

## Article

# Comparative Analysis of Arctic-Related Strategies at the National Level: Competition and Collaboration

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**Abstract:** The melting of ice creates favorable conditions for the development of the Arctic by elevating the Arctic's geostrategic value and stoking national competition. As a result, many states, both within and beyond the Arctic region, have recently released Arctic strategies or updated existing ones, clarifying their roles, interests, priorities, and policies for Arctic international cooperation. In this study, a database is generated with a collection of Arctic strategies from 16 states, and then grounded theory is applied to code the texts in these strategy documents. Using this code, word-frequency analysis, cross-tabulation, correlation analysis, and cooperative-network analysis are implemented to explore competition and collaboration in the Arctic among these 16 states. The results indicate that Arctic states are significantly concerned with governance, economic and social development, and security and stability, while environmental protection and scientific research are given more attention by non-Arctic states. In addition, the highest value of the Pearson correlation coefficient is identified as 0.85 for collaboration and Arctic public security affairs, which indicates that collaboration on Arctic security will dominate the development of Arctic affairs in the near future.

**Keywords:** Arctic strategy; grounded theory; comparative analysis; collaborative analysis



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## 1. Introduction

The Arctic region is warming 3–4 times as fast as the rest of the world, and the impacts of climate change and rising temperatures are felt more dramatically in the Arctic than anywhere else on the planet. There is almost a sixty-percent chance of an effectively ice-free Arctic Ocean in the 2030s, which is much earlier than the average projection obtained from global climate models [1]. As global temperatures continue to rise and sea ice continues to melt, the challenges of resource development in the Arctic are gradually diminishing, while its strategic importance is growing. The Arctic region has abundant oil and gas resources. The United States Geological Survey has assessed the area north of the Arctic Circle and concluded that the region may have approximately 30% of the world's undiscovered gas and 13% of the world's undiscovered oil. The abundant oil and gas resources in the Arctic region serve as a significant driving force for countries to prioritize their attention on the Arctic. Climate change has various impacts on human activities, including shipping industries and indigenous peoples [2]. Climate change in the Arctic led several observers, scientists, media, and government officials to consider the possibility of developing new shipping routes along Arctic routes, as these routes shorten the distance between Europe and Asia [3]. The Northern Sea Route (NSR) will reduce travel distance by approximately 40% [4–6], contributing to savings of 3–5% in fuel costs when compared to the conventional Suez Canal Route (SCR) [7].

There are risks and opportunities in the Arctic. With the advent of the post-Cold War era, the Arctic has emerged as a region for sustainable future growth, and various forms

of cooperation and conflict coexist as mutual interests between coastal states [8]. In the Arctic, indigenous peoples are again seeing their food security threatened and cultural continuity in danger of disruption [9]. Arctic climate change will have global impacts beyond the Arctic region. The higher Arctic temperatures promote thawing and erosion of the polar permafrost, which can result in the release of large amounts of carbon dioxide and methane, providing significant propulsion to global warming [10]. Increases in the global sea level due to the melting of Arctic land ice are another important impact of Arctic warming [11–13], and this ice melt is expected to weaken the ocean’s meridional overturning circulation, with implications for regional climate change and global ocean heat and carbon uptake [14]. The difference-in-difference (DID) method was utilized to estimate the influence of Russia’s Arctic policy on the development of ports along the NSR [15].

The Arctic is of great geostrategic and economic importance and attracts attention from both Arctic and non-Arctic states. Currently, numerous states have formulated policies and propositions regarding participation in Arctic governance. The Arctic policy of non-Arctic states has attracted wide attention around the world. Xinmin Ma examined China’s inaugural White Paper through the lens of international law and concluded that China’s Arctic policy is based on international law and pursues common interests [16]. Similarly, there are discrepancies in the Arctic policies released by the same states on different issues. While most non-Arctic nations have formulated only a single Arctic policy, Arctic states have developed multiple policies on the region. In addition to the Arctic strategy issued by the White House, the Department of Energy has also released its own Arctic strategy to guide its operations in the region. The initial comparative studies and analyses of Arctic strategies were published in the early 2010s [17]. Comparative analysis was conducted for the conceptual framework and key priorities of the Arctic policy of the Russian Federation and other circumpolar powers based on a study of their national Arctic strategies [18]. Kim H J aimed to analyze the Korean government’s Master Plan from both the legal and policy perspectives, as well as to make constructive comments for its improvement [19]. Weingartner K A et al. examined how the distinct styles and preferences of Presidents Obama and Trump in the US Arctic policy-making process interact with growing climate change and defence challenges in the region [20]. Some scholars have studied the Arctic strategies of several Arctic states. By utilizing conceptually informed thematic content analysis, we illustrate the creation, circulation, and utilization of resource-related affects, mainly desire, hope, pride, and denial, in shaping the Arctic resource policies of states [21].

A growing number of countries are turning their attention to the region. There has been extensive research on Arctic policy by both Arctic and non-Arctic states. In previous studies, more emphasis has been placed on Arctic policy research in individual countries, and few existing studies have addressed the allocation of attention in policy texts to a given topic and the correlations between different issues. At the same time, the current research on Arctic policy has primarily used qualitative methods, with few researchers utilizing a combination of both qualitative and quantitative approaches for the analysis of Arctic policy.

The present study mainly aims to establish an analytical framework for Arctic policies, utilizing four distinct methods, and to examine the disparities in Arctic policies between Arctic and non-Arctic states. First, the Arctic policies of 16 states, comprising 8 Arctic and 8 non-Arctic states, are coded by NVivo 12. Second, these coded data are then utilized for both qualitative and quantitative analysis. Third, key organizations and agreements referenced in the policy text are identified, a cooperation network is established, and the current state of Arctic governance cooperation is assessed. The main features of the present study are summarized as follows:

- Both qualitative and quantitative methods are used to analyze the Arctic policies of several Arctic and non-Arctic states.
- Word-frequency analysis and cross-tabulation analysis are used to identify differences in Arctic policies between Arctic and non-Arctic states.

- Correlation analysis can be used to effectively identify correlations between different Arctic policy issues.
- A cooperation network serves as a tool for investigating the present state of cooperation within the Arctic region.

The remainder of the paper is structured as follows. Section 2 provides an overview of the collected policy texts, the techniques adopted, and the related theories. Section 3 employs word-frequency analysis, cross-tabulation analysis, correlation analysis, and cooperation networks to conduct a specific examination of Arctic policy and presents the findings in a visually compelling manner. Finally, in Section 4 we present findings, recommendations, research limitations, and further directions of this research.

## 2. Materials and Methods

### 2.1. Text Selection

The texts of Arctic policy papers were collected from the official websites of each country, such as the Canadian government website “Government of Canada” and the American government website “The White House”. Due to the issuance of Arctic-related policies by many states, this study selected policy texts based on three criteria: (1) having an authoritative source, such as the Information Office of The State Council; (2) the content of the text is the overall plan of the central or federal government for the governance of the Arctic, rather than the direction on a single issue; for example, the US Department of Energy’s Arctic strategy was not included in the selected policy texts; and (3) non-Arctic states were selected from the Arctic policy database, excluding the European Union; non-Arctic states believe that they have the right to participate in Arctic affairs, and actively put forward their proposition, so the Arctic policies of non-Arctic states were included in the research scope. Based on the above three criteria, the latest Arctic policy issued by each country before May 2023 was selected. Using these criteria, 16 effective policy documents were selected for use as the basis for this analysis of Arctic policy, including both 8 Arctic states and 8 non-Arctic states (China, France, Germany, India, Italy, Japan, South Korea, and the United Kingdom), as found in Table 1.

**Table 1.** List of Arctic policies for analysis.

No.	Country	Year	Title	Arctic	Non-Arctic
S1	Canada	2019	Arctic and Northern Policy Framework	✓	
S2	China	2018	China’s Arctic Policy		✓
S3	Finland	2021	Finland’s Strategy for the Arctic Policy	✓	
S4	France	2015	Science Plan 2015–2020 of the French Arctic Initiative		✓
S5	Germany	2019	Germany’s Arctic Policy Guidelines: Assuming responsibility, creating trust, shaping the future		✓
S6	Iceland	2021	Iceland’s Policy on Matters Concerning the Arctic Region	✓	
S7	India	2022	India’s Arctic Policy		✓
S8	Italy	2015	Towards An Italian Strategy for The Arctic		✓
S9	Japan	2015	Japan’s Arctic Policy		✓
S10	Kingdom of Denmark	2011	Kingdom of Denmark Strategy for the Arctic 2011–2020	✓	
S11	Norway	2021	The Norwegian Government’s Arctic Policy	✓	
S12	Russian Federation	2020	Foundations of the Russian Federation State Policy in the Arctic for the Period up to 2035	✓	
S13	South Korea	2013	Arctic Policy of the Republic of Korea		✓
S14	Sweden	2020	Strategy for the Arctic Region	✓	
S15	United States	2022	National Strategy for The Arctic Region	✓	
S16	United Kingdom	2023	Adapting To Change UK Policy towards the Arctic		✓

## 2.2. Text Coding on the Basis of Grounded Theory

A mixture of quantitative and qualitative analysis methods was used in this study. As a professional qualitative data analysis tool, NVivo 12 is primarily used to process nonquantitative and unstructured qualitative data and output results in quantitative form. Analyzing text as data has been a significant component of policy science ever since Harold Lasswell's methodological contributions to content analysis techniques [22]. Content analysis assumes that texts are a valuable data source for revealing information about phenomena [23]. Key differences among conventional, directed, and summative approaches to content analysis center on how the initial codes are developed [24]. NVivo 12 qualitative analysis software is used to logically sort the unit of analysis and cross-analyze each dimension to explore the differences in issues of concern between Arctic and non-Arctic states.

As a top-down approach to theory construction, grounded theory was proposed by Glaser et al. in 1967 [25]. Through systematic data collection, core conceptions reflecting social phenomena can be identified, and theories can be developed by establishing connections between different concepts [26]. Since a text is made by a specific state, its semantics will inevitably reflect the ideological content of the specific position, viewpoint, value, and interest. Grounded theory emphasizes the generation of theories from data, which can be traced back to the sources. Only through in-depth analysis of the data can a theoretical framework gradually emerge.

Grounded theory is a comprehensive methodology for systematic data collection and analysis, while content analysis refers to the specific process of collecting and analyzing data under particular circumstances. The combination of these two approaches enables researchers to capture their research object from both macro and micro perspectives, as well as qualitative and quantitative dimensions. Content analysis typically involves both human coding and computer coding. In NVivo software, data are encoded through a process known as "coding", which involves assigning labels and creating categories for discrete sections or "chunks" of data within a given dataset [27]. The coding process, which categorizes text fragments into related topics and concepts, can be achieved through both automatic and manual methods in NVivo. We opt for human coding methods after collecting the policy texts due to the inability of computers to accurately identify issues related to Arctic governance within Arctic policy texts. This paper carries out sentence-by-sentence coding and obtains the frequency statistics of 16 policy texts by implementing analysis software. The specific research methods of this paper start by selecting the policy texts of Arctic and non-Arctic countries that have released Arctic policies or strategies; a total of 16 of the latest policy texts released by May 2023 are selected and imported into NVivo 12 software. Second, based on grounded theory, nodes are formed after detailed reading of the text content, and a total of 49 nodes are formed in the initial coding process. Then, the correlation of these 49 nodes is investigated, and the nodes involving repeated or similar issues are merged. Finally, 20 free nodes and 6 tree nodes are formed, creating 5404 reference points for 16 policies; specific nodes and examples are shown in Table 2. Next, the encoded policy text is analyzed, including word-frequency analysis, cross-analysis, and correlation analysis, using Gephi to establish a collaborative network. Finally, the research results are explained, summarized, and verified with the actual situation to obtain the corresponding conclusions. After encoding the content of the Arctic policy text, the software can be utilized to visualize the encoded results, such as generating charts and word clouds. This enables an in-depth analysis of correlations between different themes and concepts, facilitating a comparative study of similarities and differences among Arctic policies published by Arctic and non-Arctic states.

**Table 2.** Example of the text-coding node.

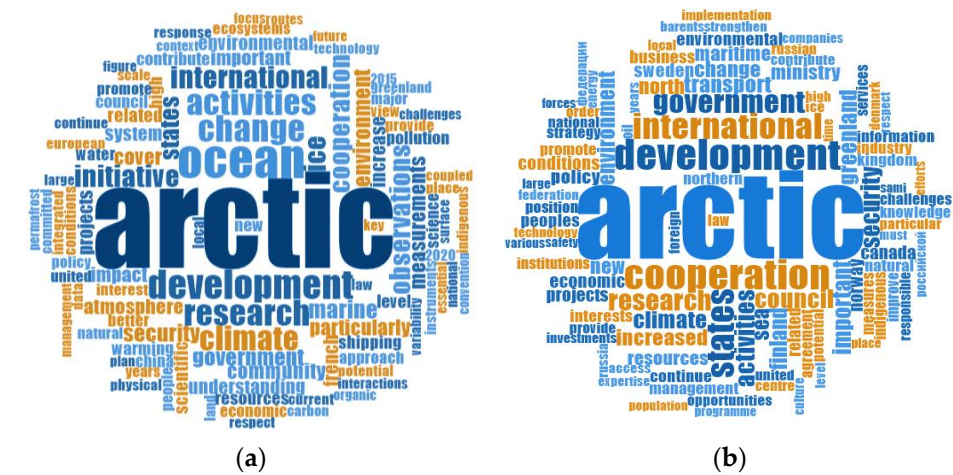
The Example of Nodes	Free Nodes		Tree Nodes	
"The Charter of the United Nations, the United Nations Convention on the Law of the Sea (UNCLOS), the Spitsbergen Treaty, and other treaties and general international law govern Arctic affairs at present."	Legal framework	A1	Governance	A
"The most important dialogue forum on this issue as far as the Arctic is concerned is represented by Arctic Council."	Governance mechanism	A2		
"Participating actively in Arctic governance and international cooperation."	Cooperation	A3		
"Climate change poses an existential threat to the Arctic as we know it, with the region experiencing warming at four times the global average."	Climate change	B1	Environment concerns	B
"We will pursue these potential opportunities, while also protecting the environment."	Environment protection	B2		
"On this basis, we can anticipate greater pressure on the Arctic ecosystems and fragile biodiversity."	Biodiversity	B3		
"Russia assesses that melting sea ice will provide it with considerable economic and development opportunities but will further expose its northern flank, increasing naval activity and volumes of maritime traffic in the region, including along the Northern Sea Route."	Sea routes	C1	Utilization of resources	C
"The exploitation of living marine resources is one of the essential economic factors in both Greenland and the Faroe Islands."	Living resources	C2		
"In no area is this more critical than in oil and gas development."	Minerals and oil and gas	C3		
"Arctic tourism is an emerging industry, and China is a source of tourists to the Arctic."	Tourism	C4		
"We will continue to be a leading producer of Arctic science and an active partner in international research collaborations, including to contribute to global understanding of climate change."	Science-related research	D1	Scientific research	D
"The UK, through NERC, maintain research vessel and vehicles capable of supporting Arctic research activities."	Engineering-related research	D2		
"To protect the environment in the Arctic, and protect the ancient lands and traditional way of life of indigenous minorities."	Indigenous peoples	E1	Economic and social development	E
"Sustainable economic development and business interests."	Business development	E2		
"The importance of digital health care, social and other well-being services is emphasized due to the long distance and the unavailability of health care personal."	Communal services	E3		
"The sharing of major oceanographic infrastructure will contribute to the further internationalization of the Italian oceanographic research in the Arctic."	Infrastructures	E4		
"In our Arctic foreign policy, the first and most important pillar towards recognizing the potential of Canada's Arctic is the exercise of our sovereignty over the Far North."	Sovereignty	F1	Security and stability	F
"It will explain how the UK will strengthen our security and resilience, and bolster our work."	National Security and significance	F2		
"Addressing Arctic governance and related emerging issues, such as public safety."	Public security	F3		
"Ensuring the military security of the Russian Federation."	Military	F4		

### 3. Results and Discussion

#### 3.1. Word-Frequency Analysis

In text analysis, at the core of most common content analysis techniques lies the frequency distribution of individual words [28]. Due to the different policy issues concerning Arctic and non-Arctic countries, the word frequency of policy texts is different. By utilizing NVivo 12 to conduct word-frequency statistics on policy texts from Arctic and non-Arctic states, we set the words displayed to 100 and the minimum length to 2, and we set groupings as synonyms. Upon executing the query, we identified certain insignificant terms

that were subsequently incorporated into our stop words list; the resulting word cloud was then exported, and then we weighed words by their rarity in the text set [29]. We generated word clouds to summarize the similarities and differences between the Arctic and non-Arctic regions, as shown in Figure 1.



**Figure 1.** High-frequency word cloud analysis. (a) For Arctic states. (b) For non-Arctic states.

By combining the word cloud with the original text, the following commonalities of the Arctic policy texts of the Arctic states and non-Arctic states are explained. The high frequency of certain words, such as “climate”, “change”, and “environment”, appearing in the Arctic policy texts of both Arctic states and non-Arctic states shows that both Arctic and non-Arctic states show a high degree of common concern about Arctic climate change and environmental protection. The frequent appearance of “international” and “cooperation” indicates that both Arctic and non-Arctic states are seeking international cooperation or joint governance in the Arctic region. The frequent appearance of “research” in both Arctic and non-Arctic policies indicates that both Arctic and non-Arctic states are demonstrating a keen interest in the realm of Arctic scientific research. At the same time, differences between the Arctic policy of Arctic and non-Arctic states can also be found. “Community” and “people” are more prevalent in the policy texts of Arctic states than in those of non-Arctic states, which shows that Arctic states are far more concerned about Arctic security and indigenous peoples than non-Arctic states. The frequent appearance of “security” appears in both Arctic and non-Arctic policies, but the proportion of this word in the policy texts of Arctic states is significantly higher than that of non-Arctic states.

### 3.2. Cross-Tabulation Analysis

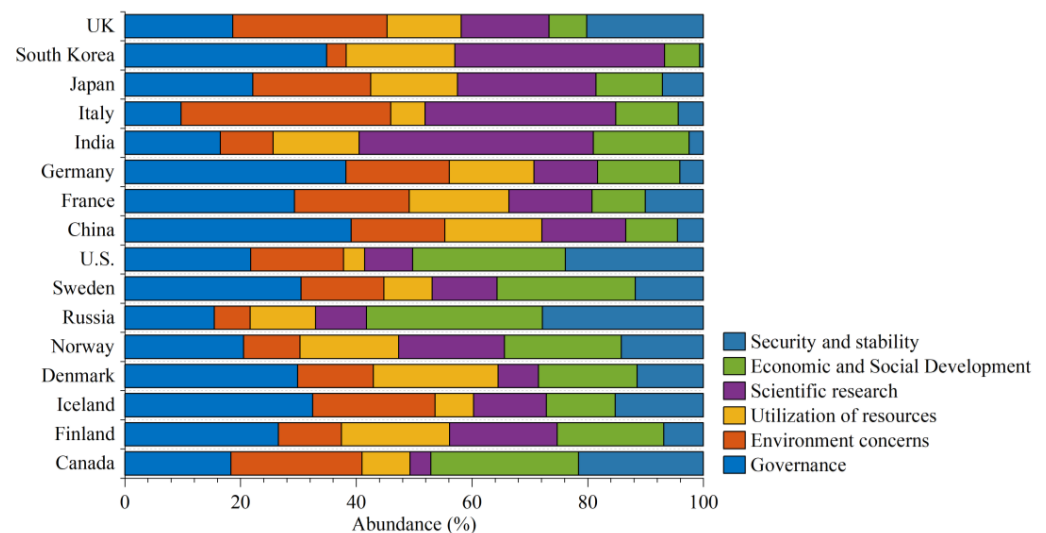
Bounded rationality suggests that decision-makers must prioritize information from various sources. Therefore, any attention to a policy area is considered a valuable time for the withdrawal from other policy areas [30]. Different countries pay different amounts of attention to the issues of Arctic governance. When formulating Arctic policies, countries must comprehensively consider the effects of politics, economics, society, the environment, and international relations. Due to varying performances in these areas among different nations, Arctic and non-Arctic countries must approach distinct policy issues with discretion under the influence of resultant factors. Although Arctic and non-Arctic states prioritize different issues related to the Arctic based on their respective national conditions, they share a common interest in addressing these issues as a whole. NVivo software used the coding framework to run coding queries and cross-tabulations for comparison of the difference in the issue of concern between Arctic and non-Arctic states.

According to Figure 2, there is no significant difference in the level of attention given to Arctic governance issues between Arctic and non-Arctic states. However, variations still exist in terms of the specific matters they focus on. Arctic states, including Russia, the

United States, Canada, Denmark, Finland, Iceland, Norway, and Sweden, are primarily concerned with issues related to sovereignty and resource management in the region. Under the current Arctic governance framework, the Nordic states have primarily strengthened their influence through multilateral cooperative institutions and actively advocated for the enhancement of Arctic governance mechanisms. Their main objective is to safeguard their rights over natural resources such as oil, gas, and fish stocks in the Arctic while also ensuring that they have a say in how the region is governed. The Arctic nations hope to hold a prominent position within the current framework of Arctic governance, emphasizing their status as sovereign states with jurisdiction over the region and remaining vigilant against non-Arctic states seeking to participate in Arctic governance. The Arctic regional mechanism includes a variety of actors, including not only state actors such as the eight Arctic states and non-Arctic states but also nonstate actors such as intergovernmental, interparliamentary, global, regional, nongovernmental, and indigenous groups. Arctic governance involves a range of regional institutions and forms, as well as global conventions and agreements, in which the Arctic states hold significant sway. The Arctic Council is considered the most important of the Arctic institutions and forums [31]; together with Finland, Sweden, and Iceland, the five Arctic states hold a prominent position in the decision-making process regarding Arctic affairs through the Arctic Council, which serves as the most significant cooperative forum within this region [32]. Similarly, the Arctic Council has established eligibility criteria for non-Arctic states to participate in Council deliberations. The main means of participation for observer states on the Arctic Council are through the contribution of expertise to the working groups. In political and academic circles, the growing involvement of non-Arctic actors in regional affairs, particularly from across Asia, has raised a great deal of suspicion about the intentions or hidden agendas of these actors [33]. India aims to enhance its involvement in Arctic affairs, deepen its comprehension of international law and the geopolitics of the region, and strengthen its governance capacity in the Indian Arctic area as a strategic objective. Non-Arctic states aim to enhance the legitimacy of their activities in the Arctic region by complying with international regulations and strengthening their influence within the Arctic governance framework. Non-Arctic states enhance their Arctic cooperation by establishing cooperative partnerships with Arctic states and engaging in comprehensive exchanges and collaboration with them on issues related to Arctic governance. The Central Arctic Ocean (CAO) has gained increasing attention since the signing of an agreement in October 2018 by representatives from five Arctic coastal states, four other states, and the European Union to Prevent Unregulated High Seas Fisheries. The signing of this agreement is considered a paradigmatic example of cooperation between Arctic and non-Arctic states. Due to the Arctic states' exclusivity in governing the Arctic, non-Arctic states mainly focus on Arctic governance issues through cooperation with the Arctic states. China has actively participated in Arctic shipping governance through extensive international cooperation at both global and regional levels [34]. Given their shared geographical location, political status, cultural traditions, and industrial bases, China, Japan, and South Korea are presented with similar policy options regarding participation in Arctic governance.

Arctic environmental protection is a shared concern among Arctic and non-Arctic states; however, the allocation of attention of Arctic states to environmental issues is much greater than that of non-Arctic states. There has been progress in safeguarding the Arctic Ocean through collaborative efforts among Arctic states and positive advancements within international organizations, particularly the International Maritime Organization [35]. The Arctic climate is changing rapidly, with widespread impacts on natural and social systems [36]. In the White House Arctic Strategy released in October 2022, National Strategy for the Arctic Region, the United States listed climate change and environmental protection as one of the four pillars of US Arctic activities. The White House has clearly stated that the new Arctic strategy aims to address climate change and guide new investments in sustainable development, with a dual focus on improving the livelihoods of indigenous peoples in the Arctic and protecting the environment. In its Arctic policy document, Russia

has proposed eight key objectives for environmental protection, including safeguarding endangered species, optimizing environmental monitoring systems, utilizing indigenous resources, and preventing infectious pathogens and radioactive materials from entering the region. The Arctic states prioritize environmental concerns, including enhancing ecological and environmental protection measures, addressing climate change, safeguarding biodiversity, preventing biological invasions, mitigating environmental harm, attending to ecosystem fragility, and averting oil spills and hazardous substance leaks. Russia, Canada, Norway, Denmark, Iceland, and other Arctic Circle states possess territories or maritime areas within the Arctic Circle. These nations exhibit a more profound comprehension of the Arctic environment, and climate change in this region will have a direct impact on the survival and development of the residents of these nations. The sensitive environment and the weak resilience of Arctic marine ecosystems to human activities is a challenge that is the responsibility of all potential economic players. Non-Arctic states' concerns in Arctic governance primarily center on the potential negative consequences of melting Arctic ice caps in the context of global temperature rise, including increased natural disasters, rising sea levels, and ecological and food security threats. Non-Arctic states can participate in Arctic governance primarily by becoming members of the Arctic Council or other cooperative organizations, engaging in scientific research to provide a basis for environmental protection, offering technical and financial support, and participating in international negotiations on climate change.



**Figure 2.** Distribution of attention to Arctic governance issues of the 16 states. Note: this figure of data was obtained from NVivo 12 and drawn using Origin 2021.

Melting polar ice has led to competing claims over access to Arctic resources. Arctic states have stronger claims to the Arctic's resources. Regarding the ownership of the NSR, Russia maintains that most of the straits within it should be classified as its "internal waters" and asserts jurisdiction over them; it also stipulates that both domestic and foreign vessels passing through these straits must comply with Russian domestic law [37,38]. Canada considers the Northwest Passage to be a combination of its internal and territorial waterways [39]. The Arctic region holds significant economic potential for Russia, and Russia is increasing its investment in the NSR to enhance its commercial viability. Conversely, Canada currently lacks sufficient infrastructure in the Arctic region and therefore cannot support commercial traffic through the Northwest Passage, which is not currently suitable for commercial traffic. China, Japan, South Korea, and other non-Arctic nations have all expressed their willingness to fully leverage their own scientific and technological capabilities to promote international cooperation on Arctic affairs as well as the development and utilization of Arctic shipping routes in an orderly manner. As the country with



the longest Arctic coastline, Russia has implemented a series of policies and guidelines aimed at developing the Arctic region and revitalizing the NSR [15]. The US has explicitly stated that both routes are recognized as international shipping routes. In July 2008, the US Geological Survey released an assessment that estimated that the Arctic region contained up to 650 billion barrels of natural gas, including 41.2 billion barrels of undiscovered resources. This represents approximately 13% of the world's remaining undiscovered oil reserves and approximately 30% of its natural gas reserves. Approximately 84% of these resources are under the ocean and break down as follows: Russia (52%), the US (20%), Norway (12%), Denmark (11%), and Canada (5%) (France, 2016). In addition to rich oil and gas deposits, the Arctic region also contains other mineral resources. Greenland is rich in mineral deposits, including zinc, copper, nickel, gold, diamonds, and platinum group metals. Additionally, it possesses significant reserves of critical minerals such as rare earth elements, estimated at 25% of the global total. Non-Arctic states primarily prioritize the exploitation of minerals, oil, and gas, as well as sea routes within the Arctic region, which are intended to occur while taking into full consideration the fragile ecological environment of the Arctic region and ensuring adherence to both the rule of law and international peace. Italy recognizes that, given the fragile environmental conditions of the Arctic, ensuring the highest standards of operational safety and environmental protection remains a necessary condition, which implies substantial investment and the widespread application of cutting-edge technology. Both Arctic and non-Arctic states have expressed significant concerns regarding environmental protection in the Arctic region and have proposed various measures and policies to promote a balance between resource exploitation and environmental conservation in this area. Non-Arctic states enhance international cooperation, promote low-carbon economic development, and take measured steps to exploit Arctic resources while respecting the environment and ecosystem of the region. The realization of Russia's strategic objective in geopolitics, economic development of the northern territories, and increased production of hydrocarbon and other mineral resources are closely linked to Arctic development [40].

Scientific research in the Arctic region, conducted by both Arctic and non-Arctic states, can be placed into two categories. The first category aims to provide better information for national activities and priorities, while the second focuses on joint research to enhance our understanding of Arctic climate change and its physical as well as biological impacts [41]. Science diplomacy provides a shared platform for international cooperation and collaboration in addressing global challenges at the intersection of foreign policy and science [42]. From the perspective of attention allocation in Arctic policies, non-Arctic states significantly contribute to Arctic scientific research. Non-Arctic states seek to use scientific research as a viable means of participation in Arctic affairs. However, this does not imply that Arctic states lack funds and energy for scientific research, and the most active states in Arctic global scientific research are the US, Canada, the UK, Norway, and Germany [43]. Arctic states invest more money and energy in Arctic scientific research than non-Arctic states. Research and science may be the driving forces for states to engage in political cooperation. In the realm of scientific inquiry, Arctic states primarily concentrate on climate change, ecological preservation, infrastructure expansion, and the advancement of indigenous health and development. In 2017, the Arctic states signed the legally binding Agreement on Enhancing International Arctic Scientific Cooperation with the same framework as the Arctic Council, and the Arctic states remain the primary actors in shaping the agreement, while the participation and influence of nonagreement stakeholders on Arctic governance are relatively limited despite their unrestricted involvement. Non-Arctic states aspire to collaborate with Arctic states in scientific research within the Arctic region, jointly striving to enhance the capacity for scientific exploration and research, fortify the construction and maintenance of scientific support platforms, and promote equipment development for Arctic scientific exploration.

Arctic states aim to utilize the abundant natural resources of the Arctic for commercial purposes and foster sustainable economic growth in the region by prioritizing the provision

of housing, education, health care, employment opportunities, and other public services for the indigenous peoples. In terms of economic development, Arctic states are increasing investments in the exploitation of Arctic resources, promoting forestry, biology, and agriculture through the development of raw materials and products. Additionally, they are encouraging the growth of tourism and traditional handicraft industries in the region to achieve sustainable development. Arctic states have prioritized the social development of indigenous peoples by focusing on health care, education, housing, conditions, and community infrastructure. While Arctic states have a more direct interest in the economic and social development of the Arctic region due to their territorial presence, non-Arctic states also express concern regarding such development. All non-Arctic states are concerned about the current or future economic benefits of an increasingly accessible Arctic, particularly for the fishing industry. They also seek to participate in cutting-edge scientific research related to climate change and may wish to influence regional environmental policy, enhance environmental protection measures, or assess the impact of Arctic environmental changes on their respective territories. As evidenced by their Arctic policies, non-Arctic states exhibit varying degrees of attention towards environmental protection in the region. However, it can be generally acknowledged that they all recognize the significance of safeguarding the Arctic environment. Non-Arctic states have engaged in Arctic environmental governance through international treaties and national legislation, augmented their research on the Arctic environment, and enhanced collaboration with other nations to safeguard the ecological integrity of the Arctic region. The Arctic's inhabitants rely on a fragile ecosystem and economy that is highly vulnerable to industrial activities, pollution, and climate change [44].

Arctic and non-Arctic states are paying close attention to the security and stability of the Arctic region. The Arctic states claim sovereignty over the Arctic region, while non-Arctic states regard the Arctic as a region open to all countries. In 2008, the five Arctic littoral states (Canada, Denmark, Norway, Russia, and the US) convened a meeting in Ilulissat and issued the Ilulissat Declaration, emphasizing the sovereignty and jurisdiction of these states over the Arctic region [45]. Russia, the US, and Canada all prioritize Arctic security in their respective Arctic policies. Due to historical factors, Russia and the US have been deploying military forces in the Arctic region since the beginning of the last century to safeguard their national territorial security. For example, in the National Strategy for the Arctic Region (2022) the United States acknowledges that it faces significant security challenges in the region, including military and security challenges as well as risks associated with climate change. Currently, Canada is reducing its reliance on the US for security and demonstrating a growing trend towards independence and autonomy in its Arctic policy as it strengthens its military capabilities. However, there are certain distinctions: the Arctic states are confronted with military and climatic threats primarily due to their geographical location, and a portion of land territory is situated within the Arctic Circle. The Arctic is the natural domain for submarine operations, and submarines deployed in the Arctic Ocean can target any location within the Northern Hemisphere without requiring extended-range capabilities. With the development of resources and the economy in the region, the fragile ecological environment of the Arctic is under threat, such as from oil spills, as well as the increased risk of military conflict due to the region's strategic importance. Non-Arctic states are not involved in territorial disputes in the Arctic region; hence, the apprehension regarding security and stability in the Arctic stems from two primary factors: the sustainable exploitation of industries, such as fishing, oil, and gas, and the maintenance of sea routes. Both factors need a secure and stable political and social environment. In general, non-Arctic states are mainly concerned with public security in the Arctic. In contrast to other non-Arctic states, Britain and France, as North Atlantic Treaty Organization (NATO) members and US allies, place a significantly greater emphasis on Arctic security concerns than their counterparts. The UK is geographically located in Europe and close to the Arctic. The UK is committed to its status as a member of the Arctic Security Forces Roundtable (ASFR), utilizing this platform to exchange information on

the changing environment in the Arctic, conflict mitigation efforts, and opportunities for further collaboration. France's armed forces must remain able to use the Arctic Ocean for transit of its naval and air force and, potentially, for naval air force operations. The White Paper on German Security Policy and the Future of the Bundeswehr published by the German government in 2016 states that the development of the Arctic region will affect Germany's security interests. Other non-Arctic states place greater emphasis on environmental and ecological protection in the Arctic region, especially in the context of climate change. Most non-Arctic states are geographically distant from the Arctic, and their security concerns are primarily about domestic and regional issues.

### 3.3. Correlation Analysis

Through the aforementioned research and analysis, this study examines and identifies Arctic policy issues while exploring the interconnections between various Arctic affairs. For instance, countries are concerned about the availability of natural resources due to rising temperatures; however, exploiting these resources could also have a detrimental impact on the fragile ecological environment of the Arctic. The implementation of oil and gas projects in the Arctic is characterized by adverse environmental impacts, leading to a disturbance of the ecological balance of this fragile ecosystem, which ultimately affects its stability [46]. There is also a correlation between scientific research on the Arctic and Arctic defence. In 2016, the General Directorate for International Relations and Strategic Affairs of the French Ministry of Defence commissioned the French Foundation for Strategic Studies to conduct an ongoing research project called "Arctic Detection" in conjunction with France's Arctic Roadmap. This project provides the Ministry of Defence with more targeted and specialized information on the Arctic. Based on the above considerations, NVivo software was utilized in this study to analyze the associations between coded nodes. NVivo is utilized to conduct node-clustering analysis, which involves grouping selected codes and cases that contain common words. The Pearson correlation coefficient is a statistical measure used to assess the linear relationship between two variables. It quantifies the degree of association between them, with values ranging from -1 to 1. The strength of the correlation between variables is positively associated with the absolute value of Pearson's coefficient, which approaches 1 when the correlation is stronger and approaches 0 when the correlation is weaker. In general, a correlation with an absolute value of (0.8, 1) is considered a strong correlation; (0.6, 0.8) is also considered a strong correlation; (0.4, 0.6) indicates a moderate correlation; and (0.2, 0.4) suggests a weak association. The specific calculation process is as follows:

To mathematically describe the node-clustering Pearson analysis process in NVivo, it is necessary to understand several related concepts. We suppose there are  $n$  nodes, and each node has  $m$  attributes. First, we need to calculate the Pearson correlation coefficient between each pair of nodes. Assuming that the correlation coefficient between node  $i$  and node  $j$  is  $r_{i,j}$ , his calculation formula is (1).

$$r_{i,j} = \frac{\sum_{k=1}^m (x_{i,k} - \bar{x}_i)(x_{j,k} - \bar{x}_j)}{\sqrt{\sum_{k=1}^m (x_{i,k} - \bar{x}_i)^2} \sqrt{\sum_{k=1}^m (x_{j,k} - \bar{x}_j)^2}} \quad (1)$$

$x_{i,k}$  represents the value of node  $i$  on attribute  $k$ , and  $\bar{x}_i$  represents the average value of node  $i$  on all attributes. This formula can be understood as calculating the similarity between two vectors.

Next, we arrange all the correlation coefficients between nodes into an  $n \times n$  matrix  $\mathbf{R}$ , where  $\mathbf{R}(i, j) = r_{i,j}$ . Then, we want to divide the nodes into several groups so that the similarity between the nodes within the same group is as high as possible, and the similarity between different groups is as low as possible. This can be achieved through clustering algorithms, and NVivo uses a hierarchical clustering algorithm. Specifically, the hierarchical

clustering algorithm starts by counting each node as a separate group and then merges groups with the highest similarity into a new group over repeated calculations until all nodes are classified into one group. When merging groups, we need to calculate the average similarity between all nodes in the two groups; that is, use the above formula to calculate the average value of these correlation coefficients. We suppose that in a certain merge, Group *A* and Group *B* turn into a new Group *C*; then, the similarity between node *i* and node *j* in Group *C* is expressed by (2):

$$r_{ij}^{(C)} = \frac{|A|r_{ij}^{(A)} + |B|r_{ij}^{(B)}}{|A| + |B|} \quad (2)$$

Here,  $|A|$  represents the number of nodes in Group *A*, and  $r_{ij}^{(C)}$  represents the correlation coefficient between node *i* and node *j* in Group *A*. This formula is equivalent to taking a weighted average of the similarity between the two groups according to their size. Finally, we obtain a dendrogram, which is a tree-like diagram. Based on the structure of the dendrogram, nodes can be divided into several different groups. These groups are the node-clustering results we need.

Figure 3 is drawn according to the tabulated data generated by NVivo by comparing each encoded node and the coding cluster analysis. The correlation between nodes was determined through word matching and represented by the Pearson correlation coefficient. Figure 3 demonstrates a strong correlation between governance mechanisms (A2), cooperation (A3), and public security (F3). Additionally, there is a significant correlation between governance mechanisms and cooperation, and the Pearson correlation between them exceeds 0.8 in value. The governance of marine affairs is intricately linked to resource exploitation, shipping operations, environmental concerns, and scientific research [41]. The Arctic governance mechanism provides a normative and legal framework for international and organizational collaboration, while also functioning as a cooperative system to some extent. The interdependence between the Arctic governance mechanism and cooperation is crucial for the sustainable development of the region. Only through a normative framework can all stakeholders engage in more effective collaboration to achieve resource allotment, environmental protection, and sustainable utilization. Public security concerns in the Arctic region encompass a range of issues, including climate change, marine pollution, navigation safety, and military security. Addressing these challenges requires collaborative efforts from both Arctic and non-Arctic states within the framework of Arctic governance mechanisms. In terms of commercial development (E2) and resource development, the correlations among sea routes (C1), living resources (C2), minerals, and oil and gas (C3) are greater than 0.6, indicating a strong correlation. The Arctic region has seen a surge in international interest and economic activity primarily focused on capital-intensive industries such as shipping, oil and gas extraction, and fishing [47]. First, for the Arctic states, the exploitation of Arctic resources can promote local economic development. The exploitation of oil, natural gas, and other resources typically necessitates significant capital investment and technological expertise (D1, D2), thereby generating substantial employment opportunities and economic benefits. Additionally, the development of resources will facilitate the growth of related industries such as construction and transportation, thereby establishing a complete industrial chain, which will also help accelerate economic development in the Arctic.

There is also a strong correlation between public security and economic and social development, scientific research, environmental protection, and Arctic governance. The establishment of a stable and secure public environment serves as the foundation for the development of other related issues. Only within a relatively stable and harmonious context can research on Arctic-related topics be conducted steadily, particularly in light of the Russia–Ukraine conflict. The peaceful relations in the High North have been threatened by increasing military competition between Russia and Western Arctic powers since the annexation of Crimea by Russia in 2014 [48]. On 3 March 2022, seven Arctic states other

than Russia made an unprecedented announcement to “discontinue their participation in any meetings of the Arctic Council and its subsidiary bodies”. A secure and stable environment is crucial for research to thrive, as it enables scientists to focus on exploring new frontiers of knowledge and driving progress and innovation in science and technology. In addition, public safety is crucial to environmental protection. The establishment of a robust public security system can effectively prevent various illegal and criminal activities, reduce environmental pollution and natural resource waste, and ensure sustainable development of the environment. Public security is also a crucial aspect of Arctic governance. The presence of security threats, such as piracy and terrorism, could jeopardize regional stability and development in the Arctic. Therefore, enhancing the public security system is an imperative task for Arctic governance.

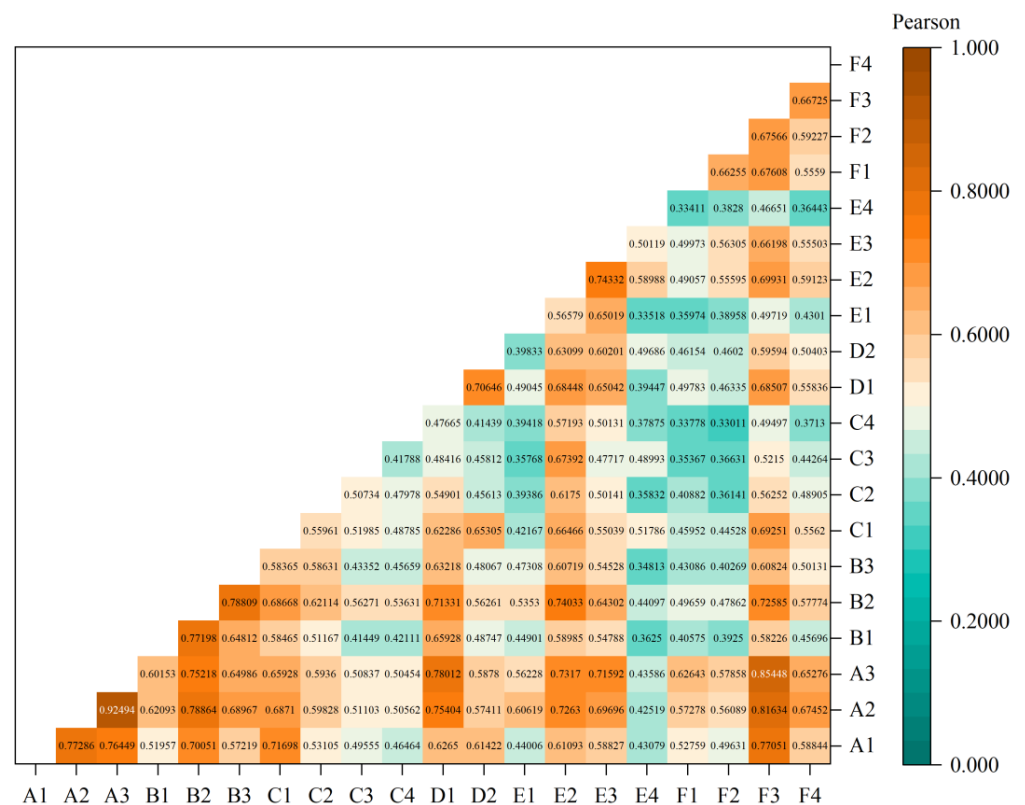


Figure 3. Pearson correlation analysis. Note: this figure of data was obtained from NVivo 12 and drawn using Origin 2021.

Apart from the robust correlation among various issues, some feeble associations were also detected. For instance, while there exists a robust correlation between the military and matters about security and stability, its association with environmental conservation, resource exploration, and exploitation as well as scientific expedition is relatively weak. There is a weak correlation between military issues and other issues, mainly for the following reasons. First, Arctic military security is predominantly focused on matters of national security and territorial integrity, whereas resource development pertains mainly to economic benefits and resource management. These two domains possess distinct objectives and tasks, thereby resulting in their relatively weak interdependence. Second, the military and resource development approaches in the Arctic differ significantly. Military operations typically necessitate the use of weaponry, military technology and equipment, and other means, whereas resource development primarily centers on scientific and technological research and development, resource exploration, industrial production, and commercial marketing. These divergent methods also result in a relatively weak correlation between them.

Given that the Arctic is a vast geographical expanse spanning multiple national jurisdictions and maritime areas, including those on the high seas, it is imperative to adopt a regionally coordinated approach to governance [49]. There is a high degree of correlation between different issues in the Arctic policies, which requires cooperation between Arctic and non-Arctic states. The various issues about the Arctic are highly interconnected and cannot be addressed in isolation. Therefore, effective measures must be taken to tackle these challenges by considering all relevant factors. Different Arctic governance issues are mutually reinforcing and complementary, without any one issue being superior to the others.

### 3.4. Cooperation Network

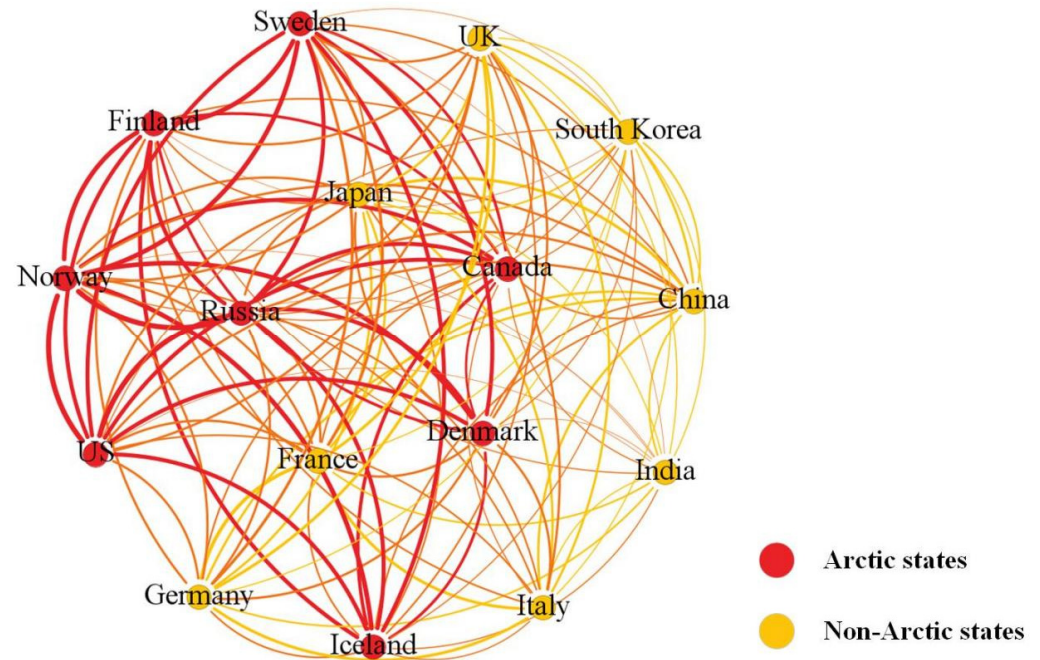
The Arctic governance cooperation network comprises a multitude of member states, including Arctic coastal states, international organizations, indigenous organizations, and other stakeholders. This study only discusses the collaborative relationships among eight Arctic and eight non-Arctic states in matters about the Arctic region. Cooperation related to the Arctic covers a wide range of topics, such as climate change, sea route governance, and environmental protection. Table 3 presents some of the Arctic-related organizations and agreements referenced in Arctic policy documents. Climate change is the primary driver of Arctic cooperation, and the forces of climate change and globalization are transforming the Arctic, tightening the links between this seemingly remote region and the world at large concerning matters of environmental protection, sustainable development, and the pursuit of peace [50]. All Arctic stakeholders hope to work together to address the issues caused by Arctic warming.

**Table 3.** Cooperation organization related to the Arctic.

No.	Cooperation Organization	The Contracting States
1	Founding member of the Arctic Council	US, Russia, Canada, Norway, Iceland, Finland, Sweden, Iceland
2	European Union (EU)	Denmark, Sweden, France, Germany, Italy
3	Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean	US, Russia, Canada, Denmark, Norway, Iceland, China, Japan, South Korea, EU
4	Ilulissat Declaration	US, Russia, Canada, Denmark, Norway
5	United Nations Convention on the Law of the Sea (DOALOS)	Canada, China, Finland, France, Germany, Iceland, India, Italy, Japan, Denmark, Norway, Russia, South Korea, Sweden, UK
6	Nordic Council	Denmark, Finland, Iceland, Norway, Sweden
7	Arctic Council observer	France, Germany, Italy, Japan, China, India, South Korea, UK
8	Arctic Council member states	Canada, China, Finland, France, Germany, Iceland, India, Italy, Japan, UK, Norway, Russia, South Korea, Sweden, US, UK
9	The Svalbard Treaty	US, UK, Denmark, France, Italy, Japan, Norway, Sweden, China, Finland, Russia, Germany
10	The United Nations Charter	Canada, China, Finland, France, Germany, Iceland, India, Italy, Japan, UK, Norway, Russia, South Korea, Sweden, US, UK
11	The International Arctic Science Committee	Canada, Denmark, Finland, Iceland, Norway, Sweden, Russia, US, France, Germany, Italy, Japan, UK, China
12	The Arctic Security Forces Roundtable	Canada, Denmark, Finland, Iceland, Norway, Sweden, Russia, US, France, Germany, UK
13	The Barents Euro-Arctic Council	Denmark, Finland, Iceland, Norway, Russia, Sweden
14	The Arctic Coast Guard Forum	US, Russia, Canada, Norway, Iceland, Finland, Sweden, Iceland

Establishing a cooperative network through the organizations and cooperative agreements collected in Table 3, we present organizations and agreements in Figure 4 as sides and the 16 countries as nodes. The cooperative relationship between states in Arctic affairs is determined by their membership in the same organization or as signatories to an

agreement, with a degree of cooperation denoted as 1. If two or more countries belong to multiple organizations or have cosigned multiple agreements, their level of cooperation is summarized. The bolder lines indicate a greater degree of cooperation between the two countries in Arctic affairs, as shown in Figure 4.



**Figure 4.** National cooperation network of the Arctic. Note: this figure of data was obtained from NVivo 12 and drawn using Gephi.

As depicted in the diagram, the lines representing cooperation among Arctic states are noticeably bolder, indicating a higher level of collaboration in Arctic affairs compared to that among non-Arctic states. While there is some degree of cooperation between non-Arctic states in this regard, it remains relatively limited. The success of a cooperation network relies on the level of interorganizational cooperation, which is influenced by various types of network structures [51]. The intensity of cooperation among Arctic states is primarily influenced by territorial disputes, resource competition, environmental concerns, regional security, and domestic politics. Cooperation between Arctic states about Arctic affairs covers a broad spectrum of areas, including resource development, scientific research, military collaboration, and environmental protection. Although the cooperation intensity among Arctic states is stronger than that between non-Arctic states from a cooperative-network perspective, there are still discernible variations in the level of cooperation intensity among different Arctic states and organizations. Intensive transnational cooperation and manifestations of the NATO–Russia security rivalry have endured for over 30 years in the post-Cold War Arctic [52]. Russia, the US, and Canada are significant military and economic powers in the Arctic region, with extensive territorial areas and robust sovereignty claims. As members of the Arctic Council, they hold a crucial position in the cooperation network and have the right to both speak on Arctic affairs and initiate actions. The primary objective of the Nordic countries in the Arctic is to advance their economies through the utilization of Arctic resources while avoiding entanglement in geopolitical disputes. Finland, Iceland, and Sweden, as non-Arctic coastal states, are not directly involved in debates over Arctic sovereignty. Nordic countries must rely on multilateral cooperation mechanisms such as the Arctic Council and European Union platforms to achieve their goals. For example, Finland believes that the ultimate goal of the Barents Euro-Arctic Council is to strengthen cooperation between Russia and the Nordic countries to ensure stability and prosperity in the northernmost regions.

The Arctic has long been a region of cooperation between nations. Due to the impact of climate change and globalization, the Arctic region has become a significant geopolitical and economic hub. The involvement of non-Arctic states in the cooperative network of Arctic affairs is also increasingly concerning. The strength of the cooperation network between Arctic and non-Arctic states regarding Arctic affairs is a multifaceted and dynamic issue. Numerous factors impact the robustness of this network, including political interests, economic considerations, and resource strategies, among others. Proposals for Arctic cooperation can be found in the policies issued by both Arctic and non-Arctic states. The UK makes clear that it shares many interests with other non-Arctic states, including other State Observers to the Arctic Council. The UK will strengthen cooperation with partners in Europe and the Indo-Pacific region in the pursuit of shared objectives in the Arctic. Russia has also clearly expressed its position that it actively engages the Arctic and non-Arctic states in mutually beneficial economic cooperation in the Arctic zone of the Russian Federation.

In the face of complex Arctic issues, Arctic and non-Arctic states must address them through collaborative efforts. There exists a wide range of areas for stakeholder cooperation. It is incumbent upon all parties to work in unison, enhance exchange, achieve consensus, and foster stability, security, and sustainable development within the Arctic region. It is a prevailing trend of the times for Arctic states to pursue bilateral and multilateral cooperation with countries both within and beyond the region, as well as to establish robust regional laws and regulations to jointly tackle complex issues facing the Arctic.

#### 4. Conclusions

In this paper, we employ both quantitative and qualitative research methods to examine the content of Arctic and non-Arctic states' policies, analyze the interrelationships among various policy issues, and investigate the cooperation network between Arctic and non-Arctic states. The findings of our study can facilitate a better comprehension of the Arctic policies released by both Arctic and non-Arctic states, thereby offering valuable insights for policy-makers in shaping their own policies. One of the main objectives in this study is to identify differences in the concerns of Arctic states and non-Arctic states on different Arctic issues. Scientific research and environmental protection present significant opportunities for non-Arctic states to engage in Arctic governance. As areas of low political sensitivity, these issues also occupy a prominent space in the documents of non-Arctic states. Promoting socioeconomic development, enhancing international cooperation, and strengthening environmental protection are identified as key priorities in the Arctic strategies of Arctic states.

Based on the research findings, Arctic cooperation exhibits both global and regional characteristics, yet the Arctic states are the primary actors in shaping policies and decisions that affect the Arctic region. The solution to issues in Arctic governance cannot be achieved without international cooperation, and Arctic and non-Arctic states still need to strengthen cooperation on different issues. Since the Russia–Ukraine conflict has affected the Arctic cooperation governance mechanism, how to effectively govern the Arctic-related issues challenges the existing governance pattern. We maintain that, despite significant disparities in Arctic policies between Arctic and non-Arctic states, it remains the prevailing trend for these states to collaborate in addressing the current dilemma of governance. There is a significant difference between Arctic states and non-Arctic states in the attention given to Arctic governance issues. Arctic states claim ownership of the Arctic, while non-Arctic states argue that the Arctic is open to all nations. Given the intricacy of Arctic governance matters, both Arctic and non-Arctic states must collaborate in tackling challenges.

There are several inherent limitations of this study. First, the study of Arctic policies did not encompass all documents related to the Arctic that were issued by non-Arctic states. Second, due to the inherent limitations of grounded theory, this research is based on personal experience in the coding process; as such, the research findings are subject to a certain degree of subjectivity. Therefore, in the future, based on the developed research



framework, potential efforts could be directed towards enhancing the scientific aspects of the coding process, comparing the links and differences between Arctic policies in different periods. The work associated with the above-mentioned issues remains in progress.

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