—such as waste reduction and lower greenhouse gas emissions. A globalized society enables transnational movements and organizations (e.g., for minority rights and environmental causes) that spotlight issues and demand structural reforms in political, economic, and social spheres. Moreover, globalization has amplified individual rights, with platforms like Facebook, YouTube, WhatsApp, Instagram, TikTok, WeChat, Messenger, and Telegram turning opinion expression into a global phenomenon.

3.2 Globalization as risk

While generating benefits, globalization has also been criticized for exacerbating socioeconomic inequalities and weakening state sovereignty in the face of multinational corporations' economic power, particularly in peripheral countries with small open economies.

Beyond deregulated financial liberalization, which increased economic volatility, globalization has also led to worker precarity, the offshoring of productive industrial activities, and the decline of local industries. Premature deindustrialization in developing economies limits their capacity to achieve inclusive growth [4]. While global inequality between nations has decreased, intranational inequality has risen in several advanced economies, fueling public sentiment of government abandonment and the consequent emergence of anti-globalization movements and protectionism. For

instance, in the USA, the most severe deindustrialization occurred in the Rust Belt, particularly in Detroit and Michigan, with factory closures and unemployment.

Furthermore, concerns arise about the erosion of nation-states in the face of global capital flows and cryptocurrencies, which may pose significant challenges to monetary sovereignty, economic regulation, and state fiscal capacity. Left-wing thinker Habermas [8] warns about the democratic deficit in supranational institutions like the World Trade Organization (WTO), while right-wing President Donald Trump opposed the WTO, believing multilateral trade agreements harmed the USA's interests while benefiting China through its developing country status. Similarly, globalization challenges states' ability to design and implement effective social and environmental policies that promote population welfare and protect local ecosystems.

According to Chakraborty et al. [9], wealthy nations export systemic risks to poorer countries, which absorb economic shocks with profound repercussions, even without corresponding economic growth returns. The expected benefits of global economic integration do not guarantee protection against abrupt events like pandemics, (trade) wars, or natural disasters, where value chains may collapse more severely in less developed countries, amplifying economic inequalities.

This also occurs in decoupling scenarios—i.e., technological and political fragmentation between economic blocs—particularly affecting countries dependent on knowledge transfer and foreign investment, blocking traditional innovation channels where neither cutting-edge technological capacity nor recognized political influence exists internationally.

Environmental externalities—such as pollution, climate change, or biodiversity loss—are intensified by global economic interconnection through expanded trade and production, impact transfers to countries with weaker regulatory capacity, global production and consumption chains, global ecological interdependence, and rapid diffusion of intensive consumption practices.

3.3 Balancing risks and opportunities

Globalization is neither inherently good nor bad, as it stems from a series of actions taken by stakeholders that generate both opportunities and threats within a context of technological, climatic, and geopolitical uncertainty. In a fragmented globalized world, stronger economies export risks while protecting their own productive ecosystems, whereas poorer countries (i.e., those with weaker economies) bear the negative impacts of globalization without proportionally benefiting from its gains in terms of access to value created by production, distribution, and trade chains [10].

Initiatives such as labor regulations and sustainable certification can mitigate these inequalities, reducing the exploitation of poorer nations and fostering a more equitable form of globalization.

Ultimately, globalization is a phenomenon that offers opportunities for innovation and economic convergence among nations, but it also generates structural inequalities and environmental and political instability in societies. Therefore, measures must be adopted to promote sustainable globalization, including (i) fair and ethical trade: commercial practices that ensure decent working conditions, fair wages, and respect for human rights contribute to a more equitable globalization; (ii) clean technologies and renewable energy: the adoption of sustainable technologies and the use of renewable energy sources reduce the ecological footprint of global production and transportation; (iii) international agreements and environmental policies: cooperation among nations through agreements is essential to address global challenges such

as climate change and biodiversity loss; (iv) education and environmental awareness: investment in global sustainability education promotes conscious consumption, respect for cultural differences, and citizen participation in global decision-making; (v) corporate responsibility: adoption of sustainable practices by businesses—e.g., reduction of polluting emissions, responsible resource use, and respect for local communities—contributes to more balanced development; and (vi) circular economy and waste reduction: material reuse prevents waste and helps reduce the environmental impact of global production and consumption.

4. Climate and geopolitical challenges on the international stage

Globalization is marked by the uncertainty of climate risks and geopolitical tensions, which transform the international landscape into a space of fragmentation, strategic realignment, and unpredictability, as outlined below.

4.1 Climate and geopolitical insecurity

Climate change has evolved from being purely an environmental issue to becoming a structural driver of regional and global instability, as its impacts transcend borders and trigger geopolitical crises.

The increasing frequency of extreme events—such as severe droughts, water scarcity, floods, tropical cyclones, desertification, rising sea levels, and food insecurity—has direct consequences for food sovereignty, water availability, migration flows, and socio-political stability in regions with weak institutional adaptation capacity (i.e., generating political tensions and conflict risks) [11]. Populations exposed to extreme weather events are forced to migrate to other countries, straining migration policies and social support systems, and fueling regional tensions and cycles of instability (e.g., social and political), as seen, for instance, in Europe.

4.2 Strategic rivalries and global fragmentation

Globalization is no longer synonymous with increasing integration and economic interdependence among nations, as a more fragmented, competitive, and unstable orientation emerges, particularly among major economic blocs.

The rise of new powers, the reconfiguration of global value chains, and geopolitical competition point toward “partial deglobalization,” marked by growing strategic regionalization and multipolar realignment. This new context creates challenges in addressing cross-cutting issues like climate change and its impacts on communities.

This shifting global landscape is fueling increasing polarization between blocs. The USA and Europe lead green and technological agendas, while China and Russia represent alternative geoeconomic models. This multipolarity is driving the reorganization of global value chains through strategies like friendshoring—where companies prioritize supply chain partners from politically and economically allied nations, typically within the same trade bloc or military alliance—and the formation of autonomous regional blocs. The war in Ukraine and accelerated Arctic ice melt—which opens new shipping routes and access to resource reserves—are intensifying territorial disputes among powers like Russia, China, and the USA, further deepening divisions. Similar patterns of rivalry over strategic resources and regional influence are playing out in the Middle East and Africa.

4.3 Energy transition under geopolitical pressure

The shift toward clean energy is an essential reality, yet it remains constrained by strategic tensions. Significantly reducing or eliminating dependence on fossil fuels weakens the geopolitical influence of exporter nations like Russia, whose economy heavily relies on oil and gas export revenues.

Moreover, the exploration and production chain for critical materials—such as lithium, cobalt, and rare earth elements (a group of 17 chemical elements found abundantly in various countries, though largely concentrated in China and Brazil, and indispensable for the technology industry)—is dominated by a handful of nations, creating future strategic disadvantages.

4.4 Global climate governance

The COP27 summit, held in November 2022 in Sharm El-Sheikh, Egypt, achieved a landmark outcome with the establishment of the Loss and Damage Fund, designed to compensate vulnerable nations for adverse climate impacts—particularly extreme weather events and environmental degradation that cannot be prevented through mitigation or adaptation.

The Green Climate Fund, established in 2010 during COP16 (Cancún) and operationalized by 2015, serves as the primary financial mechanism of the UN Framework Convention on Climate Change. It aims to “promote low-emission and climate-resilient development by financing mitigation and adaptation projects.”

Meanwhile, broader political polarization—exemplified by the USA temporarily withdrawing from the Paris Agreement between 2017 and 2020—demonstrates how national decisions can have disruptive global consequences.

4.5 Socioeconomic impact and inequality

Climate disasters—such as sudden floods, prolonged droughts, storms, and wild-fires—primarily affect the most vulnerable communities in developing countries, though developed nations are not immune. These events impact agricultural lands, indigenous populations, coastal communities, and remote forest areas, with negative consequences for income, health, housing, and food security [11]. As a result, the cost of living rises, household purchasing power declines, and access to essential goods and services (e.g., water, food, electricity, housing, and healthcare) becomes more challenging.

Developed nations have a greater capacity to invest in green policies that accelerate the energy transition, while developing countries face fiscal and budgetary constraints. Without compensatory mechanisms like the Green Climate Fund and the Loss and Damage Fund, this imbalance risks creating a center-periphery divide in climate globalization.

It is worth noting that a rapid energy transition can also fuel instability and social exclusion by displacing low-skilled workers unless accompanied by retraining and job integration measures. Yet, even amid geopolitical polarization, scientific and technological cooperation networks persist, leveraging digitalization and AI to develop climate innovation solutions.

Moreover, unforeseen disruptions to global supply chains—such as the war in Ukraine or tariffs imposed by the Trump administration—drive up production and distribution costs, fueling inflation, eroding purchasing power, and hampering economic growth.

5. Technological transition as an opportunity to address current challenges

A technological transition encompasses shifts in how society creates, disseminates, and utilizes technology, driving human progress. In the face of complex global challenges—including human development indices, per capita economic growth, climate change, geopolitical tensions, and ongoing sociocultural shifts—technological advancement presents an opportunity to build more sustainable and inclusive societies.

5.1 Opportunities and challenges in technological transition

The technological transition reflects evolution in technologies, practices, infrastructure, markets, and cultural paradigms that can revolutionize societal functioning. Digitalization, renewable energy adoption, and biotechnological advances are now entrenched in economic structures, labor markets, and social dynamics.

Digital technologies—such as AI, big data analytics, cloud computing, and automation—have reshaped economic growth and societal operations, enabling businesses to innovate, develop green products and services, optimize resource use, and reduce environmental harm.

However, productivity gains and new labor market functions also disrupt traditional sectors, employment, and social structures. These disruptions can be mitigated through proactive policies—for example, social protections for vulnerable groups, worker upskilling initiatives, and inclusive innovation ecosystems that engage all stakeholders.

5.2 Environmental sustainability, technological change, and social dynamics

As the United Nations Secretary-General consistently emphasizes, one of humanity's most urgent challenges is climate change—and the need to curb rising global temperatures by reducing fossil fuel consumption and limiting greenhouse gas emissions. Indeed, the technological transition in energy systems—from fossil fuels to renewables (e.g., solar, wind, and energy storage)—provides a pathway for decarbonization, requiring new infrastructure and shifts in consumer behavior.

By nature, change provokes resistance and dissent, necessitating coordinated efforts among governments, regulators, industries, businesses, and society [12] to align technological progress with public needs and expectations.

This progress hinges on corporate green innovation, including the adoption of sustainable processes, the creation of green jobs and products, the reduction of CO₂ emissions, waste, and environmental harm, and support for communities vulnerable to future climate risks (e.g., sea-level rise, flood-prone settlements, landslide areas, and regions facing severe wildfires).

However, technological innovation risks exacerbating inequalities between economic blocs, nations, and social groups, potentially deepening exclusion. Technological transitions profoundly reshape employment and social structures—evident in digital public services, digital communication networks, remote work (telework) *via* information and communication technology (ICT), converting homes into offices, and coworking spaces.

Digital communication transforms social interactions, enabling group participation (information/knowledge sharing) and civic/political engagement—yet also breeding risks like social fragmentation, misinformation, and digital exclusion.

Thus, public and private entities must design integrated technological measures that foster digital literacy and social equity. The main priorities may focus on policies promoting applied R&D tailored to business realities, support for SMEs adopting green technologies, and stakeholder engagement to ensure a just transition and societal well-being.

6. Conclusion

The analysis developed throughout this chapter highlights an inflection point in (contemporary) globalization. Rather than progressing toward deeper economic integration, the new global context is marked by fragmentation, geopolitical tensions, and interconnected crises—climate, energy, technological, and social. These phenomena not only challenge globalization's traditional role as a vehicle for progress but also demand new strategic, collaborative, and sustainable approaches for the future of societies.

In practical terms, globalization generates structural tensions driven by factors such as the decoupling between the USA and China, the reconfiguration of global value chains, and the growing influence of new economic blocs like BRICS+.

Simultaneously, the climate emergency and energy transition are reshaping production, consumption, and financing patterns, making sustainability and social equity imperative.

The technological transition emerges as a transformative pillar for converting risks into opportunities. Digitalization, AI, renewable energy, and smart automation are driving green innovation with the potential to redefine global competitiveness, enhance resource efficiency, and address environmental challenges. However, these transformations risk exacerbating structural inequalities—both between and within nations.

To address these challenges, some strategic actions are recommended, namely (i) strengthen global climate governance: through effective financial mechanisms (e.g., the Green Climate Fund and Loss and Damage Fund) to compensate vulnerable nations and ensure a just energy transition; (ii) invest in inclusive innovation: by supporting SMEs in adopting green and digital technologies, alongside public policies for workforce upskilling; (iii) promote digital education and literacy: to integrate at-risk populations into the digital transition and ensure equitable access to globalization's benefits; (iv) advance the circular economy: by incentivizing material reuse and waste reduction across global value chains; and (v) enhance transnational scientific cooperation: to share knowledge and develop global solutions for complex challenges like climate change.

Globalization is neither inherently positive nor negative. Its effects depend on how stakeholders (e.g., State, businesses, and civil society) shape practices, norms, and policies. The key lies in recognizing that globalization's risks and opportunities are intertwined, and that the greatest challenge is building an international governance and regulatory architecture capable of protecting the vulnerable, ensuring environmental sustainability, and fostering inclusive human development.

6.1 Suggestions for future research

Suggestions for future research include exploring AI's impact on economic power redistribution, digital and social exclusion dynamics in technological transitions, the

efficacy of international climate compensation policies, the geopolitical effects of the race for critical minerals in future technological development, and governance mechanisms to balance technological innovation with social equity and sustainability.

Only through this strategic, integrated, and ethical approach can globalization's challenges (and risks) be transformed into sustainable opportunities for businesses and society.

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Chapter 2

Sustainability Challenges and Climate Change: An Economic Perspective

Hlalefang Khobai and Nyiko Worship Hlongwane

Abstract

This chapter examines the complex issues and financial ramifications of climate change and sustainability. It highlights how social injustice, environmental degradation, and economic instability are all interconnected while looking at national and international frameworks and solutions meant to promote a sustainable future. Important subjects include how resilience and mitigation initiatives are shaped by economic tools, the green economy, governance, and inclusive engagement. The study illustrates both international and regional solutions to climate challenges from South Africa, Rwanda, China, and the European Union's case studies. The study concludes that reducing the effects of climate change and achieving sustainable development, inclusive frameworks, strong governance, and integrated policies are crucial.

Keywords: climate change, sustainability challenges, economic perspective, solutions, resilient future

1. Introduction

For decades, sustainability and climate change have sparked debate among scholars, policymakers, and governments worldwide. The 17 Sustainable Development Goals were formulated by the United Nations to achieve sustainability in different aspects. They formulated the Paris Agreement on Climate Change in 2017 and the United Nations Framework Convention on Climate Change (UNFCCC) as a way of tackling climate change and reducing its impacts on environmental degradation. According to Independent Group of Scientists [1], the world experienced the highest temperatures ever recorded, resulting in extreme heat, wildfires, floods, and storms impacting lives across the globe and the world's poorest and most vulnerable people. At the core of the report is the significant contribution of science in addressing the hunger, poverty, climate change, inequality, and loss of biodiversity, among other challenges. Many countries have committed to reducing their greenhouse gas emissions by certain percentages to reach net-zero by 2050.

1.1 Brief overview of the importance of sustainability and climate change

According to Scoones [2], the boundary work around sustainability building epistemic communities of shared understanding of and common commitment linking environmental and economic development concerns has become a major issue across the world. This shows that sustainability does not only rely on one aspect, but different aspects such as economic, social, and environmental that need to be linked together and committed to. Sustainability refers to the ability to maintain or support a process, system, or activity over time without depleting natural resources, harming the environment, or compromising the ability of future generations to meet their own needs [2–4]. On the other hand, climate change refers to the long-term warming of the planet due to an increase in the average global temperature, primarily caused by human activities that release greenhouse gases such as carbon dioxide, methane, and nitrous oxide into the atmosphere [5].

Sustainability has the advantages of environmental protection through ensuring the preservation of natural resources, ecosystems, and biodiversity. It also ensures human well-being by providing access to clean air, water, and food while promoting health and livelihoods. Additionally, sustainability helps with economic stability by supporting sustainable economic growth, reducing waste, and promoting innovations. Nonetheless, climate change impacts include rising temperatures that result in increased frequency and severity of heat waves, droughts, and storms. As global temperatures rise, sea levels also rise, leading to coastal erosion, flooding, and saltwater intrusion into freshwater sources, as alluded to by the study of Dietz et al. [6]. This leads to biodiversity loss through the extinction of species, disruption of ecosystems, and loss of ecosystem services.

Moreover, sustainability is important because it aims to mitigate global warming and climate change by reducing greenhouse gas emissions, adapting to the effects of climate change by increasing resilience, and securing a habitable future by safeguarding the planet for coming generations. To achieve sustainability and reduce climate change, individual actions are needed to make sustainable lifestyle choices, reduce non-renewable energy consumption, and promote eco-friendly practices [7]. In addition, organizational actions are needed to implement sustainable practices, reduce waste, invest in renewable energy, and collaborate to address the global nature of climate change and promote sustainable development [8–11]. By prioritizing sustainability and addressing climate change, we can build a more resilient, equitable, and environmentally conscious future.

1.2 Economic context and relevance of sustainability and climate change

Climate-related disasters, through increased frequency and severity of natural disasters, such as hurricanes, tsunamis, wildfires, and floods, which can lead to significant economic losses, are some of the climate change's economic impacts that make sustainability relevant. As an example, the United States of America suffered severe wildfires in 2024, while South Africa suffered heavy flooding in 2024 and 2025, which resulted in damage to infrastructure and loss of lives. Furthermore, resource depletion leads to overexploitation of natural resources like land, minerals, and water, which can lead to scarcity, increased costs, and reduced economic growth. Nonetheless, governments are introducing regulatory frameworks such as the United Nations Agenda 2030, the Paris Agreement on Climate Change, the Green Climate Fund, and net-zero by 2050, through implementing policies and regulations to address climate change, creating new economic opportunities and challenges [12].

Sustainability brings numerous economic opportunities, such as the green economy, sustainable innovation, and cost savings. Transitioning to a low-carbon economy can create new industries, jobs, and economic opportunities in renewable energy, sustainable infrastructure, and eco-tourism [13]. Developing and adopting sustainable technologies, products, and services can drive economic growth and competitiveness. Implementing sustainable practices can result in reduced energy consumption, waste, and costs, thereby improving business profitability [14]. Nonetheless, there are risks associated with climate change, such as assets that become obsolete due to climate change or regulatory changes, climate-related disruptions to supply chains can impact business operations and profitability, and companies that fail to address sustainability and climate change may face reputational damage and loss of customer trust [15–17].

The economic benefits of sustainability lie in new job creation through sustainable industries and practices, increased competitiveness through companies adopting sustainable practices and brand reputation, and long-term economic growth by reducing the risks associated with climate change and resource depletion. The key economic sectors are energy through transitioning to renewable energy sources and improving energy efficiency, the agriculture sector through implementing sustainable agricultural practices, reducing waste, and investing in sustainable infrastructure such as green buildings and transportation systems [18–20]. This chapter explores the economic dimensions of sustainability challenges and climate change, highlighting key issues, impacts, and potential solutions.

Addressing climate change and sustainability challenges requires adherence to the United Nations' Sustainable Development Goals. Firstly, Goal seven requires access to affordable, reliable, sustainable, and modern energy for all. According to Secretary-General [21], to achieve universal access to energy by 2030, there is a need to expedite electrification efforts, boost investments in renewable energy, enhance energy efficiency, and establish supportive policies. Secondly, Goal nine requires building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. Secretary-General [21] highlights that there is insufficient reduction in CO₂ emissions intensity to achieve a significant reduction globally, since most of the manufacturing is using fossil fuels, a challenge to transition and reduce global warming.

Furthermore, urgent action is needed to combat climate change and its impacts, as stated in SDG 13. According to Secretary-General [21], communities around the world experienced extreme weather conditions in 2023, and it demands immediate action for drastic reductions in global greenhouse gas emissions in this decade to achieve net-zero emissions by 2050. The reports from the Secretary-General [21] further suggest that despite the reduction in greenhouse gas emissions in developed countries, these emissions are 150% above pre-industrial levels, leading to global warming. Nonetheless, there has been an increase in climate change finance offered to developing and developed nations as a way of helping with the transition to clean technologies and methods that address global warming and carbon emissions. Adherence to these SDG goals highlighted above could help address the issue of sustainability challenges and climate change around the globe.

2. The economics of sustainability challenges

2.1 Definition and scope of sustainability challenges

Sustainability challenges encompass the difficulties in balancing social well-being, environmental protection, and economic growth to satisfy present demands without

endangering future generations. This scope includes issues like climate change, resource depletion, inequality, and ecological degradation, among others. Firstly, the environmental sustainability challenges consist of climate change, resource depletion, biodiversity loss, and pollution. Rising greenhouse gas emissions from burning fossil fuels are causing global warming and extreme weather events such as wildfires, floods, and disrupted precipitation patterns. Furthermore, overconsumption and unsustainable extraction of resources like water, minerals, and forests lead to depletion and pollution. According to Bodo et al. [22] and Kolawole and Iyiola [23], deforestation, habitat destruction, and pollution threaten plant and animal species, impacting ecosystems and food chains. Air, water, and land pollution from agriculture, waste and management, and industrial activities pose notable health and environmental risks.

Secondly, social sustainability challenges include poverty and inequality, social justice, and food insecurity. The unequal distribution of resources and opportunities creates social disparities and limits access to basic needs like education, health care, and proper housing. Therefore, ensuring fair treatment and equal opportunities for all groups, including the marginalized communities, is crucial for sustainable development [24, 25]. Ensuring access to affordable, nutritious, and sustainable food sources is vital for the global health and well-being of people. Thirdly, economic sustainability challenges include economic growth, resource efficiency, innovation, and technology. To avoid unsustainable practices, there is an urgent need to balance social equity, the environment, and economic growth. Therefore, reducing waste and promoting resource efficiency in production and consumption is essential for long-term economic stability [26, 27]. Investing in sustainable technologies and innovation is crucial for transitioning to a more sustainable or green economy using renewable energy from solar, wind, biomass, and water.

The key aspects of sustainability include reducing negative impacts on the environment, conserving natural resources, and protecting biodiversity. Furthermore, sustainability focuses on promoting social equity, justice, and human well-being while respecting cultural diversity and community needs. Additionally, sustainability focuses on ensuring economic viability, stability, and growth while minimizing negative economic impacts on future generations [28]. Sustainability has the following benefits, among others: intergenerational equity by ensuring sustainable actions for future demands, balancing environmental, social, and economic considerations to achieve sustainability, and taking preventive action to avoid harm to the environment, human health, and economy.

2.2 Economic impacts of sustainability challenges

The economic impact of sustainability challenges includes climate change, resource depletion, biodiversity loss, water scarcity, and pollution, which lead to direct and indirect costs globally. Firstly, the frequency and intensity of natural catastrophes like hurricanes, wildfires, and floods are increasing due to climate change, which causes losses from extreme weather events that can result in large financial losses. Furthermore, climate change affects industries such as agriculture, tourism, and insurance. Changes in precipitation patterns and temperatures can negatively impact yields and food security on a global scale [29]. Considering the tourism industry, temperature change and weather patterns can affect tourist destinations and the industries involved. Nonetheless, increased frequency and severity of natural disasters can lead to higher insurance claims and costs.

Secondly, resource depletion is another sustainability challenge that results in the loss of ecosystem services and increased costs. Degradation or loss of ecosystems, such as forests, wetlands, and oceans, can lead to economic losses and impacts on human well-being [30]. Natural resources overexploitation, such as water and minerals, can result in higher costs and reduced economic growth. Thirdly, biodiversity loss is another sustainability challenge that consists of the loss of ecosystem services and economic impacts on industries such as pharmaceuticals and agriculture. Loss of biodiversity can lead to reduced ecosystem resilience, decreased water quality, and impacts on human health. The loss of biodiversity can lead to a reduction in new medical discoveries and the loss of pollinators and other beneficial species that impact crop yields.

Fourthly, water scarcity is another sustainability challenge that results in economic impacts on industries such as agriculture and manufacturing, as well as increased costs. Moreover, reduced water availability can harm crop yields, food security, and reduced production of water-dependent industries such as hydropower plants, increased costs for water treatment, desalination, and other water management strategies globally. Fifthly, pollution is another sustainability challenge that results in health impacts and economic costs. Pollution can lead to significant health impacts, including respiratory problems, cancer, and other diseases, as well as increased health costs, lost productivity, and low economic growth [31, 32]. An economy that does not have a healthy workforce is usually characterized by low productivity and reduced growth, which leads to poor economic growth.

Additionally, sustainability challenges result in direct and indirect costs. Direct costs stemming from damage to infrastructure, as climate-related disasters can damage roads, buildings, and bridges, as well as loss of property, including homes and businesses. When infrastructure is damaged, people lose their jobs, businesses close, poverty increases, productivity decreases, resulting in reduced gross domestic product that leads to low economic growth. Indirect costs lead to lost productivity and increased health costs. Climate-related disruptions can lead to lost productivity, including impacts on supply chains, industries, and increased healthcare costs [33, 34]. Understanding the substantial and wide-ranging economic effects of sustainability concerns is essential to creating policies and plans that effectively address them and advance sustainable economic growth.

3. Climate change: Causes and consequences

3.1 Overview of climate change science and causes

Human actions like industrialization, deforestation, and the use of fossil fuels are to blame for climate change. By increasing greenhouse gas emissions, these activities cause global climate systems to be disrupted and trap heat in the atmosphere. The effects are extensive, ranging from increasing sea levels and ecological changes to more frequent extreme weather events. A continuous commitment to reducing emissions, switching to renewable energy, and enhancing resilience in vulnerable populations throughout the world will be necessary to combat climate change. The agriculture sector is the most vulnerable to climate risk, prone to flooding, increased heat, and drought, which are likely to cause a reduction in crop yields. When these extreme events happen, they pose a risk to food security globally, requiring farmers to come up with new systems of farming that are resistant to climate change.

Furthermore, extreme weather conditions will necessitate more maintenance and repair for runways and roads, infrastructure, and equipment. In the KwaZulu-Natal province in South Africa, there has been damage to infrastructure in 2024 and 2025 due to heavy rainfalls and flooding, and this has been the case in the Philippines. In the United States, wildfires have destroyed parts of California and Arizona due to extreme weather conditions. According to Zhou et al. [17], climate change also poses a risk to the financial sector since natural disasters can also increase stock price volatility, contributing to the risk effect, and these effects can spill over into other markets, leading to contagion effects both domestically and internationally. Examples of climate change consequences are given below in terms of extreme weather occurrences and sea level.

In **Figure 1**, the trend shows the change in global surface temperature, with the recent 10 years being the warmest compared to the long-term average from 1951 to 1980. This shows that global warming has been affecting the ocean temperature, likely resulting in increased sea level. In **Figure 2** global sea levels are rising because of human-caused global warming. Sea levels are rising mostly due to the expansion of sea water as it warms and the additional water from melting glaciers and ice sheets, according to NASA statistics. The sea height has been rising from below zero mm in the period before 1995 to above 100 mm in 2025.

Furthermore, because of increased human activities, the CO₂ emissions have been rising rapidly from below 320 parts per million before 1960 to above 420 parts per million post 2020, as shown in **Figure 3**. The most emitters according to our World in Data are China, the United States, India, the European Union, Russia, Brazil, Indonesia, Iran, Japan, and Saudi Arabia as of 2023.

Reducing greenhouse gas emissions to pre-industrial levels is the goal of recent initiatives like the Paris Agreement, the Kyoto Protocol of 1997, and the Montreal Protocol. The 2024 SDG Progress Report emphasizes that although manufacturing's CO₂ intensity has decreased, the results still fall short of the 2030 goals levels. Increased greenhouse gas emissions are the primary driver of both global warming and extreme weather events. Non-renewable energy sources are used by industries, and the usage of fossil fuels in cars also adds to the higher emissions seen in **Figure 3**. Scientists, economists, and governments worldwide have been conducting studies

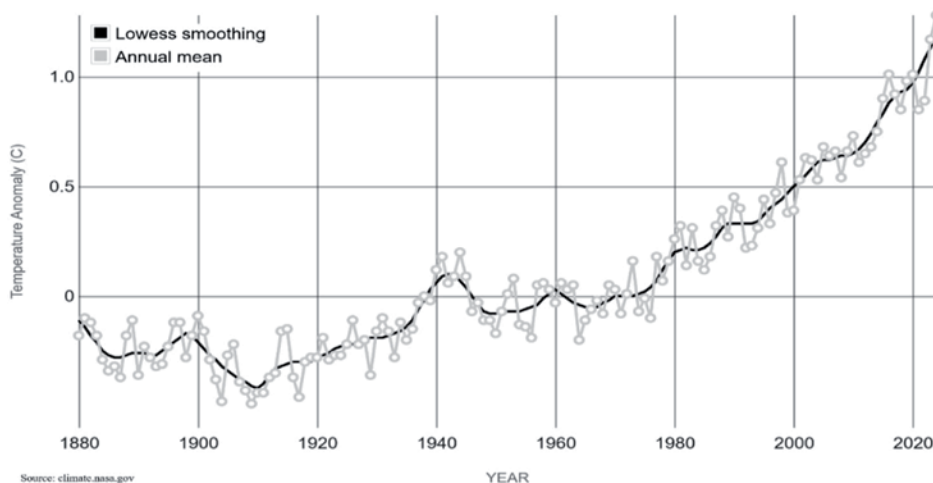


Figure 1.
Global land-ocean temperature index [35].

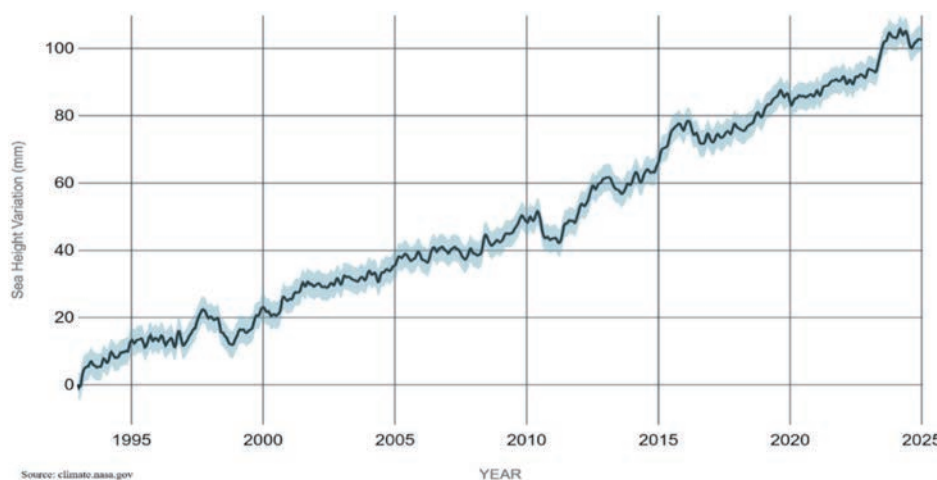


Figure 2.
 Global sea levels.

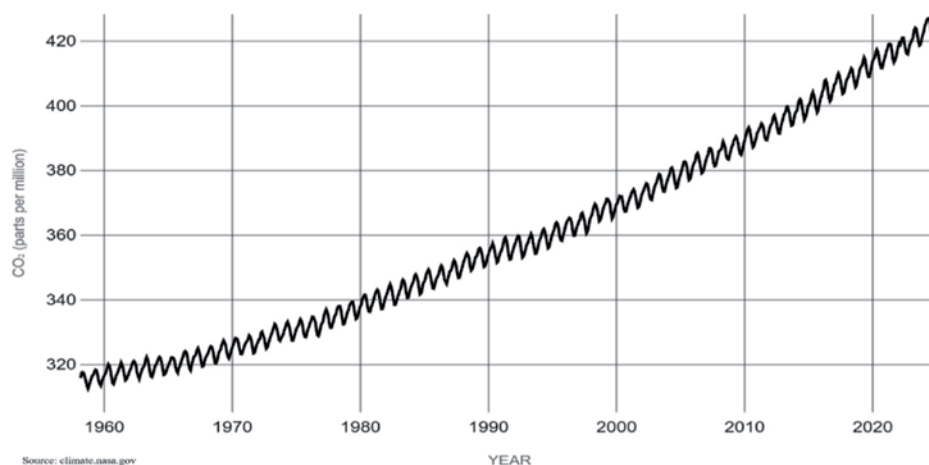


Figure 3.
 Global carbon dioxide emissions.

that show the impact of greenhouse gas emissions on economic growth, agricultural productivity, and other aspects of the economy.

4. Economic instruments for sustainability and climate change

4.1 Overview of economic instruments

According to Harrison et al. [36], economic instruments have played a significant role in policies and proposals to address climate change in many countries and regions, with the European Union Emissions Trading Scheme being the most evident one. Carbon taxes, also known as Pigouvian taxes, are usually defined as a

tax on carbon emissions and are often applied in the fossil fuel supply chain, leading to higher prices for fossil fuels, encouraging energy efficiency, and the adoption of cleaner technologies. Green tax, also known as environmental tax, can be levied on various aspects, including energy, transport, pollution, and resource extraction. However, Shahzad [37] points out that the role of environmental tax is still ambiguous and demands a more in-depth investigation. Good examples of these include the carbon taxes in South Africa and the European Union. By limiting overall emissions and enabling businesses to exchange emission permits, emissions trading schemes known as cap-and-trade systems encourage more economical emission reductions.

Additionally, incentives for renewable energy, such as tax credits or rebates, can encourage the advancement and application of renewable energy technology, which will help reduce greenhouse gas emissions and slow down climate change. The most well-known of them are the Pigouvian subsidies, which Arthur Cecil Pigou promoted. Mandatory energy efficiency requirements for buildings and appliances can also lower energy use and related emissions. Levying fees for deforestation in the land use sector can be an effective way to reduce greenhouse gas emissions. This can be applied usually in the tropical rainforest regions where massive deforestation is being practiced, for example, in the Amazon tropical rainforest. Duval [38] supports the deployment of clean technologies and funding for research and development that can hasten the creation and uptake of low-carbon solutions. Furthermore, limiting climate change may be achieved through the use of command-and-control regulation measures. The ambient standards that govern the quantity of contaminants in the surrounding ambient environment are part of the command-and-control standards. An excellent example is the US Clean Air Act, which requires an area to develop a compliance plan if it violates ambient requirements set by the federal government for six criteria pollutants in the region.

Moreover, emissions standards that govern the permissible level of emissions might be used for this. This can be done, for example, using the emissions rate, concentration, total quantity of pollutants, and residual content per unit of output. However, because they are reliant on weather and human behavior, emissions guidelines do not ensure a particular ambient level of pollution.

Polluters are also required by technology standards to employ specific technologies, methods, or practices. For example, electric vehicle utilities were required to install scrubbers with 90% efficiency ratings until 1990, and the United States requires catalytic converters in autos [39]. Robles-Lorite et al. [40] highlight that the use of catalytic converters, which are exhaust gas post-treatment systems for vehicle emissions control, is crucial for complying with increasingly stringent environmental regulations.

4.2 Examples of economic instruments in practice

Figure 4 shows the data on environmental tax as a percentage of GDP in 2021 for different countries around the world. This data consists of transport tax bases, resource tax bases, energy tax bases, and pollution tax bases as they form environmental tax bases. Based on this data, Greece, the Netherlands, France, and Latvia have the highest percentage of environmental tax bases as a percentage of GDP for the period. This means that these countries are the ones collecting a lot of tax revenue from environmental taxes as a way of addressing climate change.

Based on **Figure 4**, some high emitters, such as the United States, are found to be the least collectors of environmental taxes, as may be the case with the use of

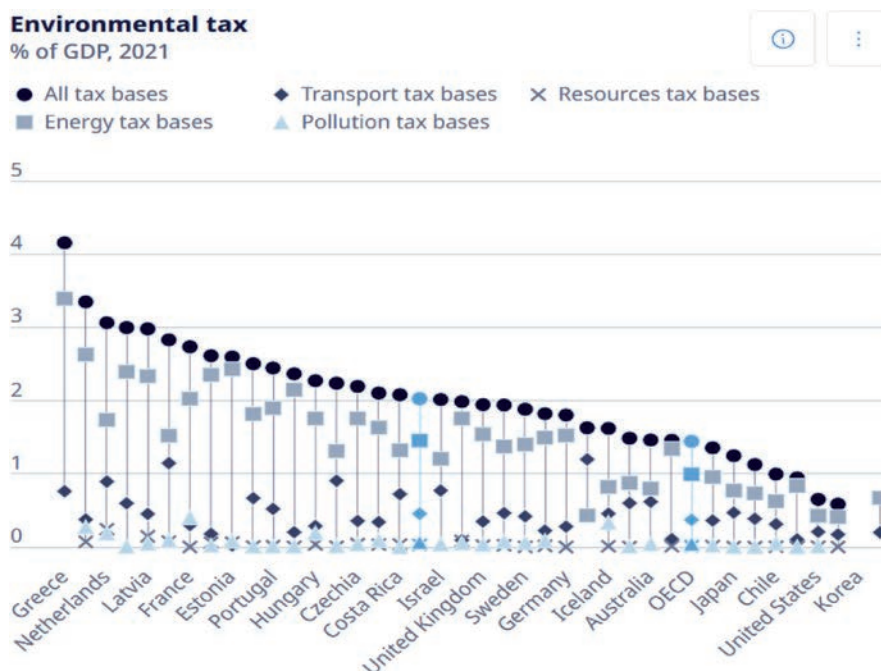


Figure 4.
 Environmental tax as a percentage of GDP in 2021. Source: OECD [41].

other economic instruments. Along with environmental taxes, 2019 saw the introduction of several sustainability-linked loans and bonds as well as cutting-edge performance-based financial products that let issuers raise money for non-green or sustainability-specific corporate reasons. According to OECD [42], sustainability-linked bonds are an increasingly widespread financial instrument, issued mainly by non-financial corporates, which mostly link the sustainability-linked issuances with emission reduction-related targets. Nonetheless, some of the SLB issuance in this sector, as shown in **Table 1**, is linked to targets related to emissions reduction per unit of production rather than total emissions, despite the issuer in some cases having set both absolute and intensity-based corporate emission reduction targets [43].

As presented in **Table 1**, the sustainability-linked bonds have been offered globally in the mining sector for the extraction and exploration of different minerals and electricity generation. Notably, the Czech Republic, the Netherlands, the United States, Greece, and the Dominican Republic have offered sustainability bonds for electricity production as a way of cutting greenhouse gas emissions. While this is a great initiative, the data shows that the sustainability bond has been extended to gas exploration and transportation, chemicals, metals, and oil exploration. In addition, it would be more beneficial if all countries still relying on fossil fuels could get these sustainability-linked bonds to modernize and transition to cleaner practices.

4.3 Discussion of the effectiveness and limitations of economic instruments

Aldy and Pizer [44] offer a range of metrics such as emission levels, emissions intensities, emission abatement, carbon prices, energy prices and taxes, and abatement costs to combat emissions. While climate change action is Goal 13 of the

Company	Sub-sector	Country	Number of issuances	Year of issuance	Amount
Oil and gas production and exploration					
Tamarack Valley Energy	Oil and gas exploration and production	Canada	1	2022	USD 300 mn
Eneos Holdings	Oil and gas exploration and production	Japan	2	2022 2022	JPY 85 bn JPY 15 bn
Eni	Oil and gas (exploration and production, power, refining)	Italy	2	2023 2021	EUR 2 bn EUR 1 bn
Polski Koncern Naftowy Orlen	Oil refinery	Poland	2	2020 2021	PLN 1 bn PLN 1 bn
Repsol	Oil and gas (exploration and production, power, refining)	Spain	1	2021	EUR 1.25 bn
Oil and gas infrastructure and transportation					
Enbridge	Oil and gas pipelines	Canada	2	2021 2021	CAD 1.1 bn USD 1 bn
Kinetik Holdings	Oil and gas transportation and infrastructure	The United States	1	2022	USD 1 bn
Nederlandse Gasunie	Natural gas transport and infrastructure	The Netherlands	2	2021 2022	EUR 300 mn EUR 500 mn
Snam	Natural gas transportation	Italy	2	2022 2022	EUR 850 mn EUR 650 mn
Worley	Oil and gas consulting and engineering	Australia	1	2021	EUR 500 mn
Utilities					
CEZ	Electricity utility	Czech Republic	1	2022	EUR 600 mn
Enel Finance International	Financing company for Enel Group (Italian electric and gas utility)	The Netherlands	22	From 2019 to 2022	Approx. USD 1 bn (on average for each issuance)
NRG Energy	Electric utility	The United States	2	2020 2021	USD 1.1 bn USD 900 mn
Public Power Corporation	Electric utility	Greece	3	2021 2021 2021	EUR 775 mn EUR 125 mn EUR 500 mn
Empresa Generadora de Electricidad Haina	Electric utility	Dominican Republic	1	2021	USD 300 mn
Chemicals					
Brasken Idesa	Thermoplastic resins and other petrochemicals production	Mexico	1	2021	USD 1.2 bn

Company	Sub-sector	Country	Number of issuances	Year of issuance	Amount
Henkel	Chemical and consumer goods	Germany	3	2022 2021 2021	EUR 650 mn EUR 500 mn USD 250 mn
Indorama Ventures	Intermediate petrochemicals production	Thailand	3	2021	THB 5 bn THB 3 bn THB 2 bn
Metals and mining					
Newmont Corporation	Gold mining	The United States	1	2021	USD 1 bn
Constelium	Aluminum	France	2	2021 2021	USD 500 mn EUR 300 mn
Jsw Steel	Steel	India	1	2021	USD 500 mn
SSAB AB	Steel	Sweden	1	2021	SEK 2 bn
Norsk Hydro	Production of aluminum and energy	Norway	2	2022	NOK 1.5 bn NOK 1.5 bn

Source: OECD [42].

Table 1.
Sustainability-linked bonds issued by companies in high-emitting sectors.

Sustainable Development Goals, economic instruments are crucial in combating climate change as they provide incentives for sustainable behavior and help internalize environmental costs. These instruments include fiscal instruments such as taxes levied on goods, services, or wealth, such as carbon taxes to discourage fossil fuel use, and subsidies such as Green Finance paid to businesses or individuals to encourage certain behaviors like renewable energy production and energy-efficient technologies.

The effectiveness of the economic instruments lies in encouraging sustainable behavior and reducing environmental impacts. These instruments also provide flexibility and innovation in environmental protection and can be cost-effective and efficient in achieving environmental goals. As an added advantage, when governments are committed to implementing different environmental taxes and subsidies, they raise funds to address environmental damage. Economic instruments like carbon taxes and cap-and-trade systems are generally considered cost-effective ways to achieve emissions reduction targets. Winkler et al. [45] highlight that putting a price on carbon can have some significant impact across sectors as it would encourage the use of low-carbon technologies over emission-intensive ones, affecting individual human behavior through the price mechanism. Additionally, they offer financial incentives to companies and individuals to lower their carbon footprint, promoting innovation and efficiency. Additionally, they allow flexibility in how emissions are reduced, enabling different sectors and actors to find the most cost-effective solutions.

Nonetheless, these instruments have limitations when it comes to monitoring, reporting, and verification, since ensuring accurate and timely information is crucial for effective implementation. Additionally, consistent commitment requires cooperation from governments, businesses, and civil society. They also have distributional impacts as they can disproportionately affect certain groups, such as low-income households, who may end up paying more for fossil fuels due to carbon taxes. If not designed properly, economic instruments can lead to unintended consequences, such

as shifts in emissions from one sector to another or increased costs for certain industries. Moreover, designing and implementing may be complex and require careful consideration of various factors. Addressing climate change requires a comprehensive approach, incorporating economic instruments, regulations, and voluntary schemes. They should be designed to address specific environmental problems while minimizing unintended consequences. International cooperation and coordination are essential for the effective implementation of economic instruments in combating climate change.

5. Sustainable development and the green economy

5.1 Overview of sustainable development and the green economy

Emas [46] defines sustainable development as development that satisfies current demands without endangering the capacity of future generations to satisfy their own needs. Sustainable development policy prioritizes protecting resources for future generations, in contrast to traditional environmental policy, which also seeks to absorb the externalities of environmental degradation. Long-term economic and environmental stability is the goal of sustainable development (SD), which can only be achieved by incorporating and recognizing social, environmental, and economic factors at every level of the decision-making process. A green economy is a type of economic structure that seeks to enhance social justice and human well-being while lowering ecological hazards and scarcity [47]. Investments that increase energy and resource efficiency, reduce pollution and carbon emissions, and prevent the loss of biodiversity and ecosystem services are what drive job and income growth in a green economy. The green economy prioritizes investments and policies that support social justice, economic resilience, and environmental sustainability, making it a useful instrument for attaining sustainable development.

5.2 Economic benefits of sustainable development and the green economy

5.2.1 Inclusive growth and poverty eradication

The concept of green economy holds the potential for a new paradigm of economic growth that is compatible with the planet's ecosystems and can help reduce poverty [48]. It also provides jobs in both public and private ventures and boosts income development.

5.2.2 Job creation

To attain sustainable physical and human development, most businesses must make significant structural and strategic adjustments in order to make the shift to the green economy. The green economy demands experts and workers who are efficient, intelligent, and diligent in honing their craft by enrolling in professional courses and training to gain the necessary expertise [49].

5.2.3 Food security

A green economy encourages effective use of natural resources, sustainable farming methods, and less environmental damage—all of which are essential for

long-term food security [50]. He et al. [51] purposed to determine the relationship between food security and green economy, and established that when the economy is green, food security increases.

5.2.4 Resource scarcities and environmental risks

Resource scarcities and environmental risks refer to the problems brought on by finite natural resources and the harm done to the environment by unsustainable behaviors. The green economy aims to significantly reduce environmental risks and scarcity of resources [49].

5.3 Examples of sustainable development and green economy initiatives

5.3.1 Renewable energy initiatives

In South Africa, there is the Renewable Energy Independent Power Producer Procurement (REIPPP) programme. The government launched this initiative to encourage private sector investment in renewable energy sources, including wind and solar. This has attracted billions of investment and has led to the creation of a thousand jobs for South Africans [52]. In Germany, there is an initiative named *Energiewende* (Energy Transition). This initiative is aimed at doing away with nuclear energy and promoting renewable energy consumption. This, according to Bundesministerium für Wirtschaft und Klimaschutz [53], increased to over 40% of electricity being generated from renewables, and this curbed the greenhouse gas emissions.

5.3.2 Sustainable agriculture

India introduced Zero Budget Natural Farming (ZBNF). This is an agricultural technique that eliminates the need for outside inputs by using natural herbicides and fertilizers. Its importance is established in increasing resilience to climate change, improving sustainability, and reducing costs. In Kenya, the government initiated an organic farming program named Kenya Organic Agriculture Network (KOAN), which served to encourage organic certification and sustainable farming practices. The importance of this initiative is viewed in enhancing soil health and farmer income.

5.3.3 Education and capacity building

There is an existence of the Green Skills Project in South Africa, which is a collaboration between the government and a non-governmental organization to study and support the development of skills for the green economy [52]. This program directs the creation of curricula and policies in higher education and training. Another initiative under education and capacity building is UNESCO's Green TVET Programmes. This program incorporates green skills and sustainability into vocational education worldwide. It serves to give young people and workers the skills they need for green jobs.

5.3.4 Sustainable transport

In the Netherlands, the government initiated the cycling infrastructure. This program involves investing in vast, secure bicycle networks to cut down on the use of cars. In the Netherlands, more than 25% of all trips are performed on bicycles,

which results in reduced emissions and healthier lives. Another country focusing on this initiative is Ethiopia, which is introducing the Addis Ababa Light Rail [54]. In an effort to lessen pollution and traffic in the cities, Ethiopia installed the first light rail system in Sub-Saharan Africa. Thousands of everyday commuters now have access to low-emission public transportation thanks to this initiative.

5.3.5 Green buildings and infrastructure

Singapore established a program to promote the design and operation of sustainable buildings called the Green Mark Certification Scheme. As a result, more than 3000 structures were accredited, and the construction industry used less energy. While in South Africa, the Green Start SA Rating System was implemented [52]. This system, which is run by the Green Building Council of South Africa (GBCSA), certifies structures that are ecologically conscious. It has led to more and more business structures that are adhering to sustainability norms.

6. Policy and governance for sustainability and climate change

6.1 Overview of policy and governance frameworks for sustainability and climate change

From the perspective of sustainability and climate change, policy and governance refer to the formulation, application, and supervision of laws, rules, and strategies that direct nations, organizations, and communities toward development that is socially and environmentally inclusive. These frameworks aim to:

6.1.1 Reduce greenhouse gas emissions (mitigation)

In order to achieve the necessary worldwide emission reductions, mitigation strategies to lower CO₂ emissions from land use and non-CO₂ emissions from waste, livestock, and agriculture are essential [55].

6.1.2 Enhance resilience to climate impacts (adaptation)

Strengthening communities, ecosystems, economies, and institutions' ability to predict, prepare for, respond to, and recover from the negative effects of climate change is the goal of improving resilience to climate impacts, sometimes referred to as climate adaptation [56]. In contrast to mitigation, which aims to lower greenhouse gas emissions, adaptation concentrates on modifying systems, infrastructure, and behaviors to lessen vulnerability and improve survival in the face of changing climate circumstances.

6.1.3 Promote the sustainable use of natural resources

Encouraging the sustainable use of natural resources means making sure that both non-renewable and renewable resources—like fisheries, minerals, water, soil, forests, and biodiversity—are managed to satisfy current demands without endangering the ability of future generations to satisfy their own [47]. Social justice, environmental sustainability, and long-term economic prosperity are all supported by this goal.

6.1.4 Ensure inclusive participation and accountability

Establishing open, equitable, and democratic procedures that enable all parties—particularly disadvantaged and vulnerable groups—to actively participate in the formulation of policies, the execution of development projects, and decision-making is essential to ensuring inclusive participation and accountability [57].

6.2 Examples of policy and governance initiatives

6.2.1 The Paris agreement

December 2015 saw the adoption of the Paris Agreement, a global pact under the United Nations Framework Convention on Climate Change (UNFCCC). It was implemented on November 4, 2016, to combat climate change and intensify the actions necessary for a sustainable, low-carbon future [58]. The primary goal is to keep global warming below 2°C over pre-industrial levels. If efforts were undertaken to limit the temperature increase to 1.5°C, the risks and consequences of climate change would be significantly reduced.

6.2.2 European Union: European green deal

The European Commission unveiled the European Green Deal in December 2019 as part of a strategic plan to make the EU the first continent to achieve carbon neutrality by 2050. It acts as the EU's road plan for long-term, sustainable economic growth by separating resource consumption from economic advancement and making sure that no individual or area is left behind throughout the shift [59]. Its main aim is to achieve net-zero greenhouse gas emissions by 2050.

6.2.3 China: Carbon neutrality goal

In order to achieve carbon neutrality, sometimes referred to as net-zero emissions, the amount of carbon dioxide (CO₂) released into the atmosphere must be balanced with an equal amount of carbon removal or offsetting [60]. This will ensure that there is no net rise in atmospheric CO₂ levels. Its goal is consistent with the Paris Agreement, which calls for keeping global warming to less than 1.5°C.

6.2.4 Rwanda: Green growth and climate resilience strategy

A national development policy called the Green Growth and Climate Resilience policy aims to address the issues of climate change while attaining sustainable economic growth. Rwanda was one of the first countries in Africa to use this paradigm, which connects economic planning and climate resilience, in 2011 [61]. The primary goals of the strategy are to promote environmentally friendly, socially inclusive, and economically efficient green economic growth.

6.2.5 South Africa: Just energy transition plan

South Africa is moving away from a coal-dependent energy system and toward a low-carbon, climate-resilient economy through the Just Energy Transition (JET) Plan. This shift places a strong emphasis on social equity in an effort to rectify past

injustices and guarantee that the advantages and costs of the energy transition are shared equitably. The following are the main goals of South Africa's JET Plan: by switching to greener energy sources, the nation can lower its greenhouse gas emissions and meet its nationally determined contributions (NDCs) under the Paris Agreement and also to encourage economic expansion by establishing new sectors like green hydrogen, electric vehicles, and renewable energy to generate long-term job possibilities [62].

6.3 Discussion of the role of policy and governance in promoting sustainability and addressing climate change

In order to achieve sustainability and lessen the effects of climate change, effective governance and policy are essential. Countries may steer society toward low-carbon, climate-resilient development through international agreements, national plans, and regulatory frameworks. Policies that encourage clean energy investment, sustainable land use, and ecosystem conservation include carbon pricing, renewable energy subsidies, and environmental laws. In order to ensure that climate change is addressed in a coordinated and inclusive manner, governance structures allow environmental issues to be included in economic and social decision-making. For instance, the Paris Agreement has strengthened accountability and openness in climate action by giving nations a worldwide forum to establish climate targets and revise them through nationally determined contributions (NDCs).

Governance structures are essential for implementation, oversight, and stakeholder engagement at both the national and local levels. By giving priority to disadvantaged groups that are most impacted by climate change, good governance guarantees that sustainability measures are not just equitable but also effective. Strong governance-based policies may help ensure a fair transition, ensuring that communities and workers are not left behind as the economy moves toward a greener future. Participatory governance also increases legitimacy and public support when corporate sector and civil society actors actively participate in climate planning. Countries such as South Africa and Rwanda serve as examples of how governance may be used to integrate social development with green growth while striking a balance between economic needs and environmental objectives.

7. Conclusion

7.1 Future research directions and policy implications

Future studies ought to concentrate on assessing the efficacy of sustainability-linked financial instruments, such as green bonds, particularly in developing economies and high-emission sectors. There is also a need for deeper investigation into localized climate adaptation strategies, especially in vulnerable urban and informal settlements where climate risks are intensified. Understanding the dynamics of green job creation and aligning educational systems with the green economy needs will be crucial for a just transition. Comparative studies across regions can identify best practices in climate governance, while the role of digital technologies in enhancing transparency and participation deserves further exploration. From a policy perspective, governments should strengthen national and local governance structures by integrating climate goals into broader development strategies. Expanding access to

equitable climate finance, ensuring inclusive stakeholder engagement, and institutionalizing accountability mechanisms are essential to achieving sustainable outcomes. Sector-specific policies targeting energy, transport, and agriculture must be accelerated to reduce emissions, enhance resilience, and promote inclusive economic growth aligned with global sustainability targets.

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Chapter 3

Globalization, Geopolitical and Geoeconomic Changes in the Contemporary World: Implications for India

Sujit Lahiry

Abstract

The phenomenon of globalization had unfolded first in European countries, namely in Britain (by Margaret Thatcher) and America (by Ronald Reagan) in the early 1980s. Their respective policy prescriptions were referred to as “Thatcherism” and “Reaganism.” Subsequently, it was spread by the former president of the Soviet Union, Mikhail Gorbachev, through his twin policies of “Glasnost” and “Perestroika” in 1985. However, the philosophical and ideological basis of globalization was laid down by the neoliberals or libertarians like Milton Friedman in the 1960s. These neo-conservative economic policies were collectively referred to as the “Washington Consensus.” This chapter studies the subtle geopolitical and geoeconomic changes brought about by globalization in the post-Soviet world since the early 1990s. It tries to understand how these strategic and tectonic shifts had led to a reconfiguration of world politics. The contemporary world is in a state of flux in most of the Western European countries and the Arab world. The Russia-Ukraine conflict and Israel-Hamas war are the two very prominent examples to support our contention. Further, this chapter also seeks to study how the policies of globalization have led to the resurgence of the “Far Right” in most of the countries in the contemporary world. Lastly, this chapter also tries to understand how these policy changes have impacted India and looks at the future of world politics in contemporary times. We conclude that deglobalization and the revival of “Social Democracy” are the only solution to a highly equitable world.

Keywords: globalization, geopolitics, geoeconomic, neoliberal, Russia-Ukraine conflict, Israel-Hamas war, social democracy

1. Introduction

Dramatic developments have unfolded in world affairs from the mid-1980s till now. One of the principal manifestations of this unfolding development has been the transition from the model of social democracy to neoliberal globalization. Globalization brought in some paradigm shifts in the understanding of world politics

and the world economy. No longer is world politics guided solely by realist and neo-realist theories and conceptualizations of International Relations (IR). However, that does not mean that the realist and neo-realist theories of IR have been completely abandoned. The realist theory of IR, with its emphasis upon the state system, conflict, aggression, war, and power politics, still remains the basic fulcrum of understanding and theorizing IR.

There are five major sections of this study. The first section traces the genesis of the concept of globalization and how it has transformed world politics and the world economy. The second section delineates the concept of geopolitics and geoeconomics and how they are intermingled with the concept of globalization at the global level. The third section has critically analyzed how the concept of globalization has propelled the rise of the Far Right in the contemporary world order. The fourth section takes the terrain of discussion to the two major wars in the contemporary world—the Russia-Ukraine conflict and the Israel-Hamas war—and how they have affected the geopolitical and geoeconomic churnings in the contemporary world. The fifth and last section deals with the conclusion, where we summarize the main arguments of our chapter.

2. Globalization: Genesis and growth

Globalization is not a new concept but, in fact, a reincarnation of the concept of financial capitalism. It means trade, commerce, and economics are decided by a free market economy, and all notions of the concept of a welfare state take a back seat [1]. The concept of the welfare state gained prominence after the Second World War ended in 1945. It meant that the state would be the main vehicle for all sorts of development-related activities as well as modernization. The concept of the welfare state was premised on the concept of “social democracy,” which gained ground in the twentieth century. The concept of social democracy seeks to empower the marginalized and vulnerable sections of society with adequate state-led social welfare measures [1]. The state would be the main vehicle for socio-economic transformation. In other words, the state would build up schools, colleges, universities, roads, dams, and bridges; provide employment to the youth and the unemployed; or provide unemployment allowance to the educated unemployed. These were the perspectives of social democrats like Harold J. Laski, and later on were also advocated by John Maynard Keynes. And, after the end of the Second World War in 1945, states and governments across the world [2] started implementing these policies of social democracy.

Very soon, we find that states in both the developed as well as developing and the underdeveloped regions of the world adopted the basic postulates of social democracy. Social democracy was a blend of liberal democracy and a socialist economy. These ideas of social democracy were adopted by the post-colonial states to assert their own distinct identity [3] and preserve their sovereignty in a turbulent world characterized by a Cold War between the two poles of power—the United States and the former USSR (Union of Soviet Socialist Republics). While the US professed a positive liberal and capitalist ideology, the former USSR advocated a socialist and communist ideology. These two ideologies were always working at cross purposes with each other. In contrast to these two superpowers, the Third World, or the post-colonial countries, advocated the notion of nonalignment. The Third World consisted of all the former colonial states of Asia, Africa, and Latin America, which had

undergone long periods of colonial subjugation under the rule of colonial powers like Britain, France, and Portugal. While Britain ruled over the Asian continent, France ruled over the African continent, and Portugal was the dominant colonial power that ruled over the Latin American continent. In other words, all the Third World countries had undergone long periods of colonial brutality. After the end of the Second World War in 1945 [4], when these Third World countries had gained independence from the colonial powers, they were particularly concerned to safeguard their territorial integrity and national sovereignty. They did not want to be used by either the US or the former USSR. Accordingly, it was Prime Minister Jawaharlal Nehru of India, President Nasser of Egypt, and President Tito of Yugoslavia who collectively framed this notion of nonalignment as the basis of their foreign policy orientation. The concept of nonalignment meant that the Third World countries would not be part of the two rival military and economic blocs of the two superpowers and would also follow an independent foreign policy. Meanwhile, the Cold War continued to drag on till the Eastern European countries collapsed in 1989 and the former Soviet Union disintegrated in 1991 [5]. This collapse was partially aided and abetted by the policies of neoliberal economic globalization, which were vociferously advocated by Prime Minister Margaret Thatcher of Britain, President Ronald Reagan of the United States, and President Mikhail Gorbachev of the former USSR (Union of Soviet Socialist Republics) in the 1980s.

The policies of Liberalization, Privatization, and Globalization (LPG) were advocated by a group of neoliberal ideologues like Isaiah Berlin, F.A. Hayek, Milton Friedman, and Robert Nozick [5] way back in the 1960s. They assumed that the welfare state had become an impediment to modernization, development, and progress. They therefore advocated the need for a shift from this policy of social democracy. These globalization theorists argued that development and progress could therefore materialize from the micro policies of globalization, like free trade, free markets, and the holding of private property, and thereby would expand human freedom [6]. In his book “Capitalism and Freedom” (1962), Milton Friedman had argued that competitive capitalism promotes individual freedom [5, 7]. In other words, every individual should have unfettered access to a free market economy. Since these policies were largely concluded in Washington, D.C., they are also referred to as the “Washington Consensus.” [5]

At the same time, globalization had led to a “time-space compression” [8]. Globalization has reduced the distinction between national and international domains. What is national is now international, and vice versa. Globalization has obfuscated and questioned the significance of the national boundaries of a state. The globalization theorists have argued that boundaries are gradually becoming elusive and mystifying in a globalized society and economy. This led some theorists to refer to the contemporary world as a “global village.” A tendency to transcend the sovereign boundaries of a state has now emerged in the contemporary world. While boundaries are still rooted in the concept of a state, national interests still form the basis of the national security of a state. But, at the same time, we also need to accept the fact that the manifestations of globalization, like the ICT revolution, e-mail, the internet, Google search, Facebook, LinkedIn, etc., have fundamentally transformed the lives of every individual across the globe. All these happenings have led to the evolution of what we refer to as a “technocratic globalized society.” All of us now live in a “virtual world,” wherein citizens have unlimited seamless connectivity with each other.

The policies of neoliberal economic globalization have completely changed the narrative about world politics and the world economy. In the contemporary world,

every state seeks to maximize its gains and minimize its losses. Taking this as the pivotal argument, we can argue that globalization has produced uneven and lopsided economic development both intra-state and inter-state. Globalization has proved to be a boon for the developed world and a bane for the developing and the underdeveloped world. This is the principal argument of the dependency theorists like Immanuel Wallerstein [9]. Wallerstein had argued that the core countries of the developed world had drained away all wealth from the developing and the underdeveloped regions of the world. Consequently, the developed countries have become much richer, and the developing and the underdeveloped countries have become much poorer. The developed core countries buy raw materials and cheap labor from the developing and underdeveloped countries at low cost. On the other hand, the developing as well as the underdeveloped countries buy the finished goods at high costs, pushing them into the semi-periphery and peripheral regions of the contemporary world. Thus, there is an unequal exchange in the global economy, and the economic surplus and profit so accrued from this unequal trade are appropriated by the core developed countries [5]. Therefore, unless this inequitable economic order is reversed, there will always exist a binary and contradiction between the various countries.

3. Interfaces between globalization, geopolitics, and geoeconomics

In this section, we will try to locate the interfaces between globalization, geopolitics, and geoeconomics. Globalization has made a profound impact on the geopolitics and geoeconomics of the contemporary world. In its simplest form, geopolitics means political geography looked at from the vantage point of a sovereign nation-state. The founder of political geography, or geopolitics, Friedrich Ratzel, had identified two core concepts in geopolitics—these are “Space” (Raum) and “Location” (Lage). Space and location together contribute to the national power of a state as determined through its growth and expansion. These conceptualizations led to the enunciation of German geopolitics, which clearly emphasized “Lebensraum” (i.e., living space) and “Autareny” (i.e., economic self-sufficiency). Ratzel’s ideas influenced Rudolf Kjellen, who defined geopolitics as “the natural environment of the state.” Kjellen laid down the essence of the science of geopolitics. The three main advocates of geopolitics have been Alfred Thayer Mahan, Halford Mackinder, and Nicholas Spykman. Mahan speculated that “sea power is world power.” [10] In other words, those powers that have control over the sea would eventually become the dominant world power. Mahan initially believed that Britain was the dominant power, as Britain had control over four narrow seas—these are the Gibraltar Strait, the Suez Canal, the English Channel, and the North Sea. He, however, later on speculated that the US would eventually replace Britain in becoming the dominant sea power [10]. Mackinder had put forward the concept of the “Heartland.” He went on to argue that those countries that ruled Eastern Europe had command over the Heartland, and later on the “World Island,” and eventually the world [11]. And, lastly, Spykman elaborated on the concept of “Rimland.” In the Rimland, Spykman included Western and Southern Europe, West and Southeast Asia, as well as East Asia. He went on to argue that those countries that control the “Rimland” are likely to be the world’s dominant power, and they would rule over Eurasia and eventually control the world [12].

The US has emerged as the dominant hegemonic geopolitical powerhouse [13] in the post-Second World War economic architecture, when the Bretton Woods Agreement created three economic institutions—the International Monetary Fund

(IMF), the International Bank for Reconstruction and Development (IBRD), and the General Agreement on Trade and Tariffs (GATT). The US has created and led all three institutions of the international financial order. The US became the dominant geopolitical superpower by virtue of both its economic and military strength. Militarily, the US created the North Atlantic Treaty Organization (NATO), South-East Asia Treaty Organization (SEATO), and the Central Treaty Organization (CENTO) as its agencies during the Cold War politics [5]. The former Soviet Union, in a calibrated response to the US, had created an alternative economic bloc referred to as the Council on Mutual Economic Assistance (CMEA) as well as a military power bloc referred to as the Warsaw Pact in 1955 [5]. The entire period of the Cold War, spanning from 1945 to 1991, between the US and the former Soviet Union was a period of [14] geopolitical, geoeconomic, and ideological competition between these two power blocs [15].

While “old geopolitics” was primarily concerned with issues of war and conflict studies, the “new geopolitics” is primarily concerned with the issues of unfair trade, economy, and commerce, as well as issues like energy crisis, environmental crisis, and climate change. In other words, geopolitics is being gradually replaced by geoeconomics because of unhindered globalization. Globalization and geoeconomics are interwoven themes, as global trade, investment, and industrial and financial capitalism constitute the essence of both these dominant concepts. Geoeconomics essentially signifies that politics is conducted through economics. In other words, when economics is used to achieve power and dominate over the world, it would result in geoeconomics [16]. The US-China trade war is symptomatic of the contradictions in contemporary geopolitics and geoeconomics. At a similar level, the rising waves of both globalization as well as the formation of regional trading blocs and free trade associations signify the growing importance of geoeconomics. Some of the prominent trading blocs in the contemporary world include the European Union (EU) and its euro currency for trade between the EU countries, NAFTA (North American Free Trade Agreement), LAFTA (Latin American Free Trade Agreement), and the SAFTA (South Asian Free Trade Area) [17].

4. Globalization and the rise of the Far Right in the contemporary world

It would not be far-fetched to argue that globalization has led to the rise of the Far Right in [4] the twenty-first century. This is essentially because the policies of globalization are completely in sync with the policies of neoliberalism [1], advocated by most of the Far-Right regimes that had ascended to power in the contemporary world. One of the defining characteristics of the Far-Right regimes is to advocate an intensive and intrusive globalization and thereby support the global village model of the world becoming a “global village.” The advocates of the global village model argue that the world has become one global village because of the sweeping ICT revolution, which has swept all across the world ever since the mid-1980s and early 1990s [18, 19]. This has transformed global politics in a fundamental manner. Moreover, both the policies of globalization and the Far Right seek to embrace the capitalist economy and liberal democracy only in their procedural form. It also eschews some sort of religious fundamentalism based on obnoxious values of their cultural supremacy. And, all these policies together create a highly authoritarian state based on the principle of dominant majoritarianism. The rise of Far-Right regimes in Italy, represented by Giorgia Meloni; Hungary’s Viktor Orban; Germany’s Alternative for Germany (AfD); Belgium’s Flemish Interest; the Dutch Freedom Party; France’s Marine Le Pen; and,

above all, Donald Trump's [20] Republican Party in the US [21] supports our contention of the growing pale of gloom in the contemporary world. In recent times, Marine Le Pen was convicted on March 31, 2025, of embezzlement of public funds and was forbidden to contest elections in France for a period of 5 years [21]. This development is surely good news for the socialists and social democrats in France.

5. Security architecture and global order: A post-Cold War perspective

This section seeks to delineate the paradigm transformation brought about by globalization. The security architecture of the global order underwent a structural transformation in the post-globalized world. This transformation was not because of "inter-state behaviour...but social groups and social movements within and across states." [22, 23] One of the chief defining characteristics of the post-Cold War global order was the shift from a bipolar structure to either a unipolar or a multipolar world order. There is a divergence of opinion between scholars on this issue. Some scholars have opined that the post-Cold War world order is essentially a unipolar world order, with the US being the only superpower [24–27]. Further, this perspective was substantiated by the US role as the world's sole policeman. The US involvement in the Gulf War (1990–1991) and its interventions in Afghanistan in 2001 and Iraq in 2003 reinforced this thinking and fear psychosis in the non-Western world. The US wanted to punish Afghanistan and to conquer and police Iraq [28, 29]. For example, the US intervened in Iraq in 2003 on the pretext that there were "Weapons of Mass Destruction" (WMDs) in Iraq [30]. However, the US charge never got substantiated. The real objective of the US was to dislodge the popular rule of Saddam Hussein's Leftist Baathist Party and thereby contain communism and install a puppet government in Iraq that would be controlled by the US. The US intervention in the Gulf War of 1990–1991 was fostered with the wider US objective to control the oil and gas economy and thereby become self-sufficient in energy security. This will ensure that the US does not remain an appendage power over the Middle East. Further, the US had categorized Iran, Iraq, Libya, and North Korea as "rogue states," as they did not fall in line with the US national interest of promoting democracy. It "had also adopted the policy of pre-emptive action" [31] in the name of promoting democracy and humanitarian intervention, an argument that seems to be hollow from all perspectives. The US policy violates the principles of territorial inviolability and sovereignty of independent states. In other words, the US strives hard to establish its own supremacy and hegemony over the entire non-Western Rest.

On the other hand, if we look at the post-Cold War and the contemporary world order from an economic perspective, we are primarily witnessing the birth of a multipolar world order. This kind of argument had been advanced by neo-realist thinkers in the post-Cold War period [32, 33], who have advanced the thesis of stable bipolarity and unstable multipolarity. This followed from their argument that rough superpower equality and nuclear deterrence during the Cold War period ensured stable bipolarity [31, p. 182]. Robert E. Harkavy made a projection of three main types of global order during the post-globalized world. The first possibility was the revival of a United States-Russia rivalry. The second one projected a United States-Japan bipolar world. And the third scenario forecasts a United States-China confrontation [34].

Let us now evaluate in what kind and form the emerging global order will be fashioned based on the dominant security architecture that has emerged in the post-Soviet world. Firstly, we will elucidate the geopolitical configurations of the

contemporary world order. The US remains an indomitable imperialist country through its very powerful military-industrial complex. It tries to protect its neo-imperialist empire [35]. Second, there has taken place a subtle shift from geopolitics to geoeconomics. Even though geopolitical parameters are important, the developmental and economic issues are increasingly becoming more dominant in the contemporary world order [14]. The states in the global South [4] assume that more and more regionalism will be an effective counter-hegemonic offensive reply to globalization.

Third, from an economic vantage point, the world seems to be a multipolar world order [5]. The US's dominant military-industrial complex has been increasingly challenged by China and Russia, as China and Russia are now dominant military and economic powers, respectively. The US had always used India as a bully to contain China's rising superpower status. Chinese communism serves as a panacea for the wider post-colonial world.

Russia had attacked Ukraine, as it assumed that Ukraine's inclusion in NATO would threaten Russia's security [5]. Moreover, Russia seeks to emancipate Ukraine from the clutches of neo-Nazis, who are taking the country in a backward and retrograde direction. The Russia-Ukraine war has led to a crisis of food, fuel, and energy [5]. Moreover, China's Belt and Road Initiative (BRI) and its [36] strong affiliation with Pakistan, the Arab world, and the Gulf countries had greatly undermined India's position in the contemporary global order [36].

The desire for a non-Western IR is also reflected in the formation of BRICS, a major Southern response to the dominant and hegemonic Western narrative in IR. BRICS includes countries like Brazil, Russia, India, China, and South Africa. Distinguished political scientist Achin Vanaik had argued that while the US remains the imperialist power, it faces considerable challenges from the "regional imperialists" or "sub-imperialists" like Turkey, Brazil, Saudi Arabia, South Africa, Indonesia, and Israel [37]. The imperialist face of the US is reflected in contemporary world politics, wherein the US under President Donald Trump has been very categorically clear that either Iran should halt its nuclear weapons program and make a corresponding deal with the US, or it should be ready for war.

Further, the Israel-Hamas war in Gaza, which started on October 07, 2023, has fueled regional tensions and war in West Asia. The US has extended its full support to the Israeli government, which is carrying out barbaric crimes of genocide against the Palestinians by killing more than 50,000 individuals till now. Moreover, Israel had totally devastated the buildings and infrastructure and had also committed crimes against women and children of the Palestinians in Gaza. The Palestinians have been denied food, water, electricity, and access to hospitals by the Israeli government. In other words, Israel had committed gross human rights violations and had also denied the dire need for humanitarian aid to the Palestinians in Gaza. The war escalated when Israel attacked the Iranian nuclear plant in Isfahan and thereby violated the Vienna Convention [38]. It is pertinent to point out here that the Iranian regime has extended unconditional support to Hamas in Palestine, Hezbollah in Lebanon, and the Houthis in Yemen [38].

All these developments reflect the US's desire to maintain its hegemony and supremacy in the contemporary world order [5]. And, in order to bolster the US objective, the West is now imposing sanctions against Iran. Despite United Nations Secretary-General Antonio Guterres and the entire international community calling for de-escalation in the Middle East, Israel is going ahead with all its vicious objectives of eliminating the Palestinians in Gaza and also subverting Iran. However, there exists a free trade agreement between Russia and Iran, and the biggest trading partner of Iran is China [38].

At a similar level, the US under President Joe Biden has extended unconditional support to Ukraine in its war against Russia as well as outright support to Israel in its war against Hamas. However, since Donald Trump assumed charge as president on January 20, 2025, the US has reversed its policy with regard to Ukraine. Trump has made a calibrated and balanced approach with regard to the Ukraine-Russia war. He sought a ceasefire deal between Russia and Ukraine. Moreover, both political parties—Democrats as well as Republicans in the US—stand together in defense of their traditional ally, Israel. The mass protests in the universities of the United States, the United Kingdom, Switzerland, Germany, France, etc., in favor of the Palestinians' rights and identity and the more vociferous and outright support for a two-state solution—Israel and Palestine existing side by side—essentially reflect a rupture in the perceptions of the ruling elite versus the civil society and the ordinary people. Recently, three European countries—Norway, Spain, and Ireland—have unanimously declared their support for a separate, sovereign, and independent Palestinian state, which should exist side by side along with Israel. Further, the International Court of Justice (ICJ) had asked Israel to stop its genocidal war in Gaza and Rafah and declare a ceasefire with Palestine. However, since the ICJ's ruling is not legally binding on independent states, Israel continues to carry on with its war against Hamas and Palestine. And the US administration, led by Joe Biden and his successor, President Donald Trump, has remained a mute spectator to the Israeli attacks against Hamas. Not only that, the US is continuing with its policy of supporting Israel and Ukraine and is helping them by providing arms and ammunition, as well as economic aid. The UN has castigated Israel for its war against Hamas, which has already killed more than 50,000 Palestinians. Despite the UN rebuke, Israel continues with its barbarism because of overt and covert support provided by the US. Since the US had veto power, it would be impossible for the UN to take stringent action against Israel, led by Prime Minister Benjamin Netanyahu. So, what is needed is that there should be greater South-South cooperation in order to counter the narrative played out by the Western powers, and especially the US [39].

6. Conclusion

The contemporary global order, therefore, poses several intrinsic questions related to the peace and security architecture in the contemporary world. Let us try to evaluate and critically analyze them one by one. Firstly, Russia has maintained that Ukraine is just a bully and that Western European countries are actually fighting a proxy war with Russia. Russia argues that in order to protect its national security interests, Russia has attacked Ukraine so that Ukraine does not become a member of [40] NATO. The European Union has a deep anxiety about [40] Russophobia. They know pretty well that Russia, in the last three decades, has amassed enormous energy security and has a huge plethora of gas and oil. Secondly, Russia is a permanent member of the UN Security Council, and [41] any vote against Russia will be vetoed by Russia and China collectively. Thirdly, Russia is a Nuclear Weapon State (NWS), and any escalation of military conflict between Russia and the divided West will increase the possibilities of [42] the looming threat of a nuclear war over the European continent. Therefore, both Russia and the divided West need to exercise restraint and maintain nuclear deterrence, as a nuclear war will destroy all of them and will thus be catastrophic. Fourthly, all parties to the Russia-Ukraine conflict should realize that war is never a solution to the conflict, and it essentially puts a huge cost of destruction on

both manpower and economic burden on a state's exchequer. Therefore, all the parties to the Russia-Ukraine conflict should shed their biases and prejudices and return to the negotiating table. They should try to resolve the conflict through dialogue and diplomacy as well as through other methods of peaceful settlement of disputes, like negotiation, mediation, arbitration, and adjudication. Fifthly, the Western European countries have accused Russia of committing gross human rights violations against the Ukrainians and the divided West and should be held liable for that. However, this author strongly contends that both Russia and Ukraine have violated the basic fundamentals of human rights as per the Geneva Convention. Moreover, the US has a long history of committing gross human rights violations, as can be reflected in the US interventions in conflicts like Afghanistan, Iraq, Kosovo, Sudan, etc. The blatant violations of human rights of the Prisoners of War (PoW) committed by the US in Guantanamo Bay are an apt example in this regard. The real objective of Ukraine and Western European countries is to annex Crimea and thereby jeopardize Russia's geopolitical strength.

At a similar level, Russia and China together need to promote the ideas of socialism and communism on a global level and especially support those countries that are fighting for those cherished values. Venezuela, Cuba, and Brazil are some of the countries that fit into our schema of things. And, if not communism, Russia and China together should get together to promote the ideas of "Social Democracy" at a global level in order to circumvent the Western notions of liberal democracy, capitalism, and the rules-based liberal international order, which is essentially Eurocentric. And, certainly, China should play the role of a mediator in resolving the Russia-Ukraine conflict, or, more appropriately, the Russia versus the divided West conflict. In recent times, the role of Russia and China as the two very powerful superpowers ready to take on the US head-on in global affairs is clearly discernible. For example, China successfully mediated between the two rival countries, Iran and Saudi Arabia, and brokered a peace deal between them. As a result, Iran and Saudi Arabia have now established diplomatic relations in their bilateral relations. Moreover, there is a gradual rejuvenation of the Russia-Iran-China axis, which can potentially destabilize the American strength as exhibited by NATO (North Atlantic Treaty Organization) and the QUAD (an alliance of four countries—the US, Australia, Japan, and India). However, since we live in a nuclear age, the possibility of a third world war breaking out over the Russia-Ukraine conflict cannot be ruled out. Therefore, there is an urgent need to take a humane approach on the part of both Russia and the divided West, including Ukraine, towards their citizens and thereby lay down the basis of a more humane [43] global order based on respect for rights, liberty, equality, dignity, justice, as well as sovereignty.

Further, the current trade war initiated by the US on April 2, 2025, between the United States and the rest of the countries, including [44] China and the global South countries, especially points out the contradictions of the contemporary world order and the broader capitalist system. The US has imposed reciprocal tariffs on products being imported from most countries of the contemporary world. However, the US has imposed 145% tariffs on all goods coming from China. In response, China has imposed 125% tariffs on all goods and products coming from the US. And, in retaliation, US President Donald Trump has increased tariffs to 245% on all Chinese goods. Trump's imposition of tariffs has hit the Sensex and stock market crash in most countries, including the US. Most of the countries have yet to recover from the tariff shock imposed by the US and are busy formulating their response plan. India, too, has been slapped with 26 percent tariffs by the US. The Indian state is yet to formulate an appropriate response to the US imposition of reciprocal tariffs.

When seen from a micro- and macroeconomic vantage point, the world economy is certainly going to experience a serious recession and stagflation. It would lead to greater poverty and unemployment, and the overall business of the world economy would not be able to circumvent any way out of this mess. All these steps have questioned the vitality of the globalization process. Will the globalization process be halted? Does Trump's imposition of tariffs signify the end of globalization? Trump has defended his policies by putting forward the model of "economic nationalism." The model of economic nationalism means putting the national interest of the sovereign nation-state first, and it calls for protectionist policies. In other words, the interests of the domestic manufacturers are being given primacy [45] before the policies of globalization, which essentially entail unregulated free trade and the free market. Our contention is that Trump's policies would certainly lead to deglobalization and would enhance the uncertainty in the world economy to an absolute level. Along with de-globalization, there is going to be a greater thrust on de-dollarization so that American hegemonistic tendencies under Donald Trump can be reduced to a minimum. We do hope sincerely that the Oriental countries are going to be mobilized around China so as to lay down the basis of an alternative world order [46].

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Chapter 4

Transition Risk to Geopolitical Risk and Climate Changes

Sean T. Chang

Abstract

This chapter examines the complex relationships between transition risk, geopolitical risk, and climate change, and how these factors impact corporate decision-making. It specifically examines the roles of corporate social responsibility (CSR) and socially responsible investing (SRI) within this framework, with a focus on the technology sector, particularly semiconductor chipmakers. In evaluating these dynamics, the chapter utilizes a triangulation method that combines theoretical frameworks and empirical analysis to understand how these multifaceted risks impact corporate values, decision-making, and financial resilience. Anecdotal evidence suggests that both corporate social responsibility and socially responsible investing may exhibit shared characteristics in terms of their risk effects. The study's findings suggest that corporate responses to geopolitical and climate change responsibilities may not have had a direct impact on behavioral decisions. This supports the criteria of impact decisions. Nonetheless, it posits that corporate decisions would have considered their corporate risk values and their inclinations toward corporate social and geopolitical responsibility risk, raising questions about how these concerns relate to transition risk, geopolitical risk, and climate change. This aligns with the Task Force for Climate-Related Financial Disclosure (TCFD), which provides guidance on climate change initiatives for associated industries. This chapter carefully articulates that corporate social responsibility risks are closely associated with threat management and risk management behaviors. Furthermore, it could facilitate a deeper exploration of attributes derived from corporate social and geopolitical responsibility characteristics and their implications for conventional corporate decision-making and existing research within corporate values.

Keywords: transition risk, geopolitical risk, climate changes, socially responsible investing, corporate social responsibility

1. Introduction

Corporations today face unprecedented challenges from climate volatility, geopolitical tensions, and shifting regulatory landscapes. These risks are no longer peripheral—they are central to strategic planning. The chapter investigates how firms respond to these pressures through CSR and SRI, and how these responses reflect deeper behavioral and philosophical underpinnings.

1.1 Research problem and significance

In an era marked by escalating climate change impacts, geopolitical instability, e.g., trade tensions in the semiconductor industry, and policy-driven transitions to sustainable practices, corporations face unprecedented pressure to align operations with environmental, social, and governance (ESG) goals.

However, two critical gaps persist:

Disconnect between CSR/SRI and corporate decision-making: Anecdotal and empirical evidence suggests that corporate responses to geopolitical and climate change responsibilities often fail to directly shape behavioral decisions, raising questions about how these concerns interact with transition and geopolitical risks.

Lack of an integrated theoretical framework: Existing models, e.g., threat management, risk valuation separately address social, geopolitical, or climate risks but do not unify these dimensions to explain holistic corporate behavior—especially in technology sectors where resource intensity and global supply chains amplify risk exposure.

The significance of addressing these gaps lies in three areas:

For corporations: It provides a tool to balance short-term financial performance with long-term resilience, particularly in high-stakes sectors like semiconductors.

For investors: It clarifies the relationship between SRI and financial returns, helping align fiduciary duties with sustainability goals.

For policymakers: It informs regulations, e.g., climate-related disclosure under the Task Force for Climate-Related Financial Disclosure, TCFD [1], by highlighting how firms integrate policy shifts into strategy.

As shown in **Table 1**, the multiple linear regression models illustrate the statistical relationships among key variables.

1.2 Definition of the CSGPBD framework

The corporate social and geopolitical behavioral decision (CSGPBD) framework synthesizes: McKeon’s pluralistic reasoning, Calhoun and Weston’s threat management principles, and Borum’s structured risk assessment [2–4].

It offers a lens to interpret corporate behavior under uncertainty, emphasizing ethical reasoning, stakeholder engagement, and resilience. The CSGPBD framework is a thematical model that integrates three core pillars to explain corporate decision-making amid global risks:

Regression analysis and correlation
Performed linear regression for three models:
Stock Performance % = $a \times \text{Qualitative ESG} + b$
Stock Performance % = $a \times \text{Quantitative ESG} + b$
Stock Performance % = $a \times \text{Combined ESG} + b$
For each regression formula that calculated: Slope (a): Indicates direction and strength of relationship. Intercept (b): Baseline performance when ESG = 0. Pearson Correlation (r): Strength and direction (–1 to +1). R^2 : Proportion of variance in stock performance explained by ESG (0–1).

Table 1.
Multiple linear regression models.

McKeon's pluralism: Emphasizes interdisciplinary reasoning, combining rhetoric, philosophy, and behavioral science to account for the subjective, context-dependent nature of risk perception, e.g., how cultural or ethical norms shape CSR priorities.

Calhoun and Weston's threat management: Provides practical guidelines for identifying and mitigating threats, e.g., distinguishing "hunters" real threats from "howlers" empty threats, and emphasizes collaboration to avoid siloed risk management.

Borum's structured risk assessment: Focuses on evaluating nonfinancial risks (e.g., leadership instability, regulatory breaches) through contextual understanding and empirical evidence, rather than solely relying on statistical models.

Together, these pillars enable CSGPBD to analyze how corporations balance:

Short-term financial goals, e.g., stock valuation, with long-term sustainability, e.g., carbon reduction.

External pressures, e.g., investor demands for SRI, geopolitical trade rules with internal governance, e.g., CSR budget allocation.

Decision-making patterns among semiconductor corporations are detailed in **Table 2**, highlighting rationale and functional roles.

2. Thematic development

Which social characteristics can abate corporate value and pricing by corporate behavioral decision-making? Policies and legal changes can take different forms and dynamics according to the jurisdiction system, leadership, and social structure, which are identified by the significant models of various societies [2].

The root issues, including culture, customs, religious beliefs, and ethical and moral behaviors, are all factors associated with corporate social policies. These factors can have a pronounced impact on profitability, particularly in the context of carbon taxes, which especially affect carbon-intensive industries [2].

Furthermore, social and geopolitical characteristics, as well as constitutions, can be compared based on risk aspects. By observing lawmakers, we can understand what makes social politics an important phenomenon, as social geopolitical actors navigate their actions based on universal principles.

From the perspective of risk management theory, certain behaviors can be categorized as threats through relationships, intentions, and targets, such as committing violence against a specific target [3].

Habits and actions establish cases that demand an appraisal of past behavior for accurate assessment. There are three distinct types of threats: antisocial, criminal, and violent, each linked to prior involvement in violent extremism [4].

Transition risk arises from policy actions that are taken and shifted away from old-fashioned tradition and toward sustainable practices [1, 5]. Factors that contributed to transition risks are: policy and legal changes, technological shifts, market dynamics changes, financial and reputational risks [1, 5].

Borum [4] suggests that threats can be identified by examining corporate behavior in the past, providing insights that can best predict future behavior. Corporate social and geopolitical responsibility may be classified into similar corporate social psychological behaviors, which act as risks characterized by mental and moral qualities that affect both groups and individuals.

In this chapter, we examine the rationale behind corporate social behavior and the factors that drive corporate decisions regarding their primary objectives. Corporate social priorities may differ based on other corporate perspectives that arise from their

1. <i>NVIDIA:</i>
The total ESG budget is <i>not explicitly disclosed</i> , estimated at around \$12 million based on foundation grants and sustainability program costs.
Key metrics include CO2 intensity of 0.9 MT CO2e per million revenue and a goal for 100% renewable energy by FY25.
Notably, “Scores are low on budget transparency, but strong in emissions and intensity metrics.”
2. <i>Micron:</i>
Micron also does not explicitly disclose its total ESG budget; estimates are derived from community investments, with diverse supplier spending highlighted at \$2.2 billion.
Metrics are weakly presented, focusing on corporate responsibility ratings, where “limited disclosure on budgets leads to lower scores” despite good supplier spending metrics.
3. <i>Intel:</i>
Intel stands out with an <i>explicit ESG budget of approximately \$11.95 billion</i> , including \$1.25 billion in green bonds and significant funds under the CHIPS Act.
It maintains strong environmental goals, including 95% renewable electricity and a 10% reduction in GHG emissions.
“High transparency with detailed figures makes Intel’s ESG metrics quantifiable and strong.”
4. <i>Qualcomm:</i>
Qualcomm’s ESG budget is mainly inferred at about \$200 million, rooted in philanthropy and supplier audits.
Their initiatives include goals for 15% Scope 3 emission reductions and a 25% representation of women in diversity, illustrating a focused approach despite low budgeting clarity.
“Balanced E/S with clear goals and strong quantifiable trackers despite a fabless model” describes their strategy.
5. <i>TSMC:</i>
TSMC’s ESG budget is estimated at \$1 billion, emphasizing green manufacturing and water recycling initiatives, with a water recycling rate of 87.5%.
The company aims for 100% renewable energy by 2030, indicating a strong commitment to environmental sustainability.
“Moderate transparency with significant E emphasis and abundant high-quality metrics” underlines TSMC’s performance.
<i>In conclusion, while some companies exhibit detailed budgets and ambitious goals, others demonstrate limited transparency in their disclosures, impacting their overall ESG reporting scores. The document emphasizes the need for improved clarity and commitment to ESG principles among these tech leaders.</i>

Table 2.
Description analysis—semiconductor corporations decision, rationale, and functions.

social and political challenges. In particular, climate change has altered the methods of financing and the forms of investment that set goals for such objectives [6].

Developments in corporate social responsibility, encompassing areas such as corporate social welfare, cultural status, social and political affairs, and economic fundamentals, represent significant aspects of corporate development. In accordance with global social politics, these elements are identified as part of the legislative process and political agenda that aim to engage effectively with the world. According to the United Nations Environment Programme (UNEP) [7], green finance decisions require forming a system to make them functional, which also involves partnerships between the government, business communities, and the public to ensure proper operation [7]. This chapter examines the social and political influences, as well as corporate social factors, associated with these dynamics.

The assessment scores and qualitative key terms are summarized in **Table 3**, providing a foundation for thematic analysis.

2.1 Theoretical foundation of risk and corporate decision-making

Our chapter offers theoretical foundation based on risk valuation that can differentiate corporate socially responsible risk factors from corporate decision-making. If valuation is the ultimate financial decision that corporate management requires to make, the method can help verify corporate decisions in socially responsible investing (SRI) and corporate social responsibility (CSR) [8]. Socially responsible forms part of the SRI issues that could affect the corporate performance and their risk, when investors should fulfill their fiduciary duties, which apply to socially responsible investing [9].

Corporate social responsibility can significantly influence corporate decisions, as demonstrated by recent research indicating that firms that integrate sustainable practices tend to perform better in the long run. When the corporate sector incorporates political and socially responsible norms into its decision-making processes, these considerations become integral to asset allocation and capital budgeting decisions. SRI can refer to a corporation that is dedicated to social values or that invests in a socially responsible manner, while generating positive returns [10].

Furthermore, social policies and socially responsible investing in corporate finance could be highly associated with corporate behavior, illustrating the connection between ethical practices and market performance.

Given that corporate social policy can evolve in tandem with corporate development, especially in rapidly developing economies in Asia, there is a noticeable divergence in how these norms are perceived compared to more established markets. Chatzitheodorou et al. [11] expected that the role of SRI is important for impact investing, particularly in terms of social, financial, and environmental attributes, during the process of selecting investments [12–14].

Developed economies, such as the US, have already undergone a revolution regarding corporate social and geopolitical norms, resulting in a complex landscape in which businesses operate. However, there are yet to be proven cases for climate

Company	Total score	Strengths	Weaknesses
Intel	37	Comprehensive across most categories; ambitious goals (e.g., RISE strategy, net-zero targets); strong measurement/tools	ESG ratings somewhat limited/inferred
TSMC	37	Outstanding in benchmarks, ratings, tools, voluntary principles, reporting; industry-leading recognitions and targets	Slightly less detail in “other” factors compared to product-focused peers
Micron	31	Excellent ratings and awards; good benchmarks and reporting	More general in governance and voluntary principles
Qualcomm	33	Robust ratings; consistent coverage in governance, benchmarks, frameworks	Less emphasis on manufacturing-specific impacts (fabless model)
NVIDIA	30	Strong in governance, benchmarks, tools, and reporting with specific policies and goals	Limited explicit ESG ratings (mostly inferred)

Table 3.
Table summarizes the assessment scores and key terms of the qualitative analysis.

change, showcasing an urgent need for corporate adaptation. Chatzitheodorou et al. [11] investigated the acceptance factors of corporations that contribute to social justice and environmental sustainability, while excluding any factors that are toxic and harmful to the environment.

In recent, fast-growing economic developments, chipmakers are under the spotlight, where the influence of social and political considerations, as well as climate change, could be initiated by shareholder activists and their major stakeholders in developed countries.

This chapter has chosen the international market and the technology industry sector to investigate whether corporate social responsibility, geopolitical factors, and climate change are factors that influence corporate behavioral decisions, emphasizing the intricate relationship between socially responsible practices and corporate strategy in today's globalized world.

Corporate financial budgeting decisions are outlined in **Table 4**, reflecting strategic resource allocation.

Company	Total ESG budget (bn, disclosure)
NVIDIA	0.1 (estimated; foundation grants ~\$0.012bn + inferred sustainability initiatives)
Micron	0.05 (estimated; philanthropy + inferred from awards/initiatives)
Intel	3.45 (green bond 1.25bn + diversifiesuppliers1.25bn + diversifiesuppliers 2.2bn)
Qualcomm	0.02 (philanthropy ~\$0.018bn + inferred Wireless Reach)
TSMC	0.19 (environmental 0.15bn + social0.15bn + social 0.04bn)
Company	% Alloc E
NVIDIA	~40% (renewable energy focus)
Micron	~50% (energy efficiency goals)
Intel	~36% (\$1.25bn green bond for energy/water)
Qualcomm	~30% (renewable targets)
TSMC	~79% (\$0.15bn env. protection)
Company	% Alloc S
NVIDIA	~40% (community, human rights)
Micron	~40% (DEI, community awards)
Intel	~64% (2.2bndiversesuppliers + philanthropy 2.2bndiversesuppliers + philanthropy 0.1bn)
Qualcomm	~50% (community programs)
TSMC	~21% (\$0.04bn community/education)
Company	% Alloc G
NVIDIA	~20% (governance oversight)
Micron	~10% (compliance)
Intel	Not disclosed (~0%)
Qualcomm	~20% (ethics/compliance)
TSMC	Not disclosed (~0%)

Table 4.
Corporate financial budget decisions.

2.2 The roles of SRI and CSR in modern corporate strategy

In recent years, the concept of corporate social responsibility (CSR) has evolved from a peripheral concern to a central pillar of strategic decision-making within firms. This chapter explores how CSR influences corporate behavior in an era marked by profound global challenges—including climate change, geopolitical instability, and the risks associated with economic transitions. These forces are not only reshaping the business landscape but also redefining the expectations placed on corporations by governments, investors, and society at large.

As companies navigate this complex terrain, they face mounting pressure to align their operations with broader social and environmental goals. Legal frameworks, regulatory standards, and cultural norms increasingly reflect a collective demand for ethical governance and sustainable practices. In this context, CSR is no longer viewed merely as a voluntary gesture of goodwill—it has become a strategic imperative.

Moreover, the rise of socially responsible investing (SRI) underscores the growing importance of these issues in financial markets. Investors are actively seeking out firms that demonstrate accountability, transparency, and a commitment to long-term value creation beyond profit. This shift signals a deeper recognition of the interconnectedness between corporate conduct, societal welfare, and environmental stewardship.

By examining the behavioral responses of firms to these evolving pressures, this chapter aims to shed light on the mechanisms through which CSR shapes decision-making and risk management. The analysis offers insights into how companies can not only mitigate emerging risks but also seize opportunities by embedding responsibility and resilience into their core strategies.

Comparative valuation and behavioral decision scores (CSGPBD) are presented in Table 5, bridging financial and geopolitical metrics.

2.3 Framework for threat and risk management

Calhoun and Weston [3] present a practical, experience-based framework for managing threats, particularly within the commercial sectors influenced by climate

Company	Stock performance change (%)	Qualitative ESG total	Quantitative ESG total	Combined ESG total
NVIDIA (NVDA)	756.17	30	17	47
Micron (MU)	87.99	31	14	45
Intel (INTC)	−46.63	37	23	60
Qualcomm (QCOM)	17.45	33	15	48
TSMC (TSM)	140.64	37	19	56

Footnotes:
Qualitative ESG: Corporate socially responsible investing qualitative attributes on environment, social and governance factors.
Quantitative ESG: Corporate socially responsible investing quantitative attributes on environment, social and governance factors.
Combined ESG: Corporate socially responsible investing qualitative and quantitative attributes combined on environment, social and governance factors.

Table 5.
Valuation versus corporate social and geopolitical behavioral decision Scores (CSGPBD).

change, geopolitical shifts, and social responsibility contexts. We expect that managing these threats will emerge as the primary source of transition risk management, illustrating how corporate managers perceive their responsibilities in controlling business, operational, and management threats concurrently with their risk management behaviors.

In their exploration, Calhoun and Weston [3] reviewed the Blue-Collar Approach to Threat Management, which serves as a vital contribution to understanding these dynamics. The research conducted by Calhoun and Weston [3] emphasizes a practical, no-nonsense methodology grounded firmly in real-world experience and empirical data.

They advocate for tools and strategies that are not only relevant to recent memories and applicable in current settings but are also focused on observable behaviors and firmly based on actual cases and concrete field experiences. This is in line with Brodback et al. [15], which suggests that management decisions could mitigate risks according to altruistic and egoistic behaviors.

This approach aligns with the broader understanding of global risks, which highlights the interconnectedness of threats that cannot be ignored, as noted in the Global Risks Report [16]. Furthermore, the necessity of such frameworks stems from the ongoing challenges posed by climate change, where adaptation mechanisms are vital for resilience, underscoring the importance of conducting thorough assessments of indirect impacts, as articulated in the report on climate change and its implications.

In Calhoun and Weston [3] 2015 examination of corporate behavior and threat management, Calhoun and Weston elucidate the intricate relationship between corporate governance and the external risks posed by geopolitical instability and climate change.

They argue that the increasing interdependence of global markets necessitates a robust framework for understanding how corporate strategies can both mitigate and exacerbate vulnerabilities to such systemic threats.

By analyzing specific case studies, the authors demonstrate that organizations often face conflicting pressures: the need to prioritize short-term financial performance while also addressing long-term sustainability challenges.

This duality is further complicated by the recognition that corporate actions can inadvertently contribute to geopolitical tensions, particularly in contexts where climate impacts exacerbate resource scarcity [13–15].

Hence, the authors advocate for a paradigm shift in corporate responsibility, encouraging businesses to adopt proactive stances that align with global efforts to manage risks associated with climate change and geopolitical volatility, thereby fostering resilience against the multifaceted threats identified in reports like the World Economic Forum's Global Risks, and a critical review of energy security policies.

Calhoun and Weston [3] present their research on the Seven Core Concepts, which identify seven fundamental principles for effective threat management.

The first fundamental principle illustrates the Hunters versus Howlers concepts, distinguishing between individuals who pose a real threat, represented as hunters, and those who make threats but are unlikely to act, referred to as howlers in their framework.

The second fundamental principle emphasizes the Need-to-Know basis, which identifies critical information necessary for assessing a threat effectively.

The third fundamental principle, Situation Dynamics, focuses on understanding how a situation evolves, which is essential for adaptive management strategies.

The fourth fundamental principle, Intervention Synergy, highlights the importance of coordinating efforts across agencies and disciplines to enhance collective responses.

The fifth fundamental principle, Avoiding Bunkers and Silos, encourages collaboration and information sharing among various organizations and sectors. Meanwhile, the principle of Avoiding Myopic Management stresses the significance of maintaining a broad, long-term perspective in decision-making.

Lastly, the principle of Post-Professionalization Reflections offers insights drawn from decades of experience in the field, emphasizing the value of ongoing professional development and critical reflection.

According to Calhoun and Weston [3], their research illustrates the Ten Guidelines for Managing Threats, which serve as practical rules derived from their extensive empirical research experience. These guidelines include prioritizing behavior over words, avoiding assumptions based on stereotypes, using multidisciplinary teams, maintaining flexibility in response strategies, and considering legacy and future outlook.

These guidelines for managing threats align with the Principles for Responsible Investment of the UN [17]. In contrast, the UNPRI [17] outlines six principles for responsible investment, which aim to manage the risk factors associated with environmental, social, and governance (SRI) issues [18].

Furthermore, Calhoun and Weston [3] reflect on the evolution of the threat assessment profession, offering valuable advice for future practitioners. They emphasize the importance of professionalization, mentorship, and continuous learning in navigating complex threat landscapes successfully.

In contrast, McKeon's study [2] is indirectly linked to corporate behavioral decision-making and risk management in the modern sense.

McKeon's research, situated within the context of rhetoric, philosophy, and the development of intellectual disciplines, provides foundational and theoretical insights that can be applied to contemporary issues.

His ideology can be indirectly connected to behavioral finance and risk management, as McKeon [2] emphasizes the plurality of methods and perspectives in understanding human behavior and decision-making.

This perspective aligns well with behavioral finance, which challenges classical economic assumptions of rationality by incorporating psychological and emotional factors into the analysis of decision-making processes.

Thus, corporate behavioral decisions rely on interdisciplinary thinking, much like McKeon's advocacy for integrating rhetoric, philosophy, and science into a cohesive approach to complex problems. Additionally, McKeon [2] supports the idea that there is no single framework for understanding human actions and decisions, emphasizing the necessity of a more nuanced lens that recognizes multiple influences.

His emphasis on rational choice theory highlights the complexity of decision-making, advocating for a more comprehensive understanding of the factors that influence human behavior in corporate environments, thereby enriching the dialog surrounding interdisciplinary methodologies.

McKeon [2] asserts that a decision-making framework centered on corporate social responsibility (CSR) significantly shapes corporate behavioral decisions by integrating pluralistic risk strategies, which not only influence internal corporate governance but also have the potential to substantially impact stock valuation [13–15].

This correlation is particularly relevant in the context of global risks, as highlighted by the Global Risks Report [16], which emphasizes the systemic impacts of interconnected global risks on organizational strategies and economic stability.

Furthermore, considering the wider implications of climate change on business operations and investment landscapes, as discussed in the literature regarding climate adaptation, underscores the importance of understanding both direct and indirect impacts on corporate decision-making processes [13–15].

It encourages investors to consider not only the financial returns but also the moral narratives and stakeholder voices that play a crucial role in shaping ethical investment decisions. As research illustrates, integrating diverse stakeholder perspectives can lead to a more sustainable and inclusive investment strategy that goes beyond mere profit maximization.

In doing so, investors not only enhance their credibility but also contribute to a more equitable market environment, as evidenced by case studies highlighting the positive impacts of socially responsible investing [19]. By prioritizing these elements, investors can align their financial goals with broader social responsibilities, resulting in a more holistic approach to investment that recognizes the interconnectedness of economic outcomes and societal well-being.

McKeon [2] emphasizes rhetoric as a tool for reasoning and persuasion, a concept that can be linked to how corporate behavioral decisions are influenced by framing, narratives, and communication—key themes in behavioral finance.

Risk perception is often shaped by how information is presented, not just by the data themselves; in fact, this notion is further supported by studies that show the significant impact of communication strategies on decision-making processes in financial contexts.

McKeon's [2] rhetorical theory helps explain why investors may react irrationally to market news or financial advice. While McKeon [2] was not directly linked to financial risk, his ideology of philosophical pluralism provides a foundation for understanding the subjectivity of risk, a core concept in behavioral finance.

Risk is not merely a statistical measure; it is also a psychological and cultural construct, which McKeon's framework helps illuminate. Borum [4] advocates for a formulation-based model, rather than relying solely on empirical studies, emphasizing that contextual understanding and interdisciplinary reasoning are crucial for interpreting complex financial situations.

This reflects McKeon's [2] epistemological pluralism, which posits that knowledge consists of multiple perspectives. Furthermore, McKeon's [2] rhetorical and philosophical framework supports the idea that risk is not purely empirical but also interpretive and situational, a viewpoint that Borum [4] integrates into the structured assessment model.

The Friedman Doctrine, famously articulated by economist Milton Friedman in his 1970 essay titled "The Social Responsibility of Business Is to Increase Its Profits," posits that corporate executives' primary responsibility is to the shareholders, specifically to maximize profits, as long as they operate within the bounds of social, geopolitical law, and ethical customs.

Friedman [20] argued that this doctrine is the cornerstone of shareholder primacy theory, significantly shaping corporate behavioral decisions. This framework is controversial, especially as corporate social and geopolitical governance concerns have gained traction in contemporary discussions on corporate behavioral theories.

Descriptive statistics of SRI scores are compiled in **Table 6**, offering insight into sustainable investment trends.

2.4 Synthesis: Toward an integrated CSGPBD model

Our chapter develops a conceptual framework that integrates philosophical reasoning, behavioral threat assessment, and risk formulation into corporate

Key term	Description
Stock performance	Change in stock price percentage, ranging from –46.63% (Intel) to +756.17% (NVIDIA).
Qualitative ESG	Environmental, Social, and Governance qualitative scores, ranging from 30 (NVIDIA) to 37 (Intel, TSMC). Higher scores indicate better qualitative ESG performance.
Quantitative ESG	Quantitative ESG scores reflecting budget allocations and measures, ranging from 14 (Micron) to 23 (Intel).
Combined ESG	Sum of qualitative and quantitative ESG scores for a holistic view, ranging from 45 upwards (exact max not fully visible).
Companies mentioned	NVIDIA (NVDA), Micron (MU), Intel (INTC), Qualcomm (QCOM), TSMC (TSM)

Table 6.
Descriptive statistics of the SRI scores.

decision-making and ethical considerations. This framework evolves from philosophical reasoning into the behavioral science of corporate social responsibility (CSR) and socially responsible investment (SRI), which are incorporated into our model of corporate social and geopolitical behavioral decision (CSGPBD).

This integration is crucial for achieving impactful results in climate change management. Decision-Making Under Uncertainty, as advocated by McKeon [2], emphasizes that pluralism supports the use of both quantitative models and qualitative judgment in navigating complex scenarios.

Furthermore, Borum [4] highlights the importance of structured risk formulation, enabling organizations to assess nonfinancial risks such as leadership instability and regulatory threats, thereby enhancing their risk management capabilities.

In the realm of behavioral biases and governance, the insights provided by Calhoun and Weston [3] through a behavioral lens are invaluable, as they help detect irrational or risky executive behavior. This understanding can significantly inform board oversight, mergers and acquisitions (M&A) decisions, and crisis management in the face of geopolitical challenges, ultimately leading to more robust decision-making processes that reflect a broader understanding of the risks at play.

The Calhoun and Weston [3] model is instrumental in assessing the organizational behavior that may lead to climate change and violations related to environmental, social, and governance (ESG) standards. This model provides a comprehensive framework that enables organizations to critically evaluate the underlying factors contributing to their environmental impact and ethical compliance [13–15].

Additionally, the Borum [4] model supports a structured evaluation of a company's exposure to social and ethical risks, offering crucial insights into the complexities of sustainable business practices. By integrating these models, organizations can enhance their strategic approaches to managing climate-related risks and ensuring adherence to SRI guidelines, thereby aligning their operational strategies with contemporary sustainability objectives.

CSR adoption may lead to improved corporate behavior or strategic allocation. At the same time, breaches introduce threat exposure, presenting potential risks for companies that fail to adhere to ethical standards and corporate governance principles.

According to Borum [4], risk management theory suggests that companies with strong risk mitigation strategies, particularly those driven by CSR policies, may limit

Theory/ author	Core Idea	Application to corporate finance	Application to SRI
McKeon [2]	Pluralism in reasoning and rhetoric	Encourages diverse perspectives in financial strategy, beyond pure quantitative models	Supports ethical reasoning and stakeholder dialog in investment decisions
Calhoun and Weston [3]	Behavioral threat assessment; practical risk management	Helps identify behavioral red flags in corporate governance and leadership	Assesses reputational and operational risks in ESG (Environmental, Social, Governance) factors
Borum [4]	Structured professional judgment in risk	Promotes contextual, behavior-based risk analysis in financial forecasting	Enhances due diligence in evaluating ethical and social risks of investments

Table 7.
Theoretical components [2–4].

volatility and enhance their long-term stock valuation. This is particularly crucial in today’s fast-paced business environment, where stakeholder’s expectations around corporate responsibility are growing.

Organizations that prioritize CSR not only create a competitive advantage but also contribute to a more sustainable economic system, mitigating risks associated with reputational damage and regulatory penalties.

Synthesis: Toward an integrated CSGPBD model

The foundational theoretical framework underpinning the transition risk analysis is outlined, integrating geopolitical dynamics with climate-related financial modeling (Table 7).

3. Conclusion summary of theoretical contributions implications for researchers and practitioners avenues for future research

In our chapter’s Theoretical Model in testing, global large market capital tech companies such as Nvidia, Micron Tech, and Intel have demonstrated a commitment to corporate social investment (CSI) and socially responsible investment (SRI). This commitment has been correlated with stronger financial resilience that translates into enhanced corporate values, supporting theories proposed by the corporate social and geopolitical behavioral decision (CSGPBD) model identified functions of McKeon [2], Calhoun and Weston [3], and Borum [4].

Outlier patterns in CSGPBD are identified in Table 8, revealing deviations from normative behavior.

In contrast, as regards Theoretical (Tables 1–6 and 8–10) Model in testing, some other global large market capital tech companies such as Qualcomm and TSMC have exhibited that corporate behavioral decisions remain largely independent of CSI and SRI; this scenario suggests that traditional financial models continue to dominate risk management strategies in their operations. This supports the arguments of Benson et al. [21], whose research results indicated that SRI-associated investments are less correlated to returns than conventional investments.

In our chapter, it was observed that large market capital tech companies, such as Nvidia and Intel, have displayed moderate fluctuations following breaches of their

SRI commitments. When these companies experienced breaches related to SRI standards, their market values were susceptible to short-term volatility, a phenomenon that the tested model evaluates by examining event-based volatility linked to these SRI breaches, as well as social and geopolitical lawsuits and a lack of disclosures.

Table 9 displays stock valuation outcomes based on CSGPBD metrics, linking market performance to social governance.

Notably among those Theoretical Models tested, large market capital tech companies such as Nvidia and Micron Tech have maintained relatively stable trends amid threats and social geopolitical pressures; both companies have integrated environmental, social, and governance (SRI) principles into their corporate strategies, which have positively influenced their long-term values [22–30]. The adoption of CSI by the largest and fastest grown market capital tech company Nvidia correlates with strategic shifts in corporate behavior, aligning closely with McKeon’s decision-making theory [31–35]. Conversely, when this largest market capital tech company Nvidia encounters SRI breaches, failures in threat management are responsible for short-term value dips, thereby supporting Borum’s structured risk assessment model.

The tech company’s (Intel’s) lack of engagement with CSI has resulted in stable stock trends, indicating that Calhoun and Weston’s model may be less applicable to firms that do not prioritize CSI. This absence of CSI efforts could also explain Intel’s steadier financial performance, which appears to focus more on risk-based decision-making, underscoring the varying impacts of CSI and SRI on corporate performance across different firms.

A statistical summary of stock valuations is provided in **Table 10**, supporting comparative financial analysis.

NVIDIA’s exceptional growth (~756%) skews results. Recalculating without it:
vs. Qualitative: $r = -0.135$ (very weak negative), $R^2 = 0.018$
vs. Quantitative: $r = -0.442$ (moderate negative), $R^2 = 0.195$
vs. Combined: $r = -0.329$ (weak negative), $R^2 = 0.108$

Table 8.
CSGPBD outlier.

Stock performance					
Month-year	NVIDIA (NVDA)	Micron (MU)	Intel (INTC)	Qualcomm (QCOM)	TSMC (TSM)
Jun-22	100	100	100	100	100
Jul-22	95.96	96.82	97.06	107.8	94.34
Aug-22	104.38	98.49	88.43	110.63	98.74
Sept-22	77.43	85.37	73.44	94.88	87.38
Oct-22	73.28	86.9	67.43	88.27	74.1
Nov-22	90	93.31	73.66	90.13	83.4112
Jan-23	101.51	93.93	73.34	92.98	98.24
Feb-23	129.54	96.96	69.87	98.95	104.55
Mar-23	147.54	93.3	71.61	92.52	102.32
Apr-23	159.54	98.55	79.49	91	98.98
May-23	182.5	104.41	75.36	82.06	101.19

Stock performance					
Month-year	NVIDIA (NVDA)	Micron (MU)	Intel (INTC)	Qualcomm (QCOM)	TSMC (TSM)
Jun-23	240.48	10791	83.49	90.03	115.72
Jul-23	263.04	105.28	85.58	93	114.58
Aug-23	265.93	10718	86.53	87.53	106.3
Sept-23	260.47	112.2	92.35	84.5	100.62
Oct-23	256.43	109.89	89.84	83.47	101.07
Nov-23	279.32	121.37	104.01	94.77	108.68
Dec-23	282.49	129.54	115.52	105.63	115.03
Jan-24	330.6	137.68	118.55	110.04	122.09
Feb-24	426.33	137.68	109.2	115.1	143.12
Mar-24	525.61	163.54	109.95	128.15	157.84
Apr-24	503.64	191.27	92.35	127.86	157.3
May-24	565.44	199.45	77.96	146.28	169.33
Jun-24	732.14	222.33	77.52	159.31	191.59
Jul-24	716.41	196.79	82.74	147.89	197.23
Aug-24	688.26	159.17	52.58	127.8	188.62
Sept-24	676.11	148.86	53.21	126.84	193.31
Oct-24	789.35	170.19	57.32	129.24	216.5
Nov-24	837.46	165.82	61.78	123.93	215.5
Dec-24	806.36	156.27	52.09	120.21	225.82
Jan-25	797.56	158.24	51.11	125.53	237.67
Feb-25	766.02	154.92	57.15	128.14	226.4
Mar-25	675.34	152.26	57.7	119.01	197.82
Apr-25	619.81	118.99	51.16	106.92	177.76
May-25	748.14	147.3	52.7	112.07	212.67
Jun-25	856.17	187.99	53.37	117.45	240.64

Table 9.
Stock valuation on CSGPBD.

Company	Stock price points	Percentage change	Key notes
NVIDIA (NVDA)	856.17	756.17%	Stock price increased more than seven-fold due to explosive growth in AI and data center businesses
TSMC (TSM)	240.64	140.64%	World's largest semiconductor foundry benefiting from strong semiconductor demand
Micron (MU)	187.99	87.99%	Memory chip manufacturer with nearly doubled stock price
Qualcomm (QCOM)	117.45	17.45%	Mobile chip giant with modest growth
Intel (INTC)	53.37	−46.63%	Traditional CPU giant facing intense competition, stock price declined nearly half

Table 10.
Stock valuation statistic summary.

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Conflict of interest

The authors declare no conflict of interest.

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Artificial Intelligence and Its Environmental Sustainability: Challenges and Opportunities

Raquel von Hohendorff and Wilson Engelmann

Abstract

The development of artificial intelligence systems opens possibilities never imagined, but it challenges the present and future of humanity. One problem is the high consumption of electricity and water, necessary for these systems to demonstrate their “intelligence” in operation. A phenomenon called the “conundrum” is evident, a kind of paradox. While the possibilities of generating positive effects increase, the consumption of electricity and water also increases. This situation is dangerous, as it will imply more effects to enhance the climate change, in addition to increasing the consumption of something essential for human life: water. The challenge is outlined, and it is up to the human being, who created the AI systems, to promote alternatives so that in the not-so-distant future, we will not have the following dilemma: leaving drinking water for human consumption or to cool the systems that operate the so-called “artificial intelligence.”

Keywords: artificial intelligence, environmental sustainability, future generations, regulation, opportunities

1. Introduction

We are currently experiencing the effects of the Fourth Industrial Revolution, where we are increasingly consuming technological innovations, but Planet Earth is overwhelmed and has shown numerous symptoms of depleted reserves. It remains necessary to discuss the production and consumption patterns of a vast majority of Earth's inhabitants, behavior that has caused serious and irreversible consequences for human and environmental health. We are facing a global crisis. We are utterly dependent on the natural world. It provides us with every oxygen-filled breath we take and every bite we eat. But we are currently damaging it so profoundly that many of its natural systems are now on the brink of collapse.

The socioeconomic development that has been occurring with the advent and implementation of new technologies in the most diverse production processes cannot ignore ethical, legal, and social aspects, as well as sustainability, always promoting the ideals of planetary responsibility and environmental non-regression. These technologies are no longer mere futuristic promises and are becoming part of society's daily routine at the beginning of the twenty-first century, thus demanding legal attention.

However, many of these new technologies are accompanied by scientific uncertainty regarding their effects and future harm to the environment and human life.

The transformations today are greater than can be predicted, and even more profound and rapid than at any other time. Thus, the current scenario presents a challenge for new analyses, studies, and research. A critical law is needed, capable of interpreting reality and capable of bringing about the necessary changes in this reality, otherwise it will remain isolated from other areas of knowledge, which will use the gaps left by law to act, including on regulatory issues. The research that will arise from the use and implementation of new technologies will require the intervention of different systems, with the assessment of emerging social, ethical, and regulatory impacts, supported by an innovation model that must be responsible and sustainable.

2. Artificial intelligence, environmental systemic risks, and corporate responsibility

Humanity's journey on Planet Earth leaves increasingly complex traces. Among the many that could be highlighted, this work will focus primarily on two: the ecological footprint, that is, the human use of natural resources, on the one hand; and, on the other, technological advancements brought about by systems, algorithms, and other tools that give rise to what is commonly referred to as artificial intelligence (hereinafter, AI).

From a broader perspective, it may be observed that technologies such as AI ought to serve the purpose of enabling greater environmental protection, thereby fostering full human development and flourishing. However, as AI systems become increasingly sophisticated¹, an opposing phenomenon has emerged: the growing demand for water and electricity [1] required for these systems to operate and, through the processing of vast volumes of data, to generate solutions in areas such as healthcare, business, quantum machine learning, the operation of Large Language Models (LLMs), cryptocurrency mining [2], and the continued reinforcement of globalization's effects.

Generative artificial intelligence (GAI) requires substantial computational resources for model training and inference, yet its implications, and the management strategies related to electronic waste (e-waste), remain largely underexplored. Recent research findings indicate that the flow of electronic waste may increase significantly, potentially reaching a cumulative total of 1.2 to 5 million metric tons between 2020 and 2030, depending on different future development scenarios for GAI. This trend may be exacerbated by geopolitical restrictions on semiconductor imports and the high turnover of servers aimed at reducing operational costs. At the same time,

¹ For the purposes of this paper, the term "AI system" means a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments; [...] ;" (according to Article 3, "Definitions", by the European Parliament and the Council of The European Union. Establishing harmonized rules on artificial intelligence (and amending Regulations (EC) No. 300/2008, (EU) No. 167/2013, (EU) No. 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Regulation), 2024. Available at: https://www.europarl.europa.eu/doceo/document/A-9-2023-0188-AM-808-808_PT.pdf. Accessed on: June 21, 2025.

evidence suggests that implementing circular economy strategies across the GAI value chain could reduce e-waste generation by 16 to 86%. This underscores the importance of proactive e-waste management considering the rapid advancement of GAI technologies [3].

At the same time, a recent publication has warned of the systemic risks to AI sustainability arising from its rapid expansion into new social, economic, and ecological contexts. This, in turn, indirectly highlights the growing need for AI literacy and the necessary systemic approach to its development.

The early stages of generative artificial intelligence (GenAI), spearheaded by the Chat Generative Pre-Trained Transformer (ChatGPT), not only transform the behavior of users in the digital media ecosystem but also significantly increase the energy consumption of companies operating in the GenAI industry, posing a fundamental challenge in the era of climate change [4]. These indicators point to the so-called “conundrum” effect: “The point is that even when humans act with what are believed to be the best of intentions, collective and coordinated efforts often run counter to our actual goals. *That is the conundrum*. As scientific innovation, increased efficiency, and good intentions can make our energy and climate problems worse” [5]. The advances driven by AI systems, blending both positive and negative effects, also generate the significant environmental impacts, as their operation requires vast amounts of water for system cooling and, simultaneously, high levels of electricity consumption for data mining processes that make these systems “intelligent.”

In a global context already marked by water scarcity, this “conundrum” effect underscores the urgent need for regulatory shifts, from a paradigm of “legal responsibility” to one of “accountability processes.” Accordingly, regulatory approaches must be designed on a global scale, as the risks generated are transnational and the resulting disastrous effects will be collective, disregarding the national borders [6]. This accountability movement must necessarily extend to the major corporations developing AI systems. Such entities should be required to establish a global fund aimed at addressing climate emergencies and safeguarding the interests of generations yet to come, without neglecting the current generations, who will continue to live for a long time.

This global legal movement is inspired by the principle of “ecological solidarity,” structured by François Ost, recognizing the “conundrum” effect: “The ideas of technology, progress, growth, and development are now simultaneously invoked as traditional guarantees of well-being, and feared as possible causes of escalating threats [7].” AI system companies must immediately engage in robust due diligence practices and may be subject to sanctions should they fail to do so. This is essential for initiating a global process of shared accountability, one that includes all living beings—humans and non-humans.

Corporate Social Responsibility, which brings together private sector actors and public authorities, draws inspiration from the European Union’s “Corporate Sustainability Reporting Directive (CSRD) [8]” and represents a step in this direction. This regulatory instrument imposes obligations on companies based in the European Union but also applies to companies outside the European territory, by virtue of the so-called Brussels Effect. As such, it constitutes an example of a globally binding regulation, aimed primarily at requiring companies to acknowledge their commitments and assume their share of responsibility in the transition toward a more ecologically balanced economy, also committed to social justice.

This first initiative by the European Union was reinforced by the Directive of May 24, 2024, which placed greater emphasis on the due diligence requirement regarding human rights and environmental matters, based on risk scales, as can be read

in Article 5, which outlines the Due diligence obligation as follows: Member States shall ensure that companies conduct risk-based human rights and environmental due diligence as laid down in Articles 7 to 16 (“due diligence”) by carrying out the following actions:

(a) integrating due diligence into their policies and risk management systems in accordance with Article 7; (b) identifying and assessing actual or potential adverse impacts in accordance with Article 8 and, where necessary, prioritizing actual and potential adverse impacts in accordance with Article 9; (c) preventing and mitigating potential adverse impacts, and bringing actual adverse impacts to an end and minimizing their extent in accordance with Articles 10 and 11; (d) providing remediation for actual adverse impacts in accordance with Article 12; (e) carrying out meaningful engagement with stakeholders in accordance with Article 13; (f) establishing and maintaining a notification mechanism and a complaints procedure in accordance with Article 14; (g) monitoring the effectiveness of their due diligence policy and measures in accordance with Article 15; and (h) publicly communicating on due diligence in accordance with Article 16 [9].

This set of measures aimed at safeguarding human rights and environmental preservation may be understood as a notion of due diligence connected to a system of responsibility of the present toward the future. In other words, they constitute the very processes through which organizations are held accountable [10].

The content of the European Union Directive of May 24, 2024, represents a significant legal initiative aimed at addressing the excessive consumption of water and electricity by large corporate entities responsible for the development of global AI systems. These accountability processes are designed in a preventive and prospective manner, rather than the traditional retrospective accountability processes. Climate change generated by the environmental impacts of AI systems must be addressed in this manner, as we are living through an inflection point in which businesses need to take responsibility for “healing the crises of our time.” All businesses must evolve into enterprises that generate positive social and environmental impact. Public policies and/or organized civil society alone will not be sufficient to accelerate the positive transformations the world urgently requires [11].

Within this context, new structural elements emerge for building mechanisms aimed at protecting and strengthening human dignity. Paraphrasing the theme of a recent publication by Bruno Latour and Nikolaj Schultz [12], there is a clear need to foster awareness that the State alone will not be capable of addressing the urgent challenges of our time. The ecological perspective is inevitably entangled with politics, yet politics does not always pursue the common good or the well-being of all. Geopolitical and economic interests often prevail.

To reach a form of “ecological consciousness” concerned with implementing practical measures to promote harmonious coexistence between humanity and the environment, which is the foundation of any transition strategy, it will be necessary to “govern the world without a world government,” as discussed by Roberto Mangabeira Unger [13]. What is required is the adoption of a “language of mutual guarantees,” bringing together the various stakeholders into an effective global governance, rather than establishing a “world government” that can give rise to an “ecological class, self-aware and confident” [12], based on the preservation of peace and mutual trust. To achieve this, it is essential to pursue a “sustainable production” grounded in a “knowledge economy.”

According to Mangabeira Unger, to have legal support for such a “world government,” it would be necessary to place greater trust in contracts, which would always

be “incomplete contracts,” which presuppose an underlying set of default rules. These foundational standards could include, for instance, the European Union Directive of May 24, 2024, the “Corporate Sustainable Due Diligence Directive,” and alongside globally accepted principles, particularly those concerning human rights. The normative flows of this legal framework would unfold through networks. The coalitions formed within this legal framework “produce something more than a contract, but less than law: what we could call *proto-law*” [13]. The dynamic interplay produced by these networked interconnections can be described as follows: “When understandings and rules developed in some of these networks are echoed by rules and understandings generated in many others, *proto-law* begins to become Law: not a Law imposed by a world government, but Law generated from the bottom up by a society of States and nations.” It is within this framework that corporate organizations should be integrated, as they share relationships of various types in the globalized world.

3. Perceptions about the social function of companies

Within this foundational legal framework, one observes the necessary transversal integration of the so-called social function of enterprises. Business organizations must place people at the center of their operations and, from this human-centered approach, contribute to consolidating the structural elements of human dignity. This includes shareholders, workers, and suppliers, but also all others who live in the organization’s surroundings and, in some way, depend on its activity, including the environmental impact from its operation. Business organizations represent “[...] a complex reality: capital and its assets, the brand, technology, the structure of government [and governance], a ‘machine’ for producing, selling, and profiting, a set of tasks that must be executed [...]. However, in its deepest reality, it is *a community of people* [...]

 [14].

The principle of the Centrality of the Human Person, which teaches that in the face of the “need to weigh up the sacrifice of the human person and questions about the implementation of technological advances, decisions must be made in favor of the human person”. The centrality of the human person within the business sphere points to the company’s social function, which may be supported by three core rationales: (a) the dignity of every human being who, in some way, contributes to the achievement of the organization’s social objectives; (b) what the person gives to the organization, be it the strength of their labor, their knowledge, experience, and other human contributions, some of which are legally defined in employment contracts, while others are not formally documented but form part of the social and moral commitments of individuals connected to the enterprise; and (c) what the person receives, such as remuneration, in the case of employees, or knowledge, skill development, relationships, and other lasting marks (“*huellas*”) that engagement with the organization may imprint upon them [15].

Companies must fulfill their social function, aiming to contribute to a more just society with opportunities for all. What sense would there be in an economy that, by its very nature, generates growing inequality, deepening individualism and the exclusion of thousands of people? The current moment has generated an increase in collective solidarity, and, in general, the need for a more humane, social, and inclusive perspective has been highlighted among leaders, a perspective that cares for others and the most vulnerable.

The social function of companies must entail an anticipation extended toward infinity in the control of their negative impacts on living beings, both human and

non-human, and on the environment, with the aim of protecting both present and future generations. This movement must encompass the prevention of the unforeseeable [16]. Through such a framework, it becomes possible to pursue (provisional) measures aimed at ensuring that current and future generations may enjoy dignified and sustainable living conditions in the years to come. In this context, the notion of protection of trust [17, 18] emerges as a fundamental prerequisite for the structuring and fulfillment of this “global pact” going forward. Such protection is essential in giving concrete expression to the present concern for living beings who do not yet exist, thus embodying the future generations.

The legal protection of individuals who do not yet exist is inherently complex, particularly under current normative frameworks: a right and a duty must be bound to a legal norm and projected onto existing beings. Absent this link, any duty purportedly owed in relation to a supposed right (in favor of future generations) becomes exceedingly difficult to sustain, especially regarding who, in legal terms, would hold such a right and who would legitimately represent it, given the non-existence of the rights holder. This characteristic gives rise to numerous legal challenges in ensuring effective protection for future generations, particularly due to the difficulty of “[...] knowing the particular identities of individuals, existing both in the past or in the present; generally, we are not in a position to refer to specifically identifiable future persons [19].” The lack of concrete and scientific knowledge about the future leads only to a probabilistic understanding of what is yet to come.

The key question, then, becomes: “[...] how can we assess the imposition of various risks of rights violations?” This is precisely the central challenge in fostering both individual and collective awareness regarding the need to protect future generations. This gives rise to legal problems, such as: “[...] the first concerns the normative significance of the immutable fact that individuals in the distant future, as well as deceased persons, do not even have the potential to exercise power over those currently living”. According to Will Theory, in order for one person to hold a right against another, the former must be capable of exercising that right in relation to the conduct of the latter. Thus, the immutable power asymmetry between non-contemporaries excludes the possibility of future non-contemporaneous persons and deceased persons holding rights-based claims against those presently alive.

Consequently, for proponents of the Will Theory, “considerations of justice do not apply to intergenerational relations.” Due to this legal difficulty, it becomes necessary to reinterpret the so-called Interest-Based Theory of Rights, which offers the following alternative: “[...] that being able to exercise one’s rights - to claim or waive the application of a right - is neither sufficient nor necessary for someone to be a right-holder. According to Interest Theory, for a person to truly hold a right, the right, when real, must necessarily safeguard one or more of that person’s interests. [...]” [19]. This theory is grounded on trust placed in the current generations, who must effectively commit themselves and begin to act in ways that make sustained life on Earth viable over the long term.

4. Conclusions

We live in strange, difficult, metamorphic, and challenging times. Although time is not on our side, it is not too late for us, both individually and collectively, to make a conscious decision to change our path. Our descendants deserve nothing less. And to do so, we are forced to rebuild, reformat, and reformulate countless questions in

search of possible new answers. It is in this way, and only in this way, that Gaia will be able to continue to exist. If we are to avoid exceeding the limits of what nature can provide on a sustainable basis, consumption and production patterns will need to be fundamentally restructured.

In this new global scenario, in which new technologies advance rapidly, the greatest challenge for technology law is how to balance the benefits without suffering the harms associated with the human health and environmental risks arising from the use of these technologies. The development of these technologies generates significant ethical, legal, and social impacts, also related to the precautionary principle and information, as well as repercussions on labor relations and the environment. It is impossible to imagine scientific and technological advances, as well as economic ones, based on social regression in terms of health and protection.

Business organizations leading the development of AI systems, which compromise access to potable water for humans and demand vast amounts of electricity, must assume a duty of “due diligence” and commit, at any point in the future, to a “duty of protection,” even in the absence of a subjectively enforceable right established by legal norm. Such a commitment gives rise to what may be termed a “protected interest [20].”

Humans are aware of the importance of nature, the environment for sustaining life. Therefore, all human actions that contribute to the environmental causes of climate change, thus jeopardizing the right to a dignified life for living beings, fall within this category of “protected interest.” Business organizations must adopt appropriate and efficient measures, under the scrutiny of global civil society, to uphold the interests of any person who may 1 day come to live on Planet Earth.

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The world is being reconfigured. Across five interconnected chapters, this book offers a multidisciplinary roadmap to the forces redefining our century: climate breakdown, shifts in geopolitical power, technological acceleration, and their implications for societies, economies, and businesses. Beginning with a panoramic overview of globalization at a crossroads, the book reveals how climate pressures, fractured supply chains, multipolar rivalry, and digital transformation are redrawing the map of international cooperation and competition. It provides an explanation of climate change as an economic force, demonstrating how global warming, extreme weather events, and resource depletion are redefining development pathways, financial systems, and global inequality. Building on this macro perspective, the content dives into the turbulence of geopolitics, revealing how rising nationalism, great-power rivalry, and regional conflicts have created a new, unstable world order. The focus then shifts to the corporate sphere, showing how companies navigate transition risk, geopolitical uncertainty, and environmental, social, and governance pressures, supported by innovative decision-making frameworks. Finally, the book also establishes that in the technological transition, artificial intelligence, resource-intensive computing, and electronic waste are colliding with ecological limits, demanding new regulatory models, ethical principles, and corporate responsibilities. This work is intended for students, managers, policymakers, and specialists and provides an integrated lens that links climate, the economy, geopolitics, business strategy, and technology governance. It enables readers to understand global change and act within it by anticipating its risks and seizing its opportunities. In a time defined by uncertainty and transformation, this book offers the clarity needed to navigate the emerging world.

*Usha Iyer-Raniga,
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