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6 The Geopolitics of Quantum Sensors, Security, and the Mitigation of Climate Change in the Arctic and High North

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1. Introduction

The polar regions have long been the poster child for climate change and, increasingly, for the geopolitics of emerging technologies. Emerging technologies, climate change mitigation and related research, and the political landscape cannot be disentangled (Acquaviva et al., 2024). Decades of greenhouse gas emissions have resulted in a rise in temperature and sea levels with cascading effects on communities and ecosystems in the Arctic (Intergovernmental Panel on Climate Change, 2022). But in addition to its many ongoing and negative effects, climate change in the Arctic is increasingly associated with opportunities presented by a profoundly changed environment. For instance, receding sea ice opens waterways to increased shipping activities and tourism; melting glaciers and snow may serve as potential resources for hydropower (Wang, 2024, pp. 3–7). Many of these opportunities come with environmental, social, economic, and security challenges. Taken together, these challenges impact geopolitics and governance.

The study of the impacts of climate change in the Arctic has become an important aspect of geopolitics. Many states, such as China and Russia, have a special interest in the effects of climate change in the region (Vincent, 2020). Expanded energy markets, mining activities, and trade routes are seen as opportunities, but they also pose security challenges and have implications for states and bodies such as the North Atlantic Treaty Organization (NATO) that seek to enhance cooperation (Liu, 2018; Biedermann, 2022). Recent interventions related to Arctic geopolitics in the context of climate change have pointed to the role of emerging technologies in facilitating both security cooperation and geopolitical competition.

Several studies have suggested that notions of security as applied to the Arctic are changing (Hossain et al., 2017; Greaves, 2019; Johnson, 2021, 2024). Hossain et al. (2017) and Greaves (2019) show that geopolitical factors and climate change shape the conditions of security, resulting in the fragmentation of the Arctic into zones of security. Greaves (2019) identifies the influence of non-Arctic states and their cooperation with Arctic states as a factor in growing geopolitical competition, especially in terms of resource

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extraction and military activities in the region. Johnson (2021) argues that states focus on directed investments in certain technologies to further security and governance goals in the region. The investment, development, and application of sensor technologies are used to expand the capacity of a state to defend its sovereignty and exert power in the world (Johnson, 2024). Thus, ideas about the security of the Arctic have changed how the region and its resources and people are governed. Relatedly, ideas about the use of technology shape – and are shaped – by security objectives.

In the international relations literature, technology is seen as a tool for (mainly) state actors to express their power in the global arena to gain or maintain a military advantage in the world and on the battlefield. Technology is frequently framed as a driver of strategic competition between states. A consequence of this framing is technology hype and the over-inflation of threats, risks, and vulnerabilities. According to Smith (2020), the "trap of hype" is where the capabilities and impacts of emerging technologies are overblown. Technology hype can feed into national security framings and further position technology as a security objective (Smith, 2020; Rossiter, 2023). However, a focus on certain capabilities over others can result in excess in certain areas at the risk of cost inefficiencies that can hinder the development of military forces (Peets, 2024). In the expression of power, ideas about technologies and their capabilities and uses play a key role in achieving geostrategic and security objectives.

Due to the effects of climate change, achieving geostrategic and security objectives becomes even more critical in the Arctic. Narratives in national policy and strategy documents related to security, risks, and threats continue to make the connection between technology, governance, and geopolitics in the Arctic. Johnson (2024) offers a critique of the continued framing of the Arctic as a space of risk and vulnerability. Johnson shows that in discourse, the Canadian Arctic is framed as being threatened by climate change–enabled geopolitical competition and technology diffusion. Central to this frame are sensor technologies and their role in Arctic security. This chapter expands the focus on how sensor technologies and Arctic security are constructed by states (Johnson, 2021, 2024) to focus specifically on quantum sensors and the linkages between security objectives and state cooperation on climate change mitigation. This chapter's novel approach is to investigate a strategic assumption made by cooperating state allies: that quantum technologies, specifically sensors, can confer a competitive advantage while also mitigating the negative impacts of climate change in the Arctic.

The focus on state cooperation in managing the threats and opportunities posed by quantum technologies has become an important part of the study of global technology governance (Csenkey & Bindel, 2023). States have begun to position quantum technologies as a strategic asset and to leverage industry by providing funding and other supports to further enhance national innovation ecosystems (Kania, 2021; Anonymous, n.d.a, n.d.b). The development of quantum technologies by states is also frequently envisioned as an ethical pursuit that can result in both security-related and economic benefits (Murphy, 2024). A focus on allied state cooperation through NATO on quantum technology security is an understudied, yet important area of investigation that can shed light on the progress of global technology governance.

As states around the world release their own national quantum strategies, the recent *NATO Quantum Strategy* marks the first time an allied security organization has adopted a formal collective strategy for managing the threats and opportunities posed by quantum technology. The strategy aims to foster the development and guide the use of quantum technologies for the security of the Alliance (NATO, 2024). Considering that the Arctic and the High North continue to be viewed as a "critical frontline" and a "pivotal area for global interests encompassing geopolitics, climate conservation, resource accessibility, and security concerns" (NATO, 2023c, 2023a), it is of interest to examine how ideas about climate change, security, and technology intersect to produce ideas about Arctic geopolitics and governance.

This leads to the following research questions:

1. How are the main strategies for abating climate change reflected in NATO's and NATO allies' policies and strategies for quantum (sensing) technologies?
2. How is the link between climate change abatement and security in the Arctic and High North described in the policies and strategies for quantum (sensing) technologies, if at all?

These two research questions are explored and addressed in the sections that follow. Section 2 presents the basics of quantum sensors and sensing applications to provide context for this study. In Section 3, the methods used to address the two research questions are presented and the limitations of this study are discussed. In Section 4, the results of the content analysis of national policy and strategies are presented in a discussion to address the two research questions. Section 5 is devoted to the conclusion.

2. The Basics of Quantum Sensors and Sensing Applications

The past decade has seen rapid advances in quantum technology research and development. Simply, quantum technologies use quantum behavior to increase the speed and efficiency of classical computing and existing technologies. Quantum technologies work in different ways than current technologies by using properties like entanglement and quantum superposition. This can potentially enable quantum technologies to carry out tasks that current technologies cannot accomplish. One area emerging from the research on quantum technologies is a focus on practical application. This focus includes an emphasis on addressing global challenges such as climate change by, for example, reducing carbon dioxide (CO_2) emissions and facilitating the development of renewable energies (Crawford et al., 2021; Ajagekar & You, 2022;

Hatano et al., 2022; Cortez, 2023; Ferdaus et al., 2024; Ho et al., 2024). For example, Hatano et al. (2022) show that quantum sensor technologies have the potential to reduce CO_2 emissions in the transportation field when used to monitor electric vehicle batteries. Ho et al. (2024) argue that quantum machine learning could be used to model complex patterns related to climate resilience problems (caused by floods, severe storms, wildfires, and other meteorological and environmental factors) at a lower computation cost compared with conventional optimization technologies.

In addition to their potential application in climate change mitigation and adaptation strategies, quantum technologies can also be used to advance military capabilities and capacities. Krelina (2021) notes that military applications of quantum technologies have the potential to enhance the power and efficiency of current and future military technologies. Specifically, quantum technologies are touted as having the ability to enhance measurement, sensing, precision, and computation capabilities (Krelina, 2021, p. 2). In reference to the threat posed by cryptographic algorithms that are vulnerable to quantum attacks, Bindel et al. (2024) argue that malevolent actors could use the capabilities of quantum computers to disrupt the security of critical infrastructure and expose confidential data that could put governments and companies at risk (pp. 39–40). For Hoofnagle and Garfinkel (2022), the high-precision capabilities of quantum sensor technologies offer a double-edged sword of enhanced surveillance: from enhancing the ability to track and locate an adversary's nuclear forces to increasing the efficiency of minesweeping activities (p. 61).

Quantum computers are often positioned at the forefront of quantum technology development, and expectation is placed on their capability to impact all facets of society. However, significant strides have been made in other technology areas, especially quantum sensors, as part of the "second quantum revolution" (Intonti et al., 2024; Krelina, 2021; Hoofnagle & Garfinkel, 2022), which refers to the control of individual quantum systems. Quantum sensors have moved from proof-of-principle experiments to real-world applications, commercialization, and adoption faster than other quantum technologies (Hoofnagle & Garfinkel, 2022). Some argue that the sensing potential of quantum devices will have a revolutionary impact on many fields, including health care, defense, and transportation (Bongs et al., 2023; Hatano et al., 2022) with applications in medicine, communications, and navigation.

Quantum sensors are systems that use the principles of quantum mechanics through coherence, interference, and entanglement to determine quantities of interest (Degen et al., 2017; Dowling & Milburn, 2003). Put another way, they are quantum-enabled technologies that can be used to measure properties, including sensing, timing, and imaging. These technologies can be applied for different contexts or problems, for example, to measure temperature; to detect magnetic fields, chemicals, and biological components; and to make wireless communication more efficient (Gerginov et al., 2017; Hott et al., 2019; Webb et al., 2021; Zhang et al., 2022; Aslam et al., 2023).

Kantsepolsky et al. (2023) survey quantum sensor prototype reports and find that magnetometry and optics are the most advanced sensor-type technologies. The authors suggest there are areas in which quantum sensors could extend the capabilities of conventional sensing technologies: GPS-free positioning; navigating services; time-based operations; topological visibility; and environment detection, prediction, and modeling (Kantsepolsky et al., 2023, pp. 31575–31577). Another example: researchers in Greece, Ukraine, Germany, France, Spain, and Hungary recently cooperated on a project to advance a high-performance spin-torque microwave detector with the potential capability to detect low-frequency radio signals and reduce overall power consumption (NATO, 2023b, p. 18).

In sum, quantum sensor technologies have the potential for use in many areas, such as remote sensing, navigation, communications, and environmental monitoring. The application of quantum to existing sensor technologies will accelerate the accuracy and precision of current capabilities. There are different applications and types of quantum sensor technologies, which may include magnetic and electric fields, precise timing, imaging, and temperature fields. Because quantum sensor technologies will allow for precision and sensitivity in many fields, their continued development and application are of interest to diverse actors in the public and private sectors. The application of these technologies to positioning, navigation, and timing activities highlights the overlap between security objectives, environmental monitoring, and climate change mitigation strategies.

Although quantum sensor systems and technologies require continued development, their capabilities are often conflated with hype and accompanied by an increase in state investment, especially in use case applications in the Arctic (Johnson, 2021, 2024) that intricately link these technologies to military, economic, and environmental activities in the region. A content analysis of the national policies and strategies of NATO allies is warranted to further investigate the linkages between the geopolitics of quantum sensing applications, climate change, and security.

3. Methods and Limitations

If states around the world are increasingly investing in developing quantum technology through various research programs, initiatives, and strategies, then it is of interest to examine the intersection points for potential cooperation on global technology governance. This study examines these points individually at the state level and collectively through NATO.

A content analysis of policy and strategy documents from NATO and NATO-allied states was conducted following Bowen's (2009) procedures for reviewing and evaluating documents. To identify the linkages between state ideas about security, technology, climate change, and the Arctic, only official government documents pertaining to quantum technologies were selected for analysis.

Table 6.1 National quantum strategies and policy documents analyzed in this study

States	*Document or program name*	*Year of publication or launch*
Canada	*Canada's National Quantum Strategy*	2022
Canada	*Quantum 2030: The Department of National Defence and Canadian Armed Forces Quantum Science & Technology Strategy Implementation Plan*	2023
Canada	*Department of National Defence and Canadian Armed Forces Quantum S&T Strategy: Preparing for Technological Disruptions in the Future Operating Environment*	2021
Germany	*Handlungskonzept Quantentechnologien der Bundesregierung*	2023
Denmark	*Strategy for Quantum Technology: Part 1 – World-Class Research and Innovation*	2023
Denmark	*National Strategy for Quantum Technology: Part 2 – Commercialisation, Security and International Cooperation*	2023
Finland	*Finnish Quantum Agenda*	2023
France	*Stratégie nationale sur les technologies quantiques*	2021
United Kingdom	*National Quantum Strategy*	2023
United Kingdom	*Policy Paper: National Quantum Strategy Missions*	2023
Hungary	Hungarian National Quantum Technology Programme (HunQuTech)	2018
Iceland	*Icelandic National Cybersecurity Strategy 2022–2037*	2022
Italy	*National Quantum Science and Technology Institute (NQSTI) Scienze e Tecnologie Quantistiche (UniCT)*	2023
Latvia	Latvia Quantum Initiative	2023
Netherlands	*National Agenda for Quantum Technology*	2019
United States	*National Strategic Overview for Quantum Information Science*	2018
United States	*Report: Bringing Quantum Sensors to Fruition*	2022

(*Continued*)

Table 6.1 (Continued)

States	*Document or program name*	*Year of publication or launch*
Belgium, Bulgaria, Czech Republic, Spain, Estonia, Greece, Croatia, Lithuania, Luxembourg, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden[1]	*European Declaration on Quantum Technologies*	2023

Table 6.1 presents the national policies and strategies on the topic of quantum technology that were analyzed for this chapter. All of these documents were read and coded to address the two research questions. Links to all of the documents are located in the **Appendix** (**Table 6.2**).

NATO members that did not (as of September 2024) have specific quantum technology–related strategies were therefore excluded from the analysis, as it was not possible to report on certain concepts or analyze linkages. In some of these cases, the state's national quantum strategy was categorized as either forthcoming or being realized through national research programs, or the state's strategy was collectively ascribed to the *European Declaration on Quantum Technologies* (European Commission, 2023). A number of national policies and strategies were not available in English, which posed a barrier for analysis. To mitigate this, Google Translate was used to interpret available content for analysis.

To understand the explicit linkages between the role of quantum technology in addressing the effects of climate change and ideas about security in the Arctic and High North, it was decided that clear mitigation and resilience strategies were needed to delineate connections. For this purpose, the main strategies for climate change abatement proposed by Fawzy et al. (2020) were employed in this study.

The authors of Fawzy et al. (2020) review the literature on climate change and identify three main strategies for mitigation: conventional mitigation, negative emissions, and radiative forcing geoengineering. Fawzy et al. (2020)'s review and abatement strategies were selected for use in this study for two reasons: first, because the authors review a breadth of strategies in the academic literature that focus on the interactive role that new technologies play in addressing the effects of climate change. Second, because Fawzy et al. (2020)'s study is based on a rigorous bibliometric analysis that specifically focuses on recent (2015 to 2020) scientific research related to climate change mitigation. To be sure, other such reviews of mitigation strategies exist and some are less detailed (e.g., VijayaVenkataRaman et al., 2012; Malhi et al., 2021); however, the review by Fawzy et al. (2020) provides clear definitions, encompasses emerging technologies, and presents approaches not confined to a single field of study.

To identify the main strategies for climate change abatement, the documents listed in **Table 1** were analyzed to identify any association with the three strategies outlined in Fawzy et al. (2020). Association was established if the analyzed document mentioned any of the connected processes or technologies described in Fawzy et al. (2020, pp. 2073–2088).

4. Results and Discussion

The results of the content analysis of NATO and NATO-allied states' national policies and strategies are reported in the following subsections and are organized by research question.

a. How are the Main Strategies for Climate Change Abatement Reflected in NATO and NATO Allies' National Policies and Strategies for Quantum (Sensing) Technologies?

Generally, the linkages between quantum technologies, quantum sensors, and climate change or environmental issues are limited to specific states. These include Canada, Denmark, France, the United Kingdom (U.K.) and, to a lesser extent, Germany. Frequently, a mention of quantum sensors appeared in reference to generic lists of quantum technologies (for example, in a case study) and not explicitly to their application. Climate change abatement strategies were rarely mentioned, except in the *NATO Climate Change and Security Action Plan* (NATO, 2021) and the national documents of Germany, France, and the U.K. (Government of Germany, 2023; Government of France, 2021; U.K. Department for Science, Innovation and Technology, 2023). In the first case, non-quantum and non-sensor technologies were considered only in connection with conventional mitigation strategies, such as renewable energy. Mention of these strategies was related to proposed emission-assessment programs in allied states (NATO, 2021, p. 3). The linkages between sensors (although not specifically quantum technologies), climate change, and the Arctic and High North were evident only in NATO's 2024 *Climate Change and Security Impact Assessment* (NATO, 2024). Although specific climate change abatement strategies were not mentioned, the connections are apparent in NATO's maritime operations domain, with specific reference to the capabilities of submarines (NATO, 2024, p. 15), especially in the North Atlantic (NATO, 2024, p. 17). Germany's action plan mentions the category of radiative forcing geoengineering in the context of using quantum sensor technologies to monitor climate change (Government of Germany, 2023, p. 16). France and the U.K. both separately mention conventional mitigation related to climate change abatement strategies (Government of France, 2021, p. 42; U.K. Department for Science, Innovation and

Technology, 2023, p. 7) but not in the High North. Germany, France, and the U.K. associate quantum sensors with the potential to address global challenges (Government of Germany, 2023, p. 16), especially natural disasters (Government of France, 2021, p. 7), and to meet national greenhouse gas emissions reduction targets (U.K. Department for Science, Innovation and Technology, 2023, pp. 7, 42). France and the U.K. both separately mention conventional mitigation related to climate change abatement strategies (Government of France, 2021). Denmark, Finland, and the Netherlands make the association between climate change and quantum sensors but do not mention specific strategies or concepts.

b. How is the Link Between Climate Change Abatement and Security in the Arctic and High North Described in the Policies and Strategies for Quantum (Sensing) Technologies, if at All?

Many NATO allies are signatories to the *European Declaration on Quantum Technologies* (European Commission, 2023) and do not have their own national quantum strategy (**Table 1**). Others are signatories[2] but also have their own strategies, are developing strategies, or are achieving objectives through research programs. In both cases, the European Commission's (2023) declaration provides guidance on the cooperation and development of quantum technologies; however, there are no strong linkages in the document between quantum technologies, including those involving sensors, climate change abatement, and/or security in the High North. Only Canada, through Quantum 2030 (Department of National Defence, 2023) and the Quantum S&T Strategy (Defence Research and Development Canada, 2021) makes the connection between quantum sensors or applications in the context of the Arctic but does not mention climate change. As both Canadian documents are defense-related, the capabilities of quantum sensors are positioned as able to enhance the operational effectiveness of, for example, light detection and ranging (LiDAR) and radar technologies (Department of National Defence, 2023, pp. 11, 13). In line with the findings of Johnson (2021, 2024), sensing and quantum-enhanced sensor technologies are connected to protecting Canadian sovereignty over the Arctic region through enhanced surveillance. Similar to NATO's 2024 *Climate Change and Security Impact Assessment* report, Canada's Quantum S&T Strategy emphasizes the application and enhanced capabilities of quantum sensor technologies in the maritime domain; however, it also includes the aerospace domain (Defence Research and Development Canada, 2021, p. 9).

5. Conclusion

Amid the increase in investment and attention paid to quantum technology research and development for the purposes of researching climate change mitigation, few cooperating states made the explicit connection between these elements in their national documents. Even fewer presented the application of specific technologies, like sensing, in relation to military usage, geopolitical competition, and the Arctic and High North. The results of this study have three main strategic and practical policy implications for NATO and NATO allies.

First, the capabilities and, therefore, the projected capacities of quantum technologies, like sensors, may be overblown in national documents as a result of technological hype. Many quantum technologies are still in development and others may serve only to enhance existing technologies – not replace them. The linkages between quantum technology application and climate change mitigation may not always be clear or a primary consideration in the development of these technologies. To be sure, the lack of explicit detail on the capabilities and projected capacities of the technology may be due to the discretion needed to protect national research and ensure operational security. Additionally, the efficiency of research and development funding is difficult to measure, especially when the technologies may not yet exist or when their capabilities are still unknown.

Second, national quantum-related documents are not usually formulated by policy communities with technical experience or knowledge. In the majority of the analyzed documents, the disconnect between actual technical capabilities, state capacity, and the application of quantum sensor technologies in real-world contexts may be the result of a disconnect between policy practitioners, researchers, and industry knowledge communities. For instance, the capabilities of certain quantum technologies may be positioned as emerging and disruptive in policy; however, researchers in the field may position their application and viability decades in the future. Additionally, quantum technologies (including sensors) are being developed at unequal rates within different fields of study, which may cause a blanket oversimplification of capabilities that translates to a generalization in policy. For instance, imaging, including LiDAR, radar, visible spectrum imaging, and photonics, are areas in which quantum sensor technologies are making specific strides.

Third, the lack of connections between the development and application of quantum sensor technologies and global challenges has overarching governance implications for cooperating actors. When the current and projected pathways for technology cooperation are unclear, then environmental, social, economic, and security challenges will remain unaddressed. This may result in the continued fragmentation of the polar regions into zones of enhanced security and geopolitical competition rather than manifesting as an opportunity to cooperatively apply technologies to address pressing global challenges. Global challenges, national policies, and quantum technologies are interconnected, requiring effective policy and practice to promote long-term funding, collaboration, and problem-solving. Effective policy and practice must focus on linking fundamental and theory-based quantum research with application.

6. Data Availability

Data is available upon request.

7. Acknowledgments

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8. Competing Interests

The author declares that they have no conflicts of interest.

Notes

1 A total of 26 countries have signed this declaration, including these 15 NATO allies. These states are listed here because they do not have a quantum technology–related strategy. The other NATO members that also signed the declaration (but that have an individual strategy) are Denmark, France, Germany, Hungary, Italy, Latvia, and the Netherlands.

2 Includes Denmark, Finland, France, Germany, Hungary, Italy, Latvia, and the Netherlands.

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Appendix

Table 6.2 List of documents analyzed for this chapter

State or organization (year), department or agency	*Title*	*Link*
Canada (2023), Department of National Defence	*Quantum 2030: The Department of National Defence and Canadian Armed Forces Quantum Science & Technology Strategy Implementation Plan*	https://www.canada.ca/en/department-national-defence/corporate/reports-publications/overview-quantum-2030/quantum-s-t-strategy-implementation-plan.html
Canada (2022), Innovation, Science and Economic Development Canada	*Canada's National Quantum Strategy*	https://ised-isde.canada.ca/site/national-quantum-strategy/sites/default/files/attachments/2022/NQS-SQN-eng.pdf
Canada (2021), Defence Research and Development Canada	*DND/CAF [Department of National Defence and Canadian Armed Forces] Quantum S&T Strategy: Preparing for Disruptions in Future Operating Environments*	https://cradpdf.drdc-rddc.gc.ca/PDFS/unc356/p812809_A1b.pdf
Denmark (2023)	*National Strategy for Quantum Technology: Part 1 – World-Class Research and Innovation*	https://ufm.dk/en/publications/2023/strategy-for-quantum-technology-part-1–2013-world-class-research-and-innovation

(*Continued*)

Table 6.2 (Continued)

State or organization (year), department or agency	*Title*	*Link*
Denmark (2023)	*National Strategy for Quantum Technology: Part 2 – Commercialisation, Security and International Cooperation.*	https://www.eng.em.dk/Media/638315714019915522/National%20Strategy%20for%20Quantum%20Technology.pdf
European Commission (2023)	*European Declaration on Quantum Technologies*	https://digital-strategy.ec.europa.eu/en/library/european-declaration-quantum-technologies
Finland (2023), Finnish Quantum Institute (InstituteQ)	*Finnish Quantum Agenda*	https://instituteq.fi/wp-content/uploads/2023/02/FQA-February–2023.pdf
France (2021)	*Stratégie nationale sur les technologies quantiques*	https://www.entreprises.gouv.fr/files/files/secteurs-d-activite/numerique/enjeux/quantique/dossier_de_presse_quantique.pdf
Germany (2023)	*Handlungskonzept Quantentechnologien der Bundesregierung* [The federal government's quantum technologies action plan]	https://dserver.bundestag.de/btd/20/066/2006610.pdf
Iceland (2023), Ministry of Higher Education, Science and Innovation	*Icelandic National Cybersecurity Strategy 2022–2037*	https://www.stjornarradid.is/library/04-Raduneytin/Haskolaidnadar-og-nyskopunarraduneytid/Icelandic%20National%20Cybersecurity%20Strategy%202022–2037.pdf
Italy (2023), Ministry of University and Research	*National Quantum Science and Technology Institute*	https://www.mur.gov.it/sites/default/files/2023–02/D.D.%20341%20_PE0000023_rev131022NF.pdf
Netherlands (2019), Quantum Delta Nederland	*National Agenda for Quantum Technology*	https://qutech.nl/wp-content/uploads/2019/09/NAQT-2019-EN.pdf
North Atlantic Treaty Organization (2021)	*NATO Climate Change and Security Action Plan*	https://www.nato.int/cps/en/natohq/official_texts_185174.htm

(*Continued*)

Table 6.2 (Continued)

State or organization (year), department or agency	*Title*	*Link*
United Kingdom (2023), Department for Science, Innovation and Technology	*National Quantum Strategy*	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1142942/national_quantum_strategy.pdf
United Kingdom (2023), Department for Science, Innovation and Technology	*Policy Paper: National Quantum Strategy Missions*	https://www.gov.uk/government/publications/national-quantum-strategy
United States (2022), Subcommittee on Quantum Information Science Committee on Science	*Bringing Quantum Sensors to Fruition*	https://www.quantum.gov/wp-content/uploads/2022/03/BringingQuantumSensorstoFruition.pdf
United States (2018), Subcommittee on Quantum Information Science Committee on Science	*National Strategic Overview for Quantum Information Science*	https://www.quantum.gov/wp-content/uploads/2020/10/2018_NSTC_National_Strategic_Overview_QIS.pdf