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Melting Frontier's: The Race for Resources and Strategic Sea Routes in the Arctic Ocean

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Abstract
The warming climate in the Arctic has revealed an area rich in natural resources as well as strategic trade routes, thus opening doors for economic opportunities and rivalries by both Arctic and non-Arctic states. This is a qualitative research study on secondary data that seeks to examine prospects and implications regarding Arctic resource exploitation, emerging shipping routes, and environmental protection. The results suggest that the massive oil and gas reserves in the Arctic, combined with new transport routes such as the Northern Sea Route, will dramatically strengthen the economies of a few nations. Yet, this growth is overshadowed by rivalry relations, especially between Russia, China, and the US. It further throws light upon the tremendous environmental pollutions, mass immigration of the indigenous tribes, and self-rule problems that generally are ignored by the federal programs and international agreements.

Keywords: Artic, Sea route, Natural resources, Environmental protection

Introduction:

The rapid melting of the polar ice caps has political and economic ramifications in Russia and Internationally. It has heightened interest in the Northern Sea Route and spurred economic activity for resource extraction (Brigham 2020). Other countries see potential for trans-Arctic shipping and economic development. Arctic coastal governments must maintain order, peace, and stability for the sake of their own national interests. Steps must be taken to further national interests in the Arctic, which offers up new maritime routes and resource-rich areas. The changing geopolitical landscape may lead to armed confrontation, necessitating negotiations for world peace and security (Rasmussen 2018). Climate change increases the demand for new technology and resource development. The potential discovery of new resources and access to the old Pacific trade route may be possible. That decreased ice coverage in the Northern Sea Route due to global climate change (Smith 2013).

Background of the study:

The Arctic is warming twice as fast as the rest of the planet. The Arctic is seeing record temperatures, diminished sea ice cover and duration, melting mountain glaciers, and significant ice sheet loss. These changes have an impact on both the regional and global climates and habitats (Center November 15, 2024.). Principles contained in the Convention, such as the rights and marine areas of coastal and other states, marine pollution, monitoring of marine conditions, and science, were first codified in this legally binding instrument. The rights of navigation, overflight, lay transshipment, and fishing in the conventionally defined exclusive economic zones of coastal states are also codified in the Convention. The precepts of the climate regime are derived from the climate convention ((UNCLOS). November 15, 2024.). The broadest environmentally related principle codified in the climate convention relates to the protection of the climate system for the benefit of present and future generations (Council 2004).

The trace changes in the Arctic Ocean climate and their environmental consequences, as well as early scientific research and international cooperation concerning this region, from the mid-19th century to the aftermath of the Comet Encounter (Brigham 2020). The Polar Year initiated formal international cooperation in Arctic research, while scientific research of the 20th century generated the Arctic treaty law antecedent. International polar exploration in the Arctic after the encounter of the two comets showed where national interests and priorities lay. The end of the 20th century saw the rapid melting of the Arctic Sea ice cover and the fast expansion of permanent and seasonal open water areas. As navigable areas appeared in the Arctic, interested states, supported by academia and industry, soon exploited their commercial and security benefits. These developments—triggered the present race for resources and strategic sea routes in the Arctic (Ebinger 2009).

Objectives:

1. To assess the economic potential of the Arctics natural resources
2. To analyze the geopolitical competition over Arctic resources.

Research Question:

1. What are the economic implications of exploiting the Arctic natural resources?
2. What are the key factors which are driving the geo political competition for the artic resources?

Methodology:

This study adopts qualitative research design through secondary data analysis to examine the relevant sources. Relevant data were collected from books, reports, policy briefs, journals, and other credible sources for the purpose of gaining a deeper understanding of the topic. The sources were selected on the grounds of relevance, credibility, and publication date with preference to peer-reviewed and official sources. Information was examined using systematic review, comparing information from various sources in order to determine the most important views and trends. Ethical standards were upheld using proper citations of all the sources and abiding by the standards of academic integrity.

Significance of The Study:

The predictions made by the unwanted consequences of climate change have begun to manifest. Events like the shrinking of the Arctic ice and increased exposure to clear water, thereby making the exploration of the ocean for resources fueling economic activities possible, have led to deep concern. This has sparked the interest of various stakeholders in the region as part of a new race

for the nerve center of the world. The study looks into the significance of this ongoing race, the roles, and positions of major powers that include countries with the longest territorial coastlines in the region, as well as Western countries.

It is established that the primary significance of the resources found in the Arctic is that they can help lead to economic prosperity, strengthen military capabilities, and provide the region's ice-free sea routes as an alternative or supplement to the existing congested, long-distance, and unsafe transportation routes, which cause tensions in international waters. Data have shown that smaller ships can save up to ten days of sailing distance using this route, and because a significant amount of natural resources rests on the seabeds of zones within the route, nations see the region's opening up as a significant strategic opportunity to enhance not only their economic power but also their military and geopolitical status

Scope of the study:

To achieve the aim of enabling the systemic evaluation of the increasing shipping traffic arising from the prospect of emerging new sea routes connecting the main world population and economic centers, and how such traffic impacts the sustainability of the Arctic region, the present work is organized as follows: The introduction contains references to the evolution of Arctic maritime activity, pointing out the unrestricted navigation in Arctic routes. A review of risks associated with traffic in the region is shown, and the extra-territorial implications of trans-polar navigation are stressed. The research material and the methods and tools used in the development of the study are then described. The review of sea traffic associated with Arctic routes and the environmental implications is presented, aiming to show the potential sources of stress and disturbance to the region's inhabitants, both marine and terrestrial, inherent to the movement of ships and their cargo operations, but also the potential impacts of a historical nature.

Research Gap:

Primary Data Deficit: Reliance on secondary sources; lacks direct stakeholder insights.
Indigenous Views: Limited exploration of indigenous perspectives on climate and governance.
Long-Term Impacts: Insufficient focus on global climate effects of Arctic changes.
Geopolitical Shifts: Needs deeper analysis of non-Arctic states' roles, e.g., China and India.
LegalSadafjansiddiqui@gmail.com Adequacy: Lacks critical evaluation of Arctic governance and UNCLOS enforcement.
Resource Feasibility: Overlooks technological and economic challenges of resource extraction.

The Geopolitical Significance of the Arctic Region:

The Arctic region is largely defined as encompassing areas and territories north of the Arctic Circle (66 degrees 33 minutes north latitude). These areas form part of eight Arctic States—United States, Russia, Canada, Norway, Denmark, Iceland, Sweden, and Finland—each with a significant stake in the future governance and management of this vital and fragile region (Center November 15, 2024.). The Arctic countries work closely in the context of the Arctic Council, established in 1996 with the key objectives of addressing environmental protection, biodiversity conservation, sustainable development, and science cooperation. A distinctive feature of the Arctic Council is the participation of indigenous peoples, who serve as full members at its meetings, contributing to discussions with their traditional knowledge(Rasmussen 2018). The Council provides a unique forum in which the Arctic States, indigenous peoples, and other interested parties continue to work together in the spirit of building cooperation among nations and peoples of the north—increasingly important in a region of intense global interest and activity.

Only recently has the world community begun to seriously assess the Arctic's potential as a source of energy, strategic sea paths, and financing needs. Yet, irrespective of the pace and timing of

commercial exploitation, increasing international attention is being focused on climate change, polar ice dynamics, access to energy resources, transoceanic commercial sea routes, jurisdictional responsibilities, and the rights and opportunities of indigenous Arctic peoples (Young 1992). The United States is entering this process with the long-standing recognition of the strategic significance of the Arctic because of its history with Russia, the early warnings it received from the DEW-line, and its contested boundary with Canada along the Northwest Passage (Melvin 2020). On the legal front, the United States has also undertaken comprehensive research into potential Arctic Continental Shelf claims; in strategic terms, the US has already announced a new approach to the Arctic. In his first address on Arctic policy, in January 2009, then-Secretary of State noted the Russian North Pole flag expedition, Danish attempts to prove that the Lomonosov Ridge is a geological extension of Greenland, and the planned International Polar Year research expedition: "We are seeing the Arctic bear substantial natural resources and energy potential. It is also true that a number of countries interested in the Arctic and the eight member states of the Arctic Council have already been active near and on the North Pole. These figures are only likely to increase, growing not just more numerous but more capable as permanent sea ice undergoes further erosion (Smith 2013)."

MAP OF THE ARCTIC OCEAN

https://youtu.be/hSGU8Gx5qOc?si=XhUbYQG6evvrnMeL

Historical Context:

Two major events in the 20th century in the Arctic were linked to military activities in the area following the two world wars; otherwise, the Arctic was traditionally defined as a region of peaceful coexistence. The first major event was the Svalbard Treaty concluded in 1920, securing free navigation and mining rights to the signatories (Pedersen 2009). The Second World War and its aftermath led to the creation of a strong military presence in the Arctic for reasons linked to the Cold War. The signing of the United Nations Convention on the Law of the Sea in 1982 hit the brakes on the militarization of Arctic politics. The positive development is indicated by the Antarctic Treaty, according to which Antarctica should be used for peaceful purposes. In the 1980s, Moscow offered a ban on new military installations north of the Arctic Circle, assistance in oil spill clean-up, ensuring the security of shipping, and access for the international community to the Northern Sea Route (Brigham 2020). In 1985, Soviet leader Mikhail Gorbachev expressed the principle of the Arctic as a region of peace. This led to a climate conducive to the dissolution of the Soviet Union and the peaceful emergence of Arctic states. In 1991, multilateral environmental issues took center stage in the Arctic, in addition to their uninterrupted tradition. In 2001, the Inuit Circumpolar Council took the initiative of a common cooperation program among the peoples of the Arctic.

Since 1994, there has been comprehensive Arctic cooperation among the Arctic species known for the most fashionable metaphor - Parliamentary Dimension, not unlike the European Parliament, but with considerable room for creative dialogue outside the forum. Two waves of Arctic exuberance, caused by the launching of the General Assembly of the Oceans and the opening of the Arctic Ocean by multilateral cooperation through the Arctic Council, were inappropriately named, or at least weakened, with the end of Cold War tensions. But it took three waves of exuberance before the new realism on an else-renamed region began in two waves, which followed each other closely. In the eyes of Arctic neighbors, the opportunities for comprehensive cooperation that arose in the region and the rigidity with which security cooperation would have to take place have been recognized for a long time (Smith 2013). At the same time, it should be noted that the region was transferred after Cold War leaders to another country where the question of who is in charge applies only to a limited extent. The race for resources in the Arctic Ocean can also in no way be compared with the noughties in the Baltic Sea, where it was a classified index operated by economic interests. However, the fact that the Arctic offers opportunities for common solutions was recognized despite the limited number of parameters (Rasmussen 2018).

Current Geopolitical Dynamics:

Tensions also arise within the council over security and jurisdiction in the region. There could be a rise in tension between Arctic countries and other interested countries, driven by external and security factors or by the interests of other countries or actors not part of the region. These extra regional factors do not form the core of international disputes in the Arctic. Little cooperation or joint work towards the goal of sustainable development of the region has occurred because of a human extinction theory that looms beneath the polar ice—the real fear of possible geopolitical conflicts, as one of the scientists put it.

But the snowball theory of the dominant state in the middle of the region is not proven (Keil 2013). Russia's neighbors, European Union member states, and candidate countries are determined to actively look for influence in the Arctic. Moreover, in 2007 the EU took a historical decision to develop an Arctic policy, and then it published a communication regarding the European Union and the Arctic Region (Commission 2008). A few years later, the EU launched the Arctic Policy, which, according to specialists, is extremely comprehensive and reflects the importance and

necessity of a systemic, coherent, and across-the-board approach in the Arctic (Wilson 2022). Besides, the region is interesting for other countries and countries from other regions for economic reasons, but also for others including energy. Currently, the council is putting in place rules for the region, clarifying the extended continental shelf, governance for the Arctic high seas, and keeping the region peaceful (UNCLOS 2019).

Resource Extraction in the Arctic:

The Arctic, characterized by its harsh climate and standing as one of the world's most underdeveloped regions, seems to be at the doorstep of rapid changes and a significantly increased economic interest. There is an increasing international demand in terms of climate change for new scientific findings and a multitude of often controversial strategies for economic development, in particular, enabled through the melting of the Arctic ice (Smith 2013). Numerous rifts opened due to the melting of the ice, which weakens the common idea of a freezing Arctic trade route year-round. However, the geopolitical status of this northern region seems to calculate geopolitical rules for already opening new sea routes, primarily for the Northern Sea Route and the Northwest Passage (Keil 2013).

At the center of the race for the Arctic region lie its abundant natural resources, including freshly thawed waterways and energy resources. Some of the most important oil and gas reserves to be exploited in the future have been found in the Arctic regions (Wilson 2022). Two immediate impacts of the melting of the Arctic ice cover due to global climate change on energy economics may be observed, namely increased exploration and production of the marine reserves around the Arctic region and increased shipping of oil and gas and its associated products between Asian consumers and the potential Russian and other production areas on the one hand and European consumers through the Suez Canal on the other hand (Smith 2013). Rising global prices of the products, more expensive transportation by pipelines, and concerns about geopolitically risky sea routes in the Gulf of Persia and the Arabian Gulf led to considering the Arctic as a place to be explored, conveying a potentially larger contribution to the union's energy mix. The most attractive potential profits for the waterway in the predictions are related to the following: significant ice cover, difficult access in some parts of the year due to the presence of thickening ice or due to perilous icebergs, perhaps requiring nighttime observations, and important distances in terms of sea navigation (Council, Arctic Environmental Protection Strategy 2021).

Oil and Gas Reserves:

The region develops as a petrochemical pole since at the beginning of the last century several reserves of liquid gold were discovered, which are estimated to be around 90 billion barrels, or one-fifth of global reserves (Bird 2008). While a more recent estimate evaluated that there are reserves of 20% of the energy resources estimated throughout the world in the Arctic (Ebinger 2009). Functioning as a sort of energy bank in the region, this valuable resource is only circumstantially used, as it operates as a reserve of time and resources for the global economy, since projections also estimate that at the current rate of consumption reserves may run out in no more than 25 years.

For Shell, this region is a diamond in the rough and estimates that in the Chukchi Sea reserves reach 30 billion barrels, while for the more elusive Danish Greenland, the estimates point to around 20 billion barrels, although these estimates are divided. However, one aspect is unquestionable at this point: the ongoing melting provides direct access to this new Gold Coast, creating conditions that allow the exploration of these potential reserves, which technology does not currently allow, at extreme temperatures that are felt in the rest of the globe, under unfavorable geological and oceanographic conditions (Østhagen 2020). With investment made in technology and infrastructure to take advantage of these reserves, including the necessary adjustments in oceanic

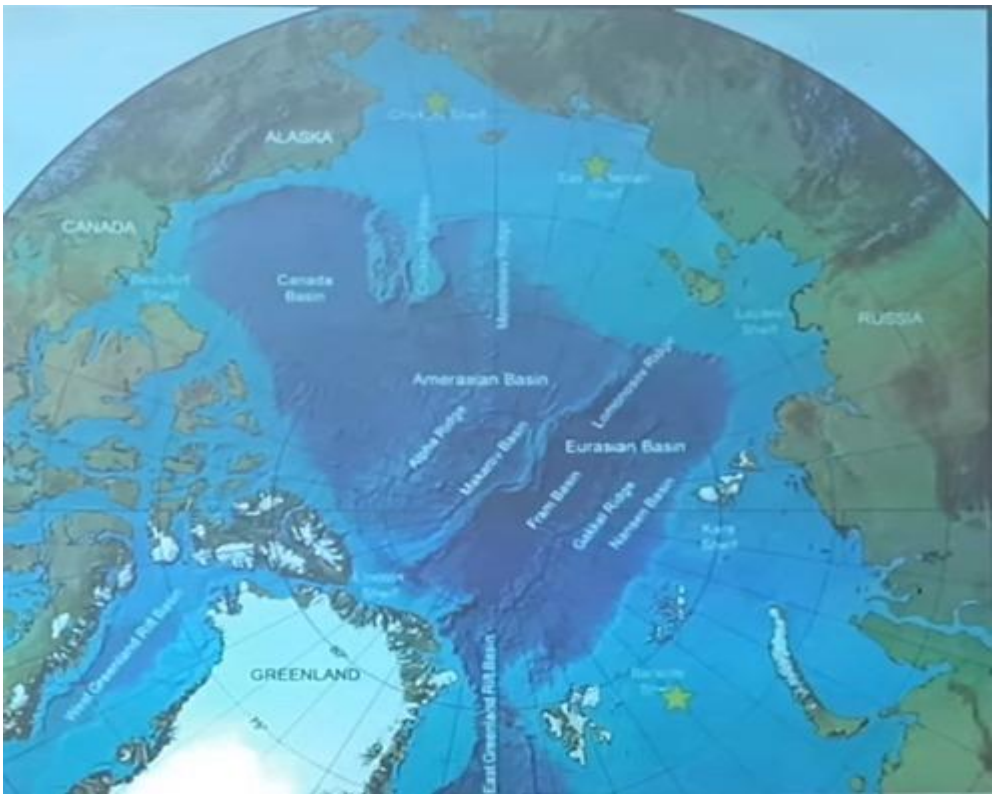
hydrological structures to allow transshipment, it will allow shortening routes and increasing the supply of hydrocarbons to the rest of the world, which, given the present indispositions from some international partners and political instability in various strategic regions, especially the Middle East, would act as a major stimulus for investors.

Strategic Sea Routes in the Arctic Ocean:

The Arctic Ocean possesses not only marine resources such as fish stocks and hydrocarbons but is also geopolitically important to Russia, a major part of which is above the Arctic Circle. From the time of the Russian Empire, its strategic locations have ensured that the Arctic Ocean is always the most important frontline for the war with North European countries (Dodds 2016). Today, the economic resources of the Arctic Ocean are not only exploited by Arctic littoral states such as Russia, the United States, Canada, and others like Norway, Iceland, and Greenland, but are also increasingly attracting non-Arctic states such as China, South Korea, and European Union countries who hope to exploit these resources or use the various sea routes. At the forefront of this race are China and the United States, who both announced their Arctic strategies in 2019 (Keil, The Arctic as a Transit Region for Shipping: Paths to a Legal Order for Navigation along the Northern Sea Route 2015). States with large Arctic coastlines include Russia, Canada, Finland, Sweden, Denmark, Norway, Latvia, Lithuania, Estonia, Iceland, and the United States.

In July 2013, Russia submitted an application to request the extension of its territory in the Arctic Ocean to include an area with the sea bottom part of the Lomonosov Ridge and Gakkel Ridge. Subsequently, Russia has started to build up its military presence in its Arctic region, including expanding its polar bases and deploying their latest radar stations. Its interest in its Arctic region is understandable as it has 18,000 km of Arctic coastline out of the 23,500 km that is spread among the Arctic littoral states. On October 17, 2019, the U.S. Secretary of State headed to Montana to deliver a speech on U.S. foreign policy. The United States lifted its moratorium on oil and gas exploration in the Arctic National Wildlife Refuge on August 12, 2020. On April 25, 2019, the policy of the State of Russia in the Arctic to 2035 was approved and signed by the President of Russia. On June 18, 2019, the U.S. Coast Guard released its Arctic Strategic Outlook document (Baev 2018).

Canadian Route



Northern Sea Route:

Along with the Northwest Passage, the Northern Sea Route has become another increasingly controversial issue due to its exploitation during the summer months, especially as the Arctic's summer grows longer. The route, whose exploitation is obstructed by the rapidly melting ice, is of strategic interest to a large group of countries, including the United States, because traversing it could cut two-thirds of the time required for a trip from Europe to Asia, savings being the goal of all stakeholders (Smith 2013). Yet in reality, it is mostly navigated by Russian channels, of which the local administration has the final say over who can navigate it, and to a large extent by Russian icebreakers (Weber September 10, 2021). Russia has been trying to have the Northern Sea Route, along with its adjacent waters, recognized as an area of national jurisdiction, as it is the nation with the greatest territorial rights around the Arctic land periphery (Byers 2013).

The most important debate, focusing not on the route as such, but on the water in which it is located, revolves around the nature of these waters in terms of international law. According to the UN Convention, the Northern Sea Route would be subject to the regime of

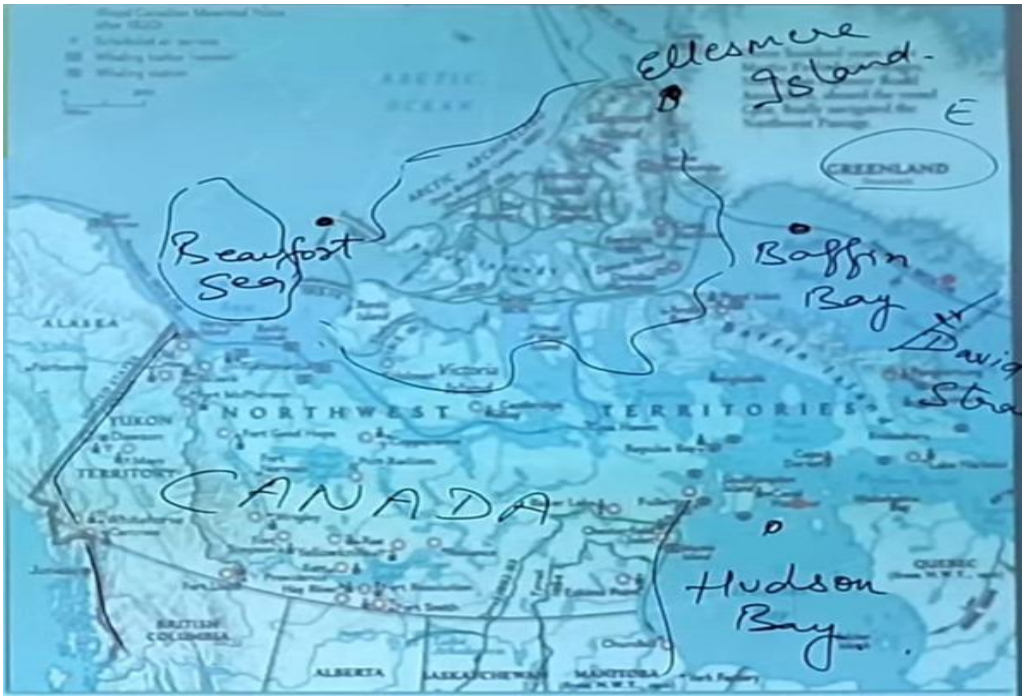
Russian route *https://images.app.goo.gl/ebJhVLbmPDBZuHB16*

the high seas except for the caveat that ships which are not 'ice strengthened' are not appropriate for navigating the route (UNCLOS, United Nations Convention on the Law of the Sea 1992). Russia disagrees, invoking the rules of the regime of the territory that runs along its northern coast, the archipelago of the Franz Josef Land islands, and the Svalbard islands, as well as its contribution to 'saving' the sensitive Arctic ecosystem and the protection of maritime security. The former argument is compounded by the intensive oil and gas exploitation activities in the region. The matter will surely be settled through a series of unilateral practices, with a coalition of interested stakeholders ultimately leading the way in the Arctic, in this case, Canada and Russia, managing to establish their own spheres of influence (Chaturvedi 2005).

Northwest Passage:

The Northwest Passage and its possible navigability have and will continue to exercise the imagination of the world's explorers and navigators. The Northwest Passage reduces, if it does not eliminate, the sea distance between New York and Yokohama by some nine thousand miles and between Yokohama and Liverpool by some three thousand miles (Young 1992). Over the centuries, many lives have been lost in the attempt to discover the fabled seaway to the riches of the Orient. The area has periods where temperatures rise above freezing and the ice will melt. For a small number of days in the late summer, the Arctic becomes temporarily navigable. The issue of navigability for both vessels and warships is of significant concern to Arctic capitals (Byers 2013).

The Inuit, who have traditionally inhabited the area, have known of the navigability of the passage for centuries. In 1906, the Norwegian explorer successfully navigated the Passage over a three-year period. This was before warming caused increases in regional temperatures and corresponding



increases in the retreat of the ice in the summer months (Weber September 10, 2021). In May 1969, a US oil tanker transferred oil by helicopter to a vessel at the entrance to the Strait of Belle

Isle, Newfoundland, becoming the first oil tanker to transit the Passage. In August 1976, a commercial vessel became the first to tread the Northwest Passage. A merchant ship was the first commercial ship to unescorted transit the Passage in 1984 (Council, Arctic Marine Shipping Assessment 2009).

Challenges and Opportunities for Arctic Governance:

New forms of cooperation in the Arctic have been established to address a range of administrative and legal issues arising from the increased interest in the region. While the Arctic has historically been a region of low political tension, the potential impacts of climate change and the necessity of developing and managing new commercial opportunities in a sensitive environment make the development of strong and effective institutions a pressing concern (Doe 2022). There are several challenges to the development of such institutions. These concerns include enlargement of the institutional framework, the mix of political and scientific leadership, divergent policy mandates, and the nature of indigenous involvement in assessment work and policy development. The strategic and political context in which these types of development are occurring was analyzed, drawing from some of the specific post-Cold War issues impacting the region (J. a. Smith 2023).
The results of two studies focused on addressing key European R&D needs and priorities for the Arctic. Building on the knowledge gained from Arctic research projects, a key achievement was to define a joint Polar research programme for the Pan-European Polar research area. The project focused on assessing the risks and opportunities for the intersection of new and pre-existing economic interests within the Arctic. Key challenges for rapid but sustainable development were identified (Taylor 2021). These identified points deserve further elaboration on the regulatory and institutional perspective as well as updates in the light of Arctic Council developments since writing

Environmental Concerns:

The most pressing challenges around which Arctic governance is increasingly focusing are environmental. Over the last few decades, the Arctic has warmed at almost twice the rate of the rest of the planet, causing changes to the Arctic environment and ecosystems such as shrinking ice sheets and glaciers, changes to the frozen soil, and in the animals, fish, and birds that are its Indigenous and non-Indigenous communities' life-support systems (J. a. Smith 2023). Some of these are generally positive, or seen as such. For example, the permafrost melt can make family and community life in the Arctic much easier and require far less expensive infrastructure such as heating, water, and sewage installations. For those preparing to transform it into cheap transport infrastructure of global significance, the melt is also good news. However, these developments come together with many threats, both seen individually and in the aggregate of many probable simultaneous trauma events.
The most widely scrutinized threats are probably Arctic thawing's potential to act as a self-strengthening amplifier of further warming, through the massive release of methane reserves trapped in the permafrost and underneath the Arctic Ocean. There is also substantial anxiety concerning the survival of sea ice in the Arctic Ocean, which is central to the already observed accelerating ice melt overall. However, the changes to other aspects of the environment, including to wind and water patterns at the poles in particular, and more globally to the circulatory systems of the world's oceans, and the influx of new chemical compositions and toxicity of the melting seafloor and permafrost are also of very significant concern (Taylor 2021). Fish stocks in the Barents Sea, the North Atlantic, and the adjacent Arctic seas are already showing considerable shifts of distribution. This matters because, together with oil and gas, and more recently also on the renewable energy front, such as wave or tidal energy, these stocks are an increasingly important source of income for the Arctic region.

International Cooperation:

Future cooperation between the Arctic Ocean coastal states could pursue either an "interpretative" or an "implemented" role of the current legal principles. While implementation means extending Arctic principles to the use and management of natural resources, such as hydrocarbons and other minerals, "interpretation" means the use of the legal framework only for the set of states and submitting future activities in the Arctic to specific binding instruments. Most of the Arctic studies prefer implicit reference to the former behavior, recalling the existence of both a legal framework and technical know-how, which might provide in due time a sufficient level of general regulation (Overland 2019). Nonetheless, most of the criticism revolves around the imminent need to have a specific Arctic regime, or – to say the least – a convention, properly negotiated by the coastal states and by other countries that currently have recognized rights in the sea basin (Molenaar 2017).

The negotiation of an Arctic regime will not be an easy task. Currently, the legal framework is seen favorably for Articles 234 and 76 of the United Nations Convention on the Law of the Sea. In other words, the current legal framework attaches relevance to UNCLOS, its international peculiar role and developments, but considers it undue or at least premature at this stage to establish a specific regime that requires a specific convention (UNCLOS, United Nations Convention on the Law of the Sea 1992).

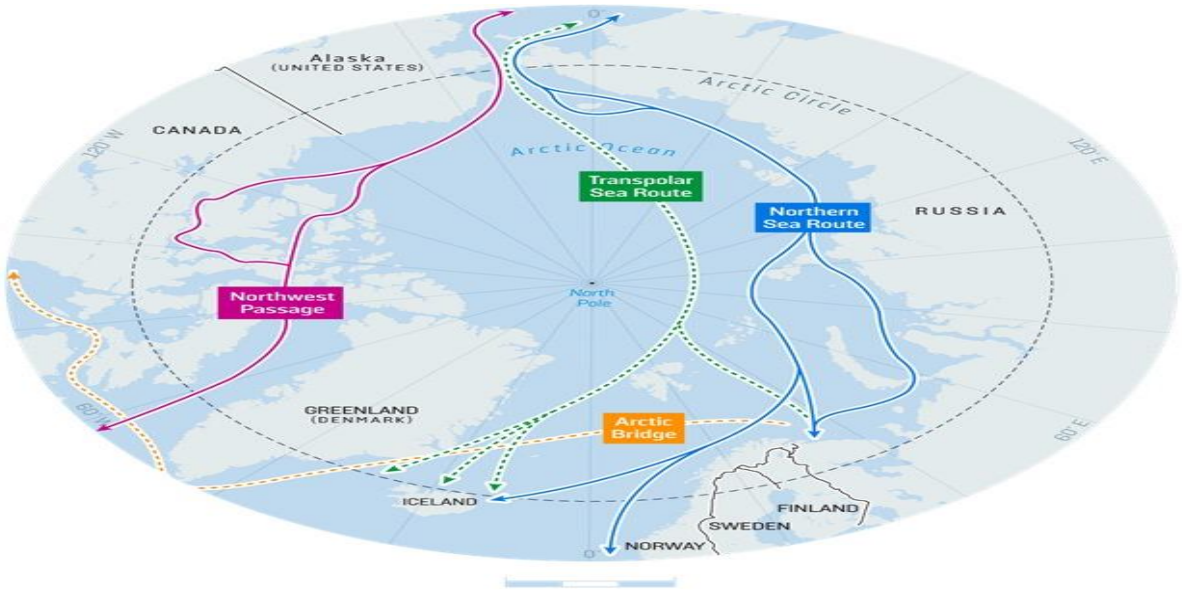
The Russian Federation and other Arctic states have developed their Arctic policy strategies, military responses, and diplomatic initiatives in the region, and established overarching and multi-faceted high-level institutional arrangements to pursue their goals and interests north of the Polar Circle. The Arctic Ocean explores how Russian security policy in the Arctic region is formulated today in the context of climate change, the region's energy and mineral resources, defense, and the exploitation of new commercial maritime shipping routes. It highlights Russia's strategic role in the Arctic region and how the country is supporting the reapers of ambitious plans in energy security and the development of the Northern Sea Route, within the matrix of today's new Sino-Russian strategic relationship, which is competition and cooperation by other means. Without a doubt, the region is a political-ecological locus for both new opportunities and possible future peril because of the implications of the vast scale of the environmental, military, and commercial challenges of such a transformational undertaking (Young, The Arctic in Play: Governance in the Arctic Ocean." 2012).

Recent scenario's:

The Impact of Climate Change on the Arctic Region:

The Arctic Ocean, with its rich hydrocarbon resources, strategic sea routes, and unique ecosystem, is identified as one of the critical geopolitical frontiers of the 21st century (AMAP 2021). The ongoing global warming has considerably accelerated the melting of the Arctic ice cover, which, in turn, has made the development of the region's subsoil resources more economically viable and increased the potential for commercial shipping through the waters of the Northern Sea Route (Piskounova 2022). However, the responses of the Arctic Ocean littoral states to this relatively recent climate change phenomenon are quite different, as is the extent of their presence in the region. Thus, the mission of this contribution is to evaluate the geopolitical role of the Arctic melting frontiers due to the impact of climate change by studying external and internal factors such as hydrocarbons and other mineral resources, transcontinental transport corridors, including strategic sea routes, and the Arctic Ocean ecosystem. The study period comprises 2020–2024, as well as 2020 and 2021, which witnessed considerable political and international law developments with respect to the pollution control issue related to the use of hydrocarbons and liquefied natural gas as a bunker fuel.

The ongoing process of climate change in the Arctic region results in the gradual regression of the ice cover in the Arctic Ocean. While this can be seen as a general global environmental concern, the primary attention of the international community is currently focused on the potentially new



legal and political order in the Arctic region, due to the fact that the melting of the ice cover is expected to result in the increasing economic potential of the subsoil resources of the Arctic seabed, as well as progressively better navigational

Trade Route's

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.paradigmshift.com.pk%2Fthe-arctic-region%2F&psig=AOvVaw0CzlchW_vUrcbCZ7BqcvSy&ust=1729223126684000&source=images&cd=vfe&

Conditions in the Arctic Ocean. It is with this factor in mind that the maritime category of the "melting frontiers" arises. A second-order energy balance feedback, which is expected to increase the Arctic warming processes, is primarily due to the decrease in albedo in the spring as snow and ice on the sea surface decrease, leading to more radiation warming the underlying dark ocean. Around 30% of the warming since the late 1970s has been attributed to albedo feedback. During the last 30 years, the Arctic has become warmer than other subequatorial regions of the world, the world climate has become more variable, extreme weather has become more intense, and the northern regions have encountered numerous climate change-induced environmental phenomena. The most substantial warming during the last 100 years was found to be in winter, while during the spring and autumn, the Arctic Sea ice coverage has manifested a significant decreasing trend (Stroeve 2018).

Environmental Concerns and Challenges:

The Arctic is a unique, fragile, and increasingly important region of the Earth, characterized by its vital environmental and climatic systems and the sometimes-extreme nature of the challenges faced by inhabitants and outsiders. However, many environmental concerns or challenges related to water inclusion in the Arctic region are encountered on a regular basis. Challenges such as climate change, the increasing exploitation of fossil fuels and other natural resources, shipping and maritime access, and the intensification of political disputes in the Arctic region, among other issues, represent a serious risk and immediate challenge for the populations as well as for the

environment, and potentially for the stability of the planet (AMAP 2021). There are many environmental challenges in the Arctic that include not only the impacts of climate change but also encompass unique physical, biological, ecological, social, economic, and cultural phenomena, which also have implications for the broader relationship among the Arctic countries, the conservation and sustainable use of the Arctic, and environmental security, legitimacy, the peaceful settlement of disputes, and peaceful cooperation in general (Berkman 2009). In short, environmental security in the Arctic is a multidimensional concept. The melting of the polar ice cap has led to new dynamics. These dynamics include maritime access to the Arctic and the possibility of exploiting resources previously unavailable due to the ice cover (Stroeve 2018).

Oil and Gas Reserves:

The potential oil resources in the Arctic exceed all the discovered fields combined, which account for only 2% of global oil reserves (USGS 2018). The portion of the Arctic, which stretches within the Russian zone of economic exploitation, shows the highest concentration of oil reserves. In the Arctic, in the exclusive economic zone of Russia, the combination of marine reserves is 1.6 times higher than the reserves of the same level of all onshore fields of the country. The energy resources in the Russian Arctic can compensate for the decrease in oil production onshore, caused by the depletion of natural deposits. Compared to the Soviet era, the potential for oil resources development has increased significantly (Henderson 2014).

Under the influence of the Russian climate policy, the global fuel policy launched by Western countries involves a phased reduction of the use of oil and gas. The strategic goal is a complete decarbonization of the economy and the switch to environmentally clean and renewable sources of energy (IEA 2021). Due to the enormous energy and raw materials capabilities of the Old World, the United States opposes it as the main producer and exporter of shale oil and shale gas in the world. At the same time, as soon as the restrictions on hydrocarbon production are lifted, the role of Russia in fuel and energy activities is unlikely to weaken; on the contrary, it may even strengthen. The development of oil reserves is being influenced by companies' interest in promising projects in the Russian sector of the Arctic. The present system of benefits and development rights, non-tax stimulation, and additional taxation tools has a positive effect on investment interest in new Arctic projects. At the same time, the readiness to invest in the development of hydrocarbon deposits is also determined, as is the case with a number of state monopolists in Russia (Piskounova, The Geopolitics of Arctic Climate Change: Resource Development and Navigational Potential 2022).

Mineral Resources:

Geologists broadly agree on which mineral deposits have the most potential in the Arctic: the various types of hydrocarbons, i.e., naturally occurring substances that are the main constituents of coal and petroleum, such as oil and gas, as well as other non-alternative energy sources, such as coal and peat, the associated elements found in some regions, such as uranium, and the rare earths found in a number of Arctic deposits. When it comes to the Arctic, one always starts with hydrocarbons. Researchers have known for over seventy years that the oil-and-gas-bearing basins of the Arctic contain the major part of the world's hydrocarbon resources (R. Smith 2023). In terms of its total gas reserves, the Arctic is the only region in Russia with any appreciable long-term export potential. The coal reserves in the Arctic make up 12% of the world's resources (Johnson 2021). According to some estimates, there are investments being made in the development of coal bed methane reserves (Peterson 2020).

The types of minerals in the Arctic that are of practical interest for further study are typically divided into traditional and new (non-traditional) resources. Traditional resources are the ones that have an established industrial and commercial base, such as raw hydrocarbons, natural gas

condensate, peat, hard coal, and rare earths. In view of the heightened interest in coal and other solid fossil-fuel deposits of the Arctic, they are considered separately as a new type of resource. Mineral oil, natural gas, and rare earths are natural resources that are in demand on the global market and that play an important role in the technological modernization of world economies. Since the onset of the Northern Sea Route's renaissance, the demand for them has been rapidly growing throughout the world (Anderson 2019). The Arctic's share of the world's petroleum resources stands at 22-25%, its share of natural gas at 36-40%, and its share of rare earths at around 20-25%. Any expansion of resource exploration and extraction activity on the Arctic shelf will definitively alter the regions' geopolitical status and the "political and information sides" of this status (Brown 2022).

Fisheries and Biodiversity:

While many Arctic nations see the early spring ice reduction in many areas of the Arctic as a clear opportunity to expand commercial fishing, growing evidence and understanding suggest otherwise. Cold ocean regions in general have lower species diversity than warm temperate zones. As a result, these cold region species are most relevant to local Northern Indigenous communities that rely on harvesting for nutrition and through the amphipod fishery that is directly linked to profitable activities including the Arctic shrimp and prawn fisheries, as well as drug discoveries from metabolites produced by these organisms (White 2020). Every year, Canadian Northern communities already pay a steep price to combat diseases linked to food insecurity that cause much hardship and ill health to these vulnerable communities (J. Taylor 2018)s. The effect of climate change-driven melting and co-occurring impacts of ocean acidification will likely forever reduce ocean life forms relevant for these community-linked economic bases. These new community economic opportunities then become either unavailable or else move further North. In the Far North, for members of these communities, it is unclear what the implications are of long, dark, cold six-month periods for survival. Shrimp was the shellfish that suffered the greatest growth due to oil development and increased services, capping out at between 113,000 and 123,000 metric tons. For the future without oil development-related changes, large increases are unlikely in the Arctic. People in Western high latitudes have a strong interest in ensuring that sensitive areas are carefully considered in sustainable ways. Non-exploitation, while safeguarding long-term harvesting benefits, is the priority (Miller 2019).

Strategic Importance of Arctic Sea Routes:

To understand the utility of the Arctic Sea routes for Russia, it is essential to outline the overall importance of these sea routes for other great powers and the U.S. in particular. The Northern Sea Route is the main gateway to the Asia-Pacific region. 60 million tons of cargo are expected to be shipped through this route by 2025. The route is characterized by a shorter distance between Asian megacities and Europe, between various Asian cities and the U.S. East Coast, and between the Americas, Europe, and the Indo-Pacific region. Due to this fact, the route is expected to reduce the cost of transporting goods between the mentioned regions and also the level of air pollution arising from shipping activities in lower latitudes, associated with the consumption of cheap, low-quality fuel (R. Smith 2023).

Just as the Northeast Passage connects the Asia-Pacific region with the Atlantic region of Europe, so the Northwest Passage connects the Atlantic region of the EU with the western part of the Asia-Pacific region, including the U.S. It is a shorter route connecting the American East Coast with Far Eastern ports. In this case, the port of Yokohama is closer to Vancouver by 750 nautical miles via the Northwest Passage than via the Strait of Malacca and the Panama Canal. Through the Northwest Passage, the journey between the U.S. East Coast and the Far Eastern ports is shorter by 780 nautical miles than the traditional route via the Strait of Malacca and the Suez Canal. This

corresponds to one-week savings in the delivery time of goods. The above geo-economic usefulness of the Arctic Sea routes shapes the strategic importance of the region and, in consequence, the significance of the U.S. confrontational policy, which is determined by its great-power rivalry with Russia and the China containment strategy (M. E. Taylor 2021).

Northern Sea Route (NSR):

NSR is becoming an area of friction. Russia considers it its internal seas. Despite all the unfriendly statements, the NSR is of interest to many. As a result of global warming, trade traffic between Europe, Asia, and the Americas is growing, which prefers the route north of the Eurasian continent (Peterson 2020). The main problems on the northern routes are posed by the northern region of Russia itself, with ports and infrastructure not ready for constant use. Equipment is not designed for continuous operation at low temperatures, annual repair work is carried out, and the training of qualified marine personnel is lagging behind. NSR icebreakers are old and do not meet modern needs. Their replacement is not foreseen in the announced list of planned measures until 2035. By the end of January 2021, for the upcoming navigation, there were no applications from cargo owners. Thus, the Russian geopolitical authorities themselves are not ready for the full operation of the NSR. The observed intensity of the use of the NSR is largely due to the subsidy policy of the Russian state and legal requirements for the carriage of hydrocarbons, as well as the desire of foreign shipping corporations to present potential customers with additional freight options (Johnson 2021). All this does not create the necessary conditions for reducing the burden on over-congested trade routes, as well as ensuring the interests of our Northern future (Green 2020).

Northwest Passage:

The main question at the heart of the dispute around the Canadian route is whether or not it is considered part of internal Canadian waters. Through the years, it has been clearly distinguished in official announcements, legal documents, negotiations, or even commercial travel between both Roosevelt and Eisenhower canals (on the West Coast) by practicing the proven principle that an international thoroughfare cannot be closed. Because these straits are international and thus outside of the internal Canadian jurisdiction, any external state vessels and ships enjoy free and innocent passage if they give Canada notification of that fact along with accurate details of their passage. In addition, warships and other ships destined for a military mission and undertaking a non-innocent passage need Canada's prior authorization (J. Miller 2023).

Canada has held quite an inestimable position and remained inflexible on the strict application of its sovereignty over the waterway of the Arctic Archipelago, but it has had quite delicate and prone periods to evolve the legal character of the Northwest Passage (White 2020). Indeed, the two easiest options for Canada to establish a modus vivendi over the Northwest route, without amending its internal waters position, were to negotiate with the USA an agreement on a transit regulation regime or to rationalize its regulations before both the changes in the legal interpretation disposing of the factions of the interests of the actors mainly involved are carried out. The former option was renounced by the government because it was anticipating the imposition of re-vote duties by the USA Congress on any agreement, essentially meaning loss of sovereignty in exchange for marginal gain (Brown 2022).

Key Players and Stakeholders:

There are a number of ways to classify key countries in the Arctic region. The most important are countries with territory and coastline in the Arctic, and countries connecting to the Arctic region. Countries with territory and coastline in the Arctic are Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden, and the United States (R. a. Smith 2022). Beyond the Arctic region, countries that connect physically, economically, or politically to the region are the

most important by geographical proximity: Iceland, the Faroe Islands, and the Svalbard archipelago. The countries connecting to the Arctic as a result of common geographical borders without an Arctic frontier are China, South Korea, and Japan, with the leading role of China (Brown 2022). Other countries inclined to establish trans-regional and multilateral relations are Estonia, Latvia, Lithuania, the United Kingdom, Germany, Poland, the Netherlands, Belgium, France, Denmark, the European Union, Singapore, and India (M. E. Taylor 2021).

Russia has taken a leading role in the region. It is one of the three countries that have military forces in the region and the only country that has insisted on its central role in the management of maritime routes (K. Anderson 2023)s. Russia has adopted strategies to support its presence and influence in the region. With the active interests of major regional players, particularly Canada, Greenland, and Russia, the Arctic is becoming an area of international cooperation and debate. The five permanent member states of the UN Security Council influence negotiations on a wide range of issues. They provide a unique opportunity to discuss issues of regional security and economic use. Other key regional stakeholders include multinational corporations and international environmental, industry, and indigenous groups. The Arctic Council is viewed as the most significant organization in the region, as formal decisions affect issues of interstate and interethnic identity. Russia operates without the presence of a general agreement on the principles of interaction (White 2020).

Arctic Council Members:

The Arctic Council members are states that legally control territory in the Arctic region and are responsible for cooperation, protection, and sustainable development according to the Arctic Council itself. During the transition from the Cold War to the next new world order, these member states were: Canada, Denmark (in respect of Greenland and the Faroe Islands), Finland, Iceland, Norway, Russia, Sweden, and the United States (M. E. Taylor 2021). In 2009, the Kingdom of Denmark, representing Greenland and the Faroe Islands, officially preferred to be called 'Denmark in respect of the Faroe Islands and Greenland'. In 2013, the Arctic Council admitted China, Japan, South Korea, Singapore, and India as observers, together with Italy representing the European Union (R. a. Smith 2022). The number of non-Arctic states and organizations as observers was then separated.

In 2017, Finland submitted an application for admission as a member state of the Arctic Council. By May 2020, the Vietnamese Foreign Ministry made an official announcement about the country's satisfaction as an official observer of the Arctic Council and expected to participate actively and contribute effectively (Brown 2022). By now, the interested observer countries are Saudi Arabia, Brazil, and Indonesia. In 2023, inviting these countries to the Arctic Circle might increase the interests of Saudi Arabia, Brazil, and Indonesia and encourage them to submit their applications to become member states of the Arctic Council at a reasonable time. Active participation and effective contribution are necessary qualifications for admission as a member state, considering what constitutes member participation and qualification in the definition of the members themselves. On the other hand, extensive international cooperation concerning the protection from risks, threats, and opportunities has asymmetrically increased awareness of Arctic states and big emerging economies. Moreover, since big emerging economies play a critical role in respect of the Arctic Ocean and climate change, Arctic states and big emerging economies have used various means to cooperate on the subject. The extension of the membership of the Arctic Council impacts the geographical scope and jurisprudence of the protection, regulation, and management of the Arctic Ocean further in the coming years (White 2020).

Non-Arctic States with Interests in the Region:

China, as the biggest power in the Pacific region, holds numerous scientific and economic interests. On this basis, it increasingly aims to take an active part in shaping the legal regime aimed at defining the model of governance of available resources. Recently, China applied for the status of permanent observer to the Arctic Council. As far as the American continent is concerned, the biggest player in regional geopolitics and economics is the United States. Their interests are related to environmental problems and the conduct of research concerning air and sea lines of communication (Institute. 2020). Among other non-Arctic states, five European countries hold Svalbard Treaty rights, with Spitsbergen as the symbolic center of their engagement in the governance of the region. Owing to its close proximity, people have spent a long time living in the vicinity of the island, even though its hinterland remains practically unexplored until the present time. These important neighbors include powerful states with interests linked to the desire to control channels between the Atlantic and Pacific Oceans and strategic military bases characterized by various legal statuses on the map of the Arctic Ocean. As a consequence of the resolution of these problems, the situation is becoming increasingly more complex. The authorities of the Principality of Monaco also signaled their interest in the region, stating their intention to take part in the Arctic Council (Council. 2013).

Geopolitical Tensions and Cooperation:

The United States, the PRC, and Russia: A Triangular Relationship The United States and Russia are the two main powers capable of polar geopolitics. They are joined by the People's Republic of China, which has decided to expand its global reach by prioritizing its national interest in the Arctic. We can identify convergence between China and Russia concerning both global governance and the need for commercial development. On the other hand, we see a Churchillian paradox from the United States towards the Arctic. It is a constant expression of interest in Arctic affairs, with attacks and complaints about anything non-Western. In general, U.S. actions consist of scurrying to defend freedom of navigation, spreading democracy, and the defense of the international legal regime, while opposing claims to nearly established political states or blocking the interests of the PRC. We consider that changes to the geopolitical criterion may still be different.

Boycott on the Arctic in recent years, events in the Arctic have led to a certain level of verbal complacency when discussing a broad region in the Arctic. A certain concept suggests that we can experience some kind of geopolitical boycott. It is at this point where our text can contribute in the demographic sense – what does the world's most significant research say about the events analyzed in this section? Since 2007, we can observe a boycott in the international context of the Arctic Council by NATO and the Atlantic bloc against the predominant consensus regarding Russia and Canada. In 2019, we saw an increase in the elements of conflict in the Arctic, and the first reasons seem eminently nationalist. Recent building events are derived or closely related to Russian national interests and have nothing to do with climate change. In addition, it is worth adding that the inflow of externalization of the category of 'geopolitical right' towards hard bases generates an acceleration of partnerships between Russian and U.S. authorities since the phase of hypersonic weapon tests by Russia and China, perhaps due to previous influence on Chinese national interests. It is interesting to note that the Permanent Military Forces – Royal Canadian Air Force, the United States Army Corps of Engineers, or the British amphibious fleet, also known as the Response Force Task Group – were involved at an advanced level in the exercises conducted in northern waters by the United States, the United Kingdom, Italy, Germany, or the Netherlands. However, the state of reservations is as follows, since the involvement of Russia, China, and partners in the Sea-Breeze exercises of July 2021 was mentioned. Official Kyiv speaks of the exercises as a

diversion from the geopolitical direction of the Western powers and associated powers, the energy and defense corporations (Institute., China and its Arctic Trajectories." 2023).

Territorial Disputes and Claims:

Canada's sovereignty over its Arctic waters and archipelago is widely recognized. In 1985, the US and Canada signed an agreement recognizing the archipelago status, and the provisions of this agreement have been incorporated into the Oceans Act and the Arctic Waters Pollution Prevention Act. Canada, however, remains to accept normal passage through the Northwest Passage, a claim countered by the US, which considers the Northwest Passage international waters. In particular, in 1985, the USCGC Polar Sea and in 1985 and 1987, the SS Manhattan showed the US objection against Canada's claims with the transit of the Northwest Passage.

The Northwest Passage is the northern water passage between the Atlantic and Pacific Oceans, and Canada considers the entire route an internal waterway because of the many islands and thick ice conditions. Section 10 of the UN Convention on the Law of the Sea prescribes the transit passage regime only for straits used for international navigation between two parts of the high seas or exclusive economic zones, with the limitation on the exercise of the right that the transit must be continuous and expeditious, and the aircraft carriers do not take action other than to maintain their seaworthiness. These limits make the Northwest Passage an archipelagic route suitable for navigation by icebreaker submarines quite challenging during July and August.

Military Presence and Security Concerns:

The central feature of the security landscape in the Arctic is that no Arctic state has, or is likely to acquire, the capacity to address security concerns in the region by itself. In the Arctic, there have been numerous exceptional agreements on enhancing cooperation to address common security challenges, as demonstrated by collaborative maritime search and rescue missions, joint military training exercises, and bilateral and multilateral military dialogues. Yet, in spite of the emphasis on the need for a cooperative approach to security challenges, the military dimensions of these emerging state policies tend to overshadow them. The new Arctic strategies announced by the Arctic states are considered a sign of these countries' growing interest in the area. The United States and Canada, on the one hand, and Russia, on the other hand, have committed to significantly upgrading their military capacities in the Arctic. Both the Canadian Department of National Defence White Paper on Defence and the Defence Strategic Policy Statement issued by the United States Department of Defense indicate that Arctic security is emerging as a key mission. Norway is also increasing its naval and air defenses in the north, announcing a new base north of the Arctic Circle, while Denmark has unveiled plans for three Weapon Storage Sites to be built before 2023, five Ultra Rapid Scan Containers to be available in 2024, and a maximum of 12 Tactical Air Defence System Activation Kits.

In 2020, public attention was attracted by the announcement of the US plan to use long-range precision weapons against Russia. This suggests that the role of the High North in the global security system is becoming more crucial. The capabilities of countries in implementing the multifaceted agreement on the Arctic are also gradually improving. Increased military activities in the region and the build-up of naval and territorial defense forces, along with enhanced military cooperation, including among Arctic Council members, may shift the overarching framework of Arctic relations to one based on defense capability. As comprehensive strategic and military guidance on national defense and security interests in the region is expected to be provided by the Defence White Paper 2024, these assumptions are made based on information coming from military policy documents, as suggestions of increased military activities in the Arctic are interdisciplinary in nature and comprise not only matters directly associated with defense, but also significant geopolitical, economic, and legal circumstances. The neglect of caution in both

scholarly research and policymaking engagement may pave the way to the militarization of the Arctic, contradicting stability and peaceful civilization building. In this context, the proactive Arctic policy being developed by the European Union, based on the promotion of multilateral governance and a rules-based international order, is increasingly necessary.

Bilateral and Multilateral Cooperation Efforts:

The Arctic states are both competing and cooperating in the region. Some key cooperative initiatives include the Arctic Environmental Protection Strategy, the BA-CA Working Group, the Arctic Council, the Encouragement of Coastal States to Discuss Management of Living Resources in Certain Parts of the Arctic Ocean, the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic, the Nordic Defense Cooperation, the Joint Development of the Shtokman Gas Condensate Field, the Convention on the Prohibition of the Export of Agricultural and Other Non-Fuel Products, the Komi Model Joint Venture to Protect Environmental Heritage of the Nenets Autonomous Area, the Arctic Military Environmental Cooperation, the International Arctic Science Committee, as well as numerous non-governmental and corporate initiatives, among others.

Recent bilateral deals include: the Novatek and CNPC Sino-Russian Arctic LNG Joint Venture; the Russian and Chinese Energy Cooperation and Investment Route into the Arctic; renewal of the Russian and Chinese Polar Code Agreement; and the Fifth Arctic Forum of International Cooperation. Recent multilateral deals include: the Korean Arctic Research Station on the Russian Arctic Research Platform; the Marine Scientific Research Center of the Korea Polar Institute; Unity of the Five; the KMI & ROSCOSMOS Rossotrudnichestvo – KIMS Project; and the Arctic Business Council and Arctic Frontiers Business Team with worldwide satellite Arctic hubs in Japan, China, Korea, the USA, and Western Europe. While mechanisms of cooperation exist, international organizations often find themselves lacking in ability to respond in the ever-changing and dynamically contested political domain in the Arctic. These limitations, in turn, limit their ability to uphold the peaceful use and strategic commons principles they strive to promote, due to gaps in holding the wide array of actors accountable for their actions in legal scope, power, and political fluency or reality enforcement.

Conclusion:

The region could become the Caribbean of the 21st century due to the temperature rise plus natural resources rush. High latitude countries are not the only ones who toy with old doctrine. In recent years the Convention on the Law of the Sea has been played with almost Kindergarten-style by the nations who now consider 4 million cubic kilometers form the outer limit of their physical territory, after their gardens. The geopolitical relevance of the Arctic region makes the current situation in the northernmost part of the world worrying; it has the potential to generate security and stability challenges, as it has received renewed attention from Arctic and non-Arctic states, as well as from a variety of non-state actors. The outlook for the future of this region is very uncertain, and one of the main factors that will define how events unfold is the rising temperatures brought about by climate change. A rise of one degree Celsius seems to have a low positive impact on several resources and strategic sea routes, but a two-degree increase is sure to have much more pronounced consequences. The target of keeping global average temperatures below two degrees, and striving to limit the increase to one and a half degrees compared to pre-industrial levels, should be reached.

It can be concluded that the Arctic region has the potential to offer serious strategic importance to a multitude of different actors, be they Arctic littoral states, including the non-Arctic members, or non-littoral states from other continents. Now that the door is open for Arctic cooperation, the challenge is surely to keep that door open for cooperation to be closer to hegemonic bilateral

relations previously mentioned. That comprises every single type of inter-state relation, both positive and negative: conflict and antagonism define how the space is distributed and define an apparent zero-sum logic; cooperation serves to find the common collective benefits to define it as an apparent positive-sum logic. Today's history is being written, and the spirit of cooperation among the different actors will define how inter-state relations will unfold in the following years.

Summary of Findings:

Arctic sea ice reached a record minimum in September and is expected to disappear during summer in the near future. The balance between positive and negative feedbacks resulting from ice loss is precarious and forms highly uncertain, driving the debate about Arctic amplification and warming. Rapid changes in the Arctic environment are viewed as threats in some quarters but as opportunities in others to exploit the region's natural resources and ease of shipping. Sea routes on the Russian side stand to open more quickly, whereas Canada anticipates full-season Northwest Passage maritime activity marginally later. Significant reductions in shipping times between Europe, Asia, and North America are anticipated but are dependent on further restrictions on ice, and the rise of shipping density is likely to be modest in the near term. Current expectations are for navigation on the Northern Sea Route to increase significantly over the next 10 years, whereas travel through the Northwest Passage will increase only marginally. Long-term predictions as to route usage are uncertain, especially as potential increased operational risks are not fully factored into short-term shipping forecasts.

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