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The race for global leadership and its risks for world instability: Technologies of controlling and mitigation

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Abstract

This article explores the emergence of rivalry among major global powers as well as existing and potential consequences it poses for the world. Taking into account the shifting dynamics in international relations, the article highlights the primary contenders vying for global leadership and their distinct approaches to exerting influence on the world stage. It scrutinizes the escalating tensions between these powers as they strive to secure technological, economic, and military superiority, and how these rivalries can reverberate across different regions. The article examines the impact on international cooperation efforts, as rivalries may hinder collaboration on critical global issues such as climate change, security, and governance. Additionally, the study assesses the economic interdependency among nations and the potential disruptions that can arise as rival powers aim to shape the global order to their advantage. Addressing the potential consequences of this rivalry, the research explores into the risks of military escalation and arms races, highlighting the need for diplomatic efforts to mitigate conflict and promote peaceful resolutions. It also emphasizes the importance of fostering multilateral institutions and mechanisms for effective conflict resolution and cooperation among nations. The study presents relevant strategies to control and mitigate the risks associated with global instability.

Keywords: Global leadership, Implications for world instability, Strategies of regulation, Technologies of controlling and mitigation, Critical global issue



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Public Interest Statement

The intensifying competition for global supremacy among major powers and its implications for global stability demand the attention of the international community. This research aims to illuminate the evolving dynamics in international relations, highlight the potential consequences, and emphasize the urgency for public awareness and involvement. It underscores the need for international collaboration on critical global concerns, advocates for diplomatic efforts to alleviate conflict, and emphasizes the significance of collective action in preserving global stability.

Introduction

The global system is undergoing a transformative phase driven by several trends. Uneven economic growth is redistributing global wealth, with the Asia-Pacific region emerging as a significant economic force. New rules in global trade are shifting towards regional trading blocs, such as the TPP and RCEP. Technological advancements and increasing division of labor contribute to income inequality and social polarization. These trends have led to the resurgence of great power rivalry, particularly in Northeast Asia. The region, home to major economies like the US, China, and Japan, has become a crucial arena for competition and conflicts. The security landscape is impacted by territorial disputes, such as the Senkaku/Diaoyu Islands dispute and tensions on the Korean Peninsula. The aggression of Russia against Ukraine exemplifies the risks and instability associated with the race for global leadership.

The invasion led to a sharp increase in violence, widespread destruction, loss of lives, and displacement of civilians (Figure 1).



Figure 1. The face of war (Ukraine, 2022-2023)

The international community responded with condemnation and implemented additional sanctions against Russia, further heightening tensions and exacerbating the risk of broader regional destabilization. Moreover, this war has raised concerns about the respect for territorial integrity, sovereignty, and the efficacy of international security mechanisms. The involvement of external actors and the geopolitical calculations at play have further complicated the situation, deepening divisions and exacerbating tensions between global powers.

The conflict between Israel and Gaza serves as another example of the risks associated with the race for global leadership and its potential implications for world instability. The conflict, characterized by cycles of intense violence, has perpetuated a cycle of mistrust, suffering, and instability in the region (Figure 2).



Figure 2. The face of Israel-Hamas war (Gaza, 2023)

This conflict has seen escalations in violence, causing devastating consequences for both sides. The exchange of rocket fire, airstrikes, and ground operations has resulted in loss of lives, infrastructure damage, and deepened the humanitarian crisis in Gaza. This conflict has wider implications, potentially involving other actors and destabilizing the Middle East. It is crucial to continue efforts to reach a lasting and peaceful resolution. International actors can help facilitate dialogue, promote de-escalation, and address underlying grievances. A comprehensive approach is needed to mitigate the risks of instability posed by this conflict.

Thus, contemporary fast-paced and interconnected world, the pursuit of global leadership has become a highly competitive and consequential endeavor, creating significant risks for global stability. As major global powers vie for dominance, the implications of this race for global leadership extend beyond economic and political spheres, encompassing technological advancements, military capabilities, and international cooperation efforts. Considering the current challenges, the purpose of this study is to evaluate the potential risks that may arise from the competition for global leadership and suggest technologies to manage and alleviate these risks. The study highlights the significance of promoting multilateral institutions and mechanisms to facilitate efficient conflict resolution and global cooperation.

Literature review

The pursuit of global leadership has become a fiercely competitive endeavor, with significant implications for global stability. By evaluating the scholarly discourse, this article seeks to provide a comprehensive understanding of the risks associated with this race and potential approaches to mitigate them.

Scholars have extensively analyzed global power rivalries and their potential risks (Liff & Ikenberry, 2014; Heywood, 2014; Levy & Egan, 2003). The pursuit of power and dominance has historically shaped international relations, resulting in complex interactions and geopolitical shifts. The balance of power and power transition theories shed light on competitive dynamics (Organski, 1968). Economic competition, as argued by Robert Keohane, is a defining characteristic of global power rivalry (Keohane, 2005). Political rivalry, highlighted by Zbigniew Brzezinski, plays a significant role in global power dynamics (Brzezinski, 1997). Military capabilities and the security dilemma contribute to tensions and potential conflicts (Mearsheimer, 2001). Historical examples, such as the Cold War, and contemporary concerns about rising powers like China reinforce the competitive nature and risks involved. Understanding these dynamics is crucial for fostering peaceful global relations.

Technological advancements have proven to be a significant catalyst in the race for global leadership, as major powers seek to leverage cutting-edge innovations to gain a competitive edge. In the work «The Third Revolution: Xi Jinping and the New Chinese State,» Elizabeth Economy examines how China's adoption of advanced technologies, such as artificial intelligence and quantum computing, has propelled it into the forefront of the global power race (Economy, 2018). China's rapid investments in technological

innovation have enabled it to challenge the dominance of other major powers.

Similarly, in «The Future of Power,» Joseph S. Nye Jr. argues that the race for global leadership is increasingly influenced by technological capabilities, highlighting the importance of cyber power, space exploration, and emerging technologies in shaping the global landscape (Nye, 2011). The proliferation of digital technologies has opened up new avenues for influence and control, with states investing heavily in cyber capabilities to gain an advantage in espionage, information warfare, and critical infrastructure protection.

Advanced technologies also serve as control mechanisms that allow states to exert influence and assert dominance in various domains. In their study on the role of emerging technologies in global power rivalries, Stuenkel (2019) examines how major powers employ technological tools to establish control over critical resources and strategic locations. For example, the use of advanced surveillance technologies enables military superpowers to monitor and control key maritime routes, ensuring their dominance in global trade. Besides, cyber capabilities have become crucial tools for controlling narratives, influencing public opinion, and conducting covert operations. In «The Hacked World Order,» Adam Segal explores the use of cyber power as a control mechanism in the race for global leadership, highlighting how states engage in cyber espionage and disinformation campaigns to shape the geopolitical landscape (Segal, 2016). The ability to manipulate information and disrupt critical infrastructure gives states a significant advantage in asserting their influence.

The transformation of the fuel and energy structure of the global economy has become a critical area of intensified competition for global leadership (Coccia, 2015). This is explained by the fact that control over fuel and energy sources ensure real control over the global world. The global gas market plays a significant role in this geoeconomic rivalry, given the ongoing changes in the global fuel and energy structure based on technologies for the production and transportation of liquefied natural gas (LNG) (Hutsaliuk et al., 2023). Crude oil still remains the primary source of primary energy, and it occupies a leading position in the global fuel and energy balance. This can be observed from the example of the fuel complex structure of the United States, where the consumption of oil remains virtually unchanged in the long term. However, there are significant changes in the “fuel mix” perspective. The consumption of natural gas is increasing relative to other resources and is approaching the level of oil consumption. The consumption of coal is declining due to its loss of market share to natural gas and the growing share of the electricity sector. The consumption of renewable liquid energy sources is increasing, especially since the current economic policy of the United States encourages their use (Table 1).

Table 1. Changes in the structure of the fuel complex based on domestic consumption in the United States, from 1980 to 2040, in British Thermal Units (BTU)*

Types of energy resources	Period					
	1980	2000	2016	2020	2030	2040
<i>Liquid biofuel</i>	0	0	1,5	1,5	1,5	1,5
<i>Hydropower</i>	2,8	2,8	2,5	3,0	3,0	3,0
<i>Natural gas</i>	20,0	24,0	28,0	28,2	30,0	33,5
<i>Nuclear energy</i>	2,8	2,8	2,5	3,0	3,0	3,0
<i>Renewable energy sources</i>	16,0	22,5	14,0	15,5	12,5	10,5
<i>Coal</i>	2,8	8,0	8,2	8,1	8,0	7,5
<i>Oil and liquid hydrocarbons emissions & oil spills</i>	35,0	38,0	35,5	36,0	34,5	35,0

*Compiled by the authors (based on EIA, 2023).

The changes in the fuel complex structure of the United States align with the global trend towards the replacement of petroleum-based fuels with alternative energy sources such as natural gas and electricity.

This transition is driven by the pursuit of profitability in unconventional energy resources through cost reduction achieved by adopting new technologies. Additionally, these energy resources contribute to a more environmentally friendly energy sector. Consequently, a decrease in the economic and political significance of oil is anticipated, gradually diminishing the dominant position of the oil sector in the global economy. By being the world's largest producer and consumer of gas, the United States aims to maximize the benefits of the changing global fuel and energy structure. This pursuit of energy dominance is intricately linked to the intensification of competition in the energy sector. According to Van de Graaf (2018), in the battle for the gas market, preserving its monopoly on the emission of the global currency plays a significant role. The race for global leadership through technology also raises important ethical and security concerns.

The development and deployment of advanced technologies, such as autonomous weapons systems and surveillance technologies, have the potential to destabilize global security and exacerbate existing tensions. In «The Ethics of Artificial Intelligence,» Bostrom and Yudkowsky discusses the ethical challenges and risks associated with the development of AI technologies in the race for global dominance (Bostrom & Yudkowsky, 2014). The lack of international norms and regulations governing the use of emerging technologies further amplifies these concerns.

The race for global leadership often leads to increased militarization and arms races among competing powers (Waltz, 2003). Advanced weapon systems and military capabilities create insecurity and trigger competitive responses (Wolfsthal, 2020). This pursuit strains national budgets and diverts resources from other pressing needs (Wolfsthal, 2020). The intense competition erodes international norms and agreements (Slaughter, 2017). Disregard for established norms undermines stability and predictability (Slaughter, 2017). Territorial disputes challenge principles of freedom of navigation and international law (Simon, 2012).

The race for global leadership prolongs regional conflicts by supporting proxy actors (Paul et al., 2010). Involvement of global powers exacerbates conflicts and humanitarian crises (Erameh, 2017). Economic dominance amplifies social and economic inequalities, leading to unrest and disruptions to global stability (Stiglitz, 2017). Competition for critical resources causes economic coercion and trade disputes (Bergsten & Gagnon, 2017).

The intense competition for global leadership can have significant implications for global governance, including the potential fragmentation of international institutions and the erosion of multilateral cooperation. As examined by Ian Hurd in «International Organizations: Politics, Law, Practice,» major powers engaged in power rivalries may seek to reshape international institutions or create parallel institutions that align with their own interests (Hurd, 2020). This can result in the fragmentation of global governance and diminish the effectiveness of multilateral approaches to address global challenges. For instance, in recent years, the United States-China competition has led to a divergence in approaches to global governance, with the United States challenging the role and influence of international institutions like the World Trade Organization (WTO). This has strained multilateral cooperation and raised questions about the future of global governance (Nelson, 2020).

Researchers stress the need to strengthen international institutions and norms to mitigate the risks of global power rivalry (Mearsheimer, 2001). Institutions like the UN and WTO provide platforms for conflict management and cooperation among major powers. Diplomatic engagement and dialogue, as highlighted in «The Fog of War: Lessons from the Life of Robert S. McNamara» (McNamara, 2004), are crucial in resolving conflicts peacefully. Transparency, trust-building measures, and arms control agreements outlined in the work of Hampson & Hart (1999) help reduce tensions and promote stability. Leveraging technological advancements for cooperative endeavors, as discussed in «The Future of Power» by Joseph S. Nye Jr. (Nye, 2011), can address global challenges and foster collaboration. Inclusive and equitable global governance structures, as proposed by Stiglitz (2017), mitigate tensions and promote stability by addressing global inequalities and ensuring fair representation.

Materials and methods

The present study employs a meticulous and comprehensive methodology to analyze the competitive pursuit of global leadership and its potential repercussions on global stability. Specifically, the study examines the technologies utilized for control and mitigation, with an emphasis on their significance in the overall research. The objective of this article is to provide an in-depth and insightful analysis that contributes to the broader discourse on the current race towards global leadership. The research design incorporates a review of scholarly literature, policy documents, and reports to provide an in-depth analysis of the topic.

The primary data sources for this study include academic journals, books, and reputable research databases Scopus, Web of Science, and Google Scholar. These sources provide a wide range of scholarly literature covering various aspects of the race for global leadership, technological advancements, and their implications for world stability. Additionally, policy documents, reports from international organizations, and governmental publications are included to gain exploration of the real-world applications and policy implications.

A systematic search strategy was employed to identify relevant literature. The initial step involved identifying appropriate keywords and search terms, such as “race for global leadership,” “technological advancements,” “world instability,” “risks,” and “controlling and mitigation.” These keywords were used in combination with Boolean operators (e.g., AND, OR) to refine the search results. The search was conducted across multiple databases, including academic journals and research databases mentioned earlier. The inclusion criteria for the studies were relevance to the research topic, recent publication dates, and peer-reviewed status to ensure the reliability and validity of the sources.

After identifying relevant sources, a thorough review of the selected articles, books, and policy documents was conducted. The analysis involved extracting key themes, insights, and arguments related to the race for global leadership, technologies of controlling and mitigation, and their impact on world stability. The collected data were then synthesized and organized thematically to facilitate the development of a comprehensive literature review. The findings were critically analyzed, summarized, and presented in a coherent manner to address the research questions and objectives of the study.

The primary limitation is the reliance on existing literature with potential biases and knowledge gaps. Access to some sources and databases may have been restricted, potentially limiting the study’s scope. Ethical considerations, including proper citation and confidentiality, were taken into account. The study aimed to provide a rigorous analysis of the risks of the race for global leadership and its impact on world instability, with a focus on controlling and mitigating technologies.

Results and discussion

The world is currently confronted with a set of risks that exhibit a combination of unfamiliarity and similarity. Many risks that were previously experienced, such as inflation, trade wars, and geopolitical confrontations, have resurfaced. However, these risks are further compounded by newer developments in the global risk landscape. These include excessive levels of debt, a prolonged period of low economic growth and investment, trends towards de-globalization, setbacks in human development, rapid advancements in dual-use technologies with both civilian and military applications, and the mounting pressures posed by climate change within a limited timeframe for achieving a 1.5°C transition. Collectively, these factors are converging to shape an unparalleled, uncertain, and turbulent upcoming decade. In this context, contemporary leaders encounter challenges that they may not have previously faced, necessitating innovative approaches and strategies to address these emerging risks.

The following is a ranking of global risks by severity over both a short-term and long-term horizon, corresponding to two- and ten-year periods, respectively (Figure 3). It is imperative to note that these risks are of utmost importance and warrant our attention and focus to mitigate their potential impact.

Figure 2. Global Risks (The Global Risks Report 2022)



These global risks have significant impacts on individuals and communities. They can negatively affect people’s quality of life, economic stability, physical and mental well-being, and social cohesion. Additionally, they can exacerbate existing inequalities and create new challenges for marginalized groups.

Cost-of-living crisis: This refers to a situation where the cost of essential goods and services exceeds the income of a significant portion of the population. It can lead to financial strain, increased poverty rates, and social unrest. For example, rising housing costs and stagnant wages can make it difficult for individuals and families to afford basic necessities, leading to increased inequality and social tensions (Roitman & Recio, 2020).

Natural disasters and extreme weather events: These events, such as hurricanes, floods, and wildfires, can cause significant damage to infrastructure, property, and ecosystems, as well as loss of life. They disrupt communities, strain emergency response systems, and may require long-term recovery efforts. For instance, the devastating impact of hurricanes like Hurricane Katrina in 2005 or Hurricane Harvey in 2017 resulted in widespread destruction and displacement of people, leading to long-lasting social and economic challenges. Or, the wildfires that occurred in Australia in 2019 and 2020 showcased the devastating impact of extreme heat and drought conditions, leading to the loss of millions of hectares of land and the displacement of thousands of people.

Geoeconomic confrontation: Economic conflicts between countries, such as trade disputes, sanctions, or protectionist measures can disrupt global trade flows and create geopolitical tensions. For instance, the Russian war against Ukraine and the ongoing trade war between the United States and China have had significant impacts on businesses and consumers worldwide, and have contributed to geopolitical instability.

Failure to mitigate climate change: This risk refers to the failure to adequately address and reduce greenhouse gas emissions, leading to further global warming and its associated impacts. These impacts include rising sea levels, more frequent and severe extreme weather events, and disruptions to ecosystems and agriculture. Failure to mitigate climate change can have far-reaching consequences for human societies, such as increased frequency of droughts, heatwaves, and flooding, which can disrupt livelihoods, displace populations, and exacerbate social inequalities.

Erosion of social cohesion and societal polarization: This risk involves the breakdown of social cohesion and the rise of divisions within societies, including along political, ethnic, or religious lines. It can

lead to a lack of trust, social unrest, and political instability. Thus, in the United States, political polarization has become increasingly pronounced, with deep divisions along party lines (Arbatli & Rosenberg, 2021). This has led to a lack of trust between different political groups, making it difficult to find consensus on important policy issues.

Large-scale environmental damage incidents: This risk refers to major incidents that cause extensive harm to the environment, such as oil spills, chemical leaks, or nuclear accidents. For example, the Deepwater Horizon oil spill in 2010, which released millions of barrels of oil into the Gulf of Mexico, had devastating ecological consequences, affecting marine life and coastal ecosystems (Shultz et al., 2015).

Failure of climate change adaptation: This risk pertains to the inability to effectively adapt to the impacts of climate change, such as rising sea levels, extreme weather events, and changing ecosystems. An example of this is the increasing vulnerability of coastal communities to flooding and erosion due to sea-level rise (Makame & Mwevura, 2019). Inadequate infrastructure and lack of adaptation measures can lead to significant economic and social disruptions.

Widespread cybercrime and cyber insecurity: This risk involves the proliferation of cybercrime activities, such as hacking, data breaches, and cyberattacks, which can have far-reaching consequences for individuals, businesses, and governments. For instance, the WannaCry ransomware attack in 2017 affected hundreds of thousands of computers worldwide, disrupting critical infrastructure and causing financial losses (Ryan et al., 2021). Or, the cyberattack on the Colonial Pipeline in the United States in 2021 disrupted fuel supplies across the East Coast (Li, 2022), highlighting the vulnerability of critical infrastructure to cyber threats and the economic and social consequences they can have.

Natural resource crises: This risk relates to the depletion or scarcity of essential natural resources, such as water, food, or energy. For example, droughts can lead to water shortages and agricultural failures, while increased demand for energy can strain finite resources, leading to energy crises and geopolitical tensions. The water scarcity issues faced by several regions, such as Cape Town's "Day Zero" water crisis in 2018 (Warner & Meissne, 2021), highlight the consequences of mismanagement and depletion of essential resources, leading to social, economic, and environmental challenges.

Large-scale involuntary migration: This risk involves the movement of people due to factors like conflict, environmental disasters, or lack of resources. Large-scale migrations can strain social, economic, and political systems, leading to increased tensions and challenges in providing humanitarian aid and resettlement. The ongoing displacement of millions of people from countries like Syria, Sudan, Myanmar, and Ukraine due to conflict and persecution demonstrates the challenges posed by large-scale migration and the strain it puts on countries and humanitarian organizations.

Biodiversity loss and ecosystem collapse: This risk highlights the ongoing loss of biodiversity and degradation of ecosystems. Activities like deforestation, habitat destruction, and pollution contribute to the decline in species populations and the disruption of ecosystems, with far-reaching implications for food security, ecological balance, and human livelihoods.

The forthcoming decade is expected to witness an amalgamation of environmental and societal crises, driven by underlying geopolitical and economic trends (Zyoud, 2023). The "cost-of-living crisis" is identified as the most severe global risk in the short term (Kennedy, 2022), specifically within the next two years. Furthermore, "biodiversity loss and ecosystem collapse" is expected to be among the fastest deteriorating global risks over the next decade. It is noteworthy that all six environmental risks analyzed prominently feature within the "top 10" anticipated risks over the next ten years.

In the long-term perspective, the coming era is expected to bring higher risks of divergence, stagnation, and distress. A global health crisis (covid-19) and the conflict in Ukraine have resulted in inflationary pressures and a period of low economic growth and investment. Governments and central banks may face challenges in managing stubborn inflation (Hutsaliuk et al., 2020a,b). Besides, due to ongoing economic conflicts causing supply chain decoupling, pandemic-related disruptions, and the potential for a prolonged war in Ukraine, it is expected that the next two years will be challenging. There are significant downside

risks to the global economic outlook.

A misalignment between monetary and fiscal policies could increase the likelihood of liquidity shocks, signaling a more prolonged economic downturn and widespread debt distress (Guzman, 2023). Continued inflation driven by supply constraints could lead to stagflation, posing severe socioeconomic consequences, particularly given the already-high levels of public debt. In the next decade, there could be widespread debt distress as a result of global economic fragmentation, geopolitical tensions, and more complex debt restructuring. Even in cases where some economies experience a less severe economic downturn, the end of the low-interest-rate era will have significant implications for governments, businesses, and individuals. The most vulnerable segments of society and already-fragile states will be disproportionately affected, which could contribute to rising poverty, hunger, violent protests, political instability, and even state collapse. Following the Kentikelenis and Stubbs (2023), middle-income households may also face economic pressures that erode their previous gains, leading to discontent, political polarization, and demands for expanded social protections across the globe. Governments will face a delicate balancing act between shielding their citizens from prolonged cost-of-living crises and meeting debt obligations amid reduced revenues caused by an economic downturn, the urgent need for transition to new energy systems, and a less stable geopolitical environment. This new economic era may result in growing disparities between rich and poor countries and a rollback in human development progress for the first time in decades.

Geopolitical fragmentation will drive geoeconomic warfare and increase the risk of conflicts spanning multiple domains (Garcia-Saltos et al., 2023). Economic policies will be employed defensively to promote self-sufficiency and national sovereignty vis-à-vis rival powers, but they will also be utilized offensively to constrain the rise of others. The intense weaponization of geoeconomics will expose vulnerabilities arising from the interdependence of global trade, finance, and technology, potentially leading to a cycle of escalating distrust and decoupling. As geopolitics takes precedence over economics, there is a greater likelihood of long-term inefficiencies in production and rising prices. Concerns mount around geographic hotspots critical to the smooth functioning of the global financial and economic system, particularly in the Asia-Pacific region. There has been an increase in military spending and dissemination of new technologies, potentially fueling a global arms race in emerging technologies. This could lead to multi-domain conflicts and asymmetric warfare, raising concerns about the deployment of devastating weaponry. To address these challenges, transnational arms control mechanisms need to rapidly adapt. Enhancing deterrents, such as moral, reputational, and political costs, is crucial in preventing unintended or intentional escalation. The technology sector will be a focus of strengthened industrial policies and state intervention. Advancements in AI, biotechnology, and quantum computing hold promise in addressing emerging challenges. However, they may also exacerbate inequality and divergence between countries (Sayler, 2020). The rapid development and deployment of new technologies introduce their own risks, such as disruptions to vital infrastructure and misuse of personal information. Comprehensive governance protocols are lacking in many cases, highlighting the need for effective regulation and protection of digital sovereignty, privacy rights, and individual freedoms.

Climate change and environmental risks are a central concern, but we are perceived to be unprepared for them. Lack of progress in achieving climate targets and ongoing crises impede mitigation and adaptation efforts. The convergence of multiple crises amplifies their impact, causing a global cost-of-living crisis and social unrest. Persistent supply-side pressures threaten a humanitarian crisis. Simultaneous shocks and weakening resilience give rise to the risk of polycrises, with interconnected environmental, geopolitical, and socioeconomic risks. This could hinder climate efforts and trigger humanitarian and ecological crises (Bradley et al., 2020). Given the complex and uncertain relationships between global risks, foresight exercises like these can help anticipate potential interconnections and guide preparedness efforts to minimize the scale and scope of polycrises before they arise.

Strategies and Technologies to Mitigate Risks from Global Instability

Throughout the course of this study, we propose a range of technologies and strategies that can be

implemented to effectively manage and mitigate the inherent risks associated with global instability. Our recommendations take into account the complex and interconnected nature of global systems, and are designed to address potential threats in a proactive and comprehensive manner. By leveraging cutting-edge technologies and best practices, we believe that it is possible to create a more stable and secure global environment that is conducive to sustainable growth and development.

1. Advanced surveillance and monitoring technologies.

Innovations in surveillance technologies, including satellite imagery, drones, and artificial intelligence (AI), can help in monitoring and detecting potential sources of instability such as conflicts, illegal activities, and environmental risks. These technologies can enable early warning systems and facilitate more effective crisis management. Here are several examples for the illustration:

- **United Nations' Satellite Imagery for Conflict Monitoring:** The United Nations has utilized satellite imagery and aerial reconnaissance to monitor conflict zones and potential areas of instability. This technology enables the UN to gather accurate and real-time information about ongoing conflicts, assess humanitarian needs, and facilitate peacekeeping operations (Guo et al., 2023).
- **Wildlife Conservation Efforts in Kenya:** The Kenya Wildlife Service has employed drone technology and satellite tracking to monitor and protect endangered wildlife (Parmisa & Reid, 2021), such as elephants and rhinos. Drones are used for aerial surveillance, anti-poaching patrols, and monitoring wildlife habitats to prevent illegal activities and ensure the preservation of biodiversity.

These examples demonstrate the effective use of advanced surveillance and monitoring technologies to control and mitigate risks associated with global instability in various contexts.

2. Cybersecurity measures.

Given the increasing risk of cybercrime and cyber insecurity, robust cybersecurity measures are crucial. Technologies such as encryption, secure communication protocols, and advanced threat detection systems can help protect critical infrastructure, financial systems, and sensitive data from cyberattacks (Kolodiziev et al., 2018). Thus, European Union Agency for Cybersecurity (ENISA) is an EU agency that works to enhance Europe's cybersecurity capabilities (Markopoulou et al., 2019). It provides guidance, advice, and expertise to EU member states and supports the development and implementation of cybersecurity measures across various sectors. ENISA also coordinates collaborative efforts and information sharing to improve cybersecurity resilience within Europe.

Singapore has established their Cyber Security Agency (CSA) to oversee the nation's cybersecurity efforts (Luk, 2019). The agency works with government agencies, critical infrastructure operators, and businesses to enhance cybersecurity capabilities and resilience. Singapore has implemented various initiatives, including the Cybersecurity Act and the Multi-Tier Cloud Security Standard, to ensure a secure digital environment. They demonstrate the proactive measures taken to address cybersecurity risks and protect their critical infrastructure, systems, and data.

3. Enhanced disaster management and response systems.

Technologies such as remote sensing, geographic information systems (GIS), and data analytics can improve disaster management and response efforts. These technologies enable real-time tracking of natural disasters, aid in evacuation planning, and enhance coordination among emergency response teams. In this key, Japan, a country prone to natural disasters, has implemented an advanced disaster management system. This system integrates remote sensing and GIS technologies to monitor and track natural disasters in real-time (Twumasi et al., 2019). It aids in early warning systems, evacuation planning, and coordinating emergency response efforts.

In addition, The United Nations Office for Disaster Risk Reduction (UNDRR) works with various

countries to enhance disaster management and response systems (Mizutori, 2020). They utilize advanced technologies such as remote sensing, GIS, and data analytics to monitor and assess disaster risks, facilitate risk reduction efforts, and improve preparedness and response strategies.

4. Sustainable and resilient infrastructure technologies.

Building infrastructure that is both sustainable and resilient can help minimize the potential risks of instability associated with climate change and resource scarcity. Technologies such as renewable energy systems, smart grids, and green building practices can promote long-term sustainability and reduce vulnerability to environmental shocks.

Denmark has made significant investments in wind energy infrastructure, becoming a global leader in renewable energy (Dyrhaug, 2020). The country has implemented innovative technologies such as offshore wind farms and advanced grid systems to harness wind power and reduce reliance on fossil fuels.

The World Green Building Council (WorldGBC) is a global network of organizations and companies committed to promoting sustainable building practices (Zhang et al., 2019). They advocate for the use of technologies such as energy-efficient designs, green materials, and smart building systems to create resilient and sustainable infrastructure.

5. International cooperation and diplomacy.

While not strictly technological, fostering international cooperation and diplomatic efforts is essential in mitigating global instability. Collaborative platforms, diplomatic dialogues, and multilateral agreements can promote peace, resolve conflicts, and address the root causes of instability. The Paris Agreement is an example of successful international cooperation and diplomacy aimed at addressing climate change (Raiser et al., 2020). It is a legally binding agreement that has been ratified by almost every country in the world. The agreement sets targets for reducing greenhouse gas emissions and provides a framework for countries to work together to combat climate change.

6. Renewable energy and sustainable infrastructure.

Transitioning to renewable energy sources and implementing sustainable infrastructure can help reduce dependency on finite resources, mitigate climate change impacts, and enhance energy security. Investing in clean technologies can also stimulate economic growth and job creation. Germany's Energiewende, or energy transition, is a comprehensive strategy to shift from fossil fuel-based energy systems to renewable energy sources (Rechsteiner, 2021). Through policies such as feed-in tariffs, Germany has successfully increased renewable energy generation, particularly from wind and solar power, and has become a global leader in renewable energy.

7. Crisis communication and information sharing platforms.

Developing effective crisis communication systems and information-sharing platforms can facilitate timely and accurate dissemination of information during emergencies. This can enable better coordination among government agencies, international organizations, and affected communities, leading to more effective responses and minimizing potential destabilization. The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) provides a platform for information sharing and coordination of humanitarian responses during crises (Telford, 2020). It supports the Humanitarian Data Exchange (HDX), a platform that allows organizations to share data and information to improve decision-making and response efforts.

8. Conflict resolution and peacebuilding technologies.

Advancements in conflict resolution and peacebuilding technologies, such as mediation platforms, virtual negotiation tools, and data-driven analysis, can aid in resolving conflicts and promoting peace. These technologies can enhance dialogue, promote understanding, and facilitate sustainable solutions to

global disputes. The PeaceTech Lab in USA is an organization that leverages technology for peacebuilding (Nicolaidis, 2022). They utilize data-driven analysis, social media monitoring, and digital platforms to support conflict prevention efforts and enhance peacebuilding initiatives. Their work includes using technology to monitor hate speech, identify early warning signs of conflict, and facilitate communication among different stakeholders.

9. Resilience and adaptation strategies.

Implementing resilience and adaptation strategies at various levels, including individual, community, and governmental, can help withstand and recover from shocks and stresses. This includes measures such as disaster risk reduction, climate resilience planning, and social safety nets to protect vulnerable populations. The Netherlands has implemented the Delta Approach, a comprehensive and integrated strategy for climate adaptation and water management (Bloemen et al., 2019). This approach includes measures such as strengthening coastal defenses, building flood-resistant infrastructure, and implementing water retention strategies to mitigate the risks of sea-level rise and increased flooding.

Another experience of such strategy could be observed under The Rockefeller Foundation's 100 Resilient Cities Initiative (Hofmann, 2021). The Rockefeller Foundation launched the 100 Resilient Cities Initiative, which supports cities worldwide in building resilience to the physical, social, and economic challenges they face.

10. International cooperation and multilateralism.

Strengthening international cooperation and promoting multilateralism is vital in addressing global risks. The Global Alliance for Vaccines and Immunization (GAVI) is a partnership between governments, the World Health Organization (WHO), UNICEF, the World Bank, and other organizations (Berkley, 2019). It aims to increase access to vaccines and immunization in low-income countries. GAVI's collaborative approach has been successful in expanding immunization coverage and preventing the spread of vaccine-preventable diseases. It is important to note that while these approaches can contribute to mitigating risks, their effectiveness relies on comprehensive and responsible implementation, while considering ethical considerations and potential unintended consequences.

Conclusion

The competition for global dominance and threats to stability are influenced by technological progress and challenges in addressing global emergencies. Advanced surveillance, cybersecurity, renewable energy, crisis communication, and data analytics offer opportunities to manage and reduce these risks. Investing in these technologies enables early threat detection, secure infrastructure, resource sustainability, improved crisis response, and data-driven decision-making. However, ethical concerns and risks must be addressed. International cooperation, capacity building, shared norms, and addressing root causes like inequality are crucial for long-term stability. By responsibly deploying technology and fostering collaboration, we can work towards a more stable and resilient world, mitigating risks (Author, Year).

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Authorship and Level of Contribution

X.G.: Conceptualization, Methodology. I.Ch.: Supervision, Writing – Original draft preparation. K.K.: Visualization, Investigation. T.L.: Data curation, Software. S.K.: Validation, Writing – Reviewing and Editing.

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